SOLUBILITIES
OF
INORGANIC AND METAL ORGANIC COMPOUNDS

A COMPILATION OF QUANTITATIVE SOLUBILITY DATA FROM THE PERIODICAL LITERATURE

BY

ATHERTON SEIDELL, Ph. D.

National Institute of Health
Washington, D. C.

THIRD EDITION
THIRD PRINTING

Volume I

1940

NEW YORK
D. VAN NOSTRAND COMPANY, Inc.
250 Fourth Avenue

Printed in U. S. A.

PREFACE

The first edition of this compilation, comprising 353 pages, appeared in 1907. A completely revised second edition, containing 756 pages of tables. was published in 1919. Due to the high cost of printing tables, the new material collected after 1919 could not be economically combined with that already published, and was issued in 1928 as a supplementary volume of 500 pages. This plan cannot be repeated, since the searching of desired data in a series of three volumes would be awkward. Therefore a complete revision of the compilation has become necessary.

The cost of printing by the usual method has not declined and the amount of new data to be added has continued to increase. Consequently, the publication of a completely revised edition would not have been possible except by taking advantage of the economical process of off-set printing, and the new developments in the microfilm copying of printed pages. The present compilation is accordingly, an example of the type of compendia of experimental research which these two applications of photography have made possible.

Due to the very large amount of quantitative solubility data which is now available, its publication in a single volume of convenient size is no longer possible. Therefore, it has been decided to include all data upon inorganic and metal organic compounds in one volume, and the results upon the compounds of carbon in a second volume.

Advantage has also been taken of this circumstance to change the manner of arranging the data. The alphabetical plan based on the English names of the compounds has been changed to one having the symbols of the elements as the basis for the alphabetical.arrangement. This purely chemical system of presenting the data will be more convenient to chemists having an imperfect knowledge of English, and in addition, makes it possible to use the symbols as guiding marks for locating desired results. For this purpose the symbols of the basic constituents of the inorganic compounds are placed at the upper outer corner of the pages, and those identifying the acidic constituent, and thus the particular compound in each case, are placed lower down on the outer margins of the pages.

In accordance with the principle adopted for previous editions, the results for systems of two or more compounds are always entered under that one of which the initial letter of its formula comes first in the alphabet. This has the effect of causing the larger amount of the data to be placed under the first letters of the alphabet. With this single rule in mind it should always be possible to find results for particular systems, but not always for each separate compound of which they are composed. In order to provide for those cases in which results are given in other than the expected alphabetical position, a formula index, serving the purpose of cross references, is given at the end of this volume.

The procedure by which the new material has been collected differs from that previously followed in that, thanks to microfilm copying, it has no longer been necessary to manually transcribe from each original paper the data to be subsequently used. It has simply been necessary to note the papers found by perusing the periodicals, and have these photographically copied on microfilm. These microfilm copies then become the source material from which the compilation is made. This not only effects a saving in the effort required to collect the original data but reduces by one-half the errors due to copying.

When microfilm copies of all papers published since 1927 had been collected, the formulae of the compounds for which results were given in each case, were written on a sheet of paper to which the microfilm copy was attached. With the aid of these notations the new results could be alphabetically assembled with those taken from the preceeding volumes. Thus all available results upon each compound or system were brought together for comparison and selection of the final values to be included in the new book. The actual compilation could then be made without further recourse to the periodical collections in libraries, and under conditions particularly favorable for the orderly arrangement and accurate presentation of the data.

In reference to the manner in which the pages of the new book have been prepared for planographic reproduction, it is necessary to call attention to certain imperfections which have resulted. Since these pages are composed of tables reproduced from the volume printed in 1918, in the United States, and the supplementary volume printed in 1927, in France, together with the tables of new data typewritten on a"Varityper" and photographically reduced, a considerable variety of type size and design has resulted. This variation in typography is to be regretted but the expense of completely resetting the book would have prevented its publication.

In addition to the typographical variations, a perceptible reduction in sharpness of definition of the print will be noted in some cases. This results from the two fold photographic reproduction of the new tables, and the slight imperfection of some of the old pages. It is hoped that these deficiencies in uniformity, and occasional indistinctness of the typography will not diminish the value of the compilation to those having need of it in their work. This plan of combining the previously collected data with the new, has made it possible to prepare a more nearly complete collection of solubility data, at a far less expense, than would have been possible by the usual methods of printed publication.

Another point about which a word of explanation should be given is the variation in nomenclature resulting from the use of the latin names, such as argentum, aurum, kalium, natrium, plumbum, etc., from which the symbols used in the alphabetical arrangement, were derived. In these cases, the cost of changing the English names in the titles of the tables reused from the previous edition, did not appear warranted. Furthermore, it is recognized that in spite of the advantage of the adoption of the latin names, in rendering the language of chemistry more universal, there are many persons who prefer correctness of expression in their own language, to the more general and precise comprehension of the chemical information imparted. Although the English names are retained in the majority of cases, it is hoped that eventually an international system of naming chemical compounds will be developed. This would make the names of the substances with which chemists are concerned, as universal as the chemical symbols of which they are composed.

The general practice observed in previous editions of this compilation, with respect to limitations of scope and orderly presentations of the numerical results has been followed in the present one. Since the name alone does not always accurately identify a compound, greater precision has been sought by giving the chemical formula as well. In a few cases, however, due to lack of information in the original papers this could not be done. It should be mentioned also that occasionally the original results are presented in terms which are not accurately defined. Considering the effort involved in the quantitative determination of solubilities, it is regretable that authors sometimes fail to mention details essential to the precise comprehension of their work.

The brief remarks in connection with some of the tables are intended to indicate the general character of the experiments, the methods used, and the probable accuracy of the results. The absence of such remarks may be taken to mean that the determinations presented no exceptional difficulties, that they were made by the usual methods, and with acceptable care. For those cases where incomplete results are given or more information than is quoted in the present compilation is desired, a microfilm copy of the original paper may be obtained, at very little expense, by sending the exact reference to Bibliofilm Service, in care of the Library, U. S. Department of Agriculture Washington, D. C.

In conclusion, I wish to thank those who have called my attention to errors in the previous editions, and mention that I will be equally grateful to those who take the trouble to notify me of mistakes in the present volume.

I am greatly indebted to Mr. Leslie J. Robinson for the painstaking manner in which he has made the Varitype copies of all new tables, and to Mr. John R. Van Cott for combining these with the tables reused from the previous volumes in the final form here shown.

A. S.

Washington, D. C., March 30, 1940.

ABBREVIATIONS

Most of the following abbreviations will be found written both with capitals and without.

$[\alpha]_D$. — Specific Rotation.
abs. — Absolute.
abs. coef. — Absorption Coefficient.
alcohol. — Ethyl Alcohol.
amt(s). — Amount(s).
anhy. — Anhydrous.
aq. — Aqueous.
atm(s). — Atmosphere(s).
at. wt. — Atomic Weight.
b.-pt. — Boiling-point.
C. — Centigrade.
calc. — Calculate(ed).
cc. — Cubic Centimeter(s).
cm. — Centimeter(s).
coef. — Coefficient.
com. — Commercial.
compd. — Compound.
conc. — Concentration, Concentrated.
cond. — Conductivity.
const. — Constant.
cor. — Corrected.
crit. — Critical.
cryo. — Cryohydric.
cryst. — Crystalline.
d. — Dextro (in connection with the name of an optically active compound).
d. — Density (d_{18} — Specific Gravity at 18°, referred to water at 4°; d_{20}^{20} at 20° referred to water at 20°).
decomp. — Decomposition.
dif. — Different.
dil. — Dilute.
dist. coef. — Distribution Coefficient.
ed. — Edition.
elec. — Electric(al).
equil. — Equilibrium.
equiv. — Equivalent(s).
eutec. — Eutectic.
F. — Fahrenheit.
f.-pt. — Freezing-point.
g., gm., gms. — Gram(s).
gm. mol. — Gram Molecule(s).
G. M. — Gram Molecule(s).
hr(s). — Hour(s).
i. — ($d + l$) Inactive (in connection with the name of an optically active compound.)
inorg. — Inorganic.
insol. — Insoluble.
l. — Lævo (in connection with the name of an optically active compound).
kg. kgm. — Kilogram(s).
l. — Liter(s).
mm. — Millimeter(s)
m. — Meta.
max. — Maximum.
mg., mgm. — Milligram(s).
mol(s). — Molecule(s), Molecular.
mol. wt. — Molecular Weight.
millimol. — Milligram Molecule.
m.-pt. — Melting-point.
n. — Normal (gm. equiv. per l.).
N. — Normal (used rarely).
o. — Ortho.
ord. — Ordinary.
org. — Organic.
p. — Page.
p — Para.
pet. — Petroleum.
ppt. — Precipitate.
pt. — Point.
quad. pt. — Quadruple Point.
qual. — Qualitative.
sapon. — Saponification.
sat. — Saturated.
sol(s) — Solution(s).
sp. gr. — Specific Gravity (Density).
sq. cm. — Square Centimeter.
s. — Symmetrical.
sym. — Symmetrical.
t°. — Temperature, Centigrade Scale.
temp(s). — Temperature(s).
tr. pt. — Transition Point.
vol(s). — Volume(s).
undissoc. — Undissociated.
U. S. P. — U. S. Pharmacopœia.
wt. — Weight.
∞ — Infinity.
$.10^{-3}$, $.10^{-6}$, etc., following a result means that the decimal point is to be moved as many places to the left as indicated by the minus exponent.

ARGON

SOLUBILITY OF ARGON IN WATER

(Lannung, 1930; Von Antropoff, 1919.)

t°	Lannung		Von Antropoff
	a	l	B
0	0.0560	—	0.0580
5	0.0460	o —	0.0500
10	0.0405	0.0425	0.0450
15	0.0365	0.0391	0.0408
20	0.0336	0.0361	0.0374
25	0.0310	0.0342	0.0350
30	0.0288	0.0321	0.0327
35	0.0270	0.0305	0.0305
40	0.0252	0.0290	0.0286
45	0.0237	0.0278	0.0270
50	0.0223	—	0.0257

a = Bunsen Absorption Coefficient which shows the volume of gas (at 0° and 760 mm. Hg. pressure) dissolved by one volume of solvent at the given temperature when the partial pressure of the gas is 760 mm. Hg.

l = Ostwald Partition Coefficient which is the equilibrium distribution ratio of the volume concentrations of the gas in the solution and in the vapor phase. The relation between l and a is, $l = aT/273$ where T is the absolute temperature at which the measurement was made.

B = Kuenen's modification of the Bunsen Absorption Coefficient in which one gram of solvent is substituted for one cubic centimeter of solvent.

The results in the above table were read from curves plotted from the data given by Lannung and von Antropoff. In both cases the determinations were made with great care. Lannung points out that the previous measurements of Estreicher, 1899 are uncertain on account of the small volume of gas, the large amount of dead space in his apparatus and the difficulty of measuring the volume of gas in the dry state.

SOLUBILITY OF ARGON IN SEVERAL SOLVENTS

(Lannung 1930.)

t°	Methyl Alcohol CH_3OH		Ethyl Alcohol C_2H_5OH		Acetone $(CH_3)_2CO$	
	a	l	a	l	a	l
15	0.253	0.267	0.243	0.256	0.271	0.286
18	0.251	0.267	0.242	0.258	0.271	0.290
20	0.250	0.268	0.240	0.258	0.273	0.293
25	0.245	0.267	0.237	0.258	0.274	0.299
30	0.243	0.270	0.234	0.260	0.276	0.306
37	0.240	0.273	0.231	0.262	0.279	0.317

t°	Benzene C_6H_6		Cyclohexane $CH_2((CH_2.CH_2)_2)CH_2$		Cyclohexanol $(CH_2)_5CHOH$	
	a	l	a	l	a	l
15	0.220	0.232	0.308	0.325	—	—
18	0.221	0.236	0.307	0.327	—	—
20	0.221	0.237	0.306	0.328	—	—
25	0.222	0.242	0.305	0.333	0.112	0.112
30	0.222	0.246	0.304	0.337	0.113	0.125
37	0.222	0.252	0.303	0.344	0.114	0.129

SOLUBILITY OF ARGON IN WATER AND IN SEVERAL SOLVENTS AT HIGH PRESSURES

(Sisskind and Kasarnowski, 1931, 1933.)

A steel bomb of about 100 cc. capacity, as described by Ipatiew, Jr., Drusking-Artemowitsch and Tichomirow, 1932, was used.

Solvent	t°	Pressure in Atmospheres P	cc. A per 1 cc. Solvent at Pressure P W_o	Corrected W_o	Calc. Bunsen Absorp. Coef. α
H_2O	+0.2	1	0.0515	0.0515	0.0515
"	"	25	1.25	1.29	0.0516
"	"	50	2.46	2.52	0.0504
"	"	75	3.43	3.50	0.0467
"	"	100	4.27	4.35	0.0435
"	"	125	4.95	5.06	0.0405
CH_3OH	"	1	0.262	0.262	0.262
"	"	25	7.56	7.76	0.310
"	"	50	15.8	16.2	0.325
"	"	75	23.2	23.8	0.317
"	"	100	30.1	30.9	0.309
C_2H_5OH	"	1	0.251	0.251	0.251
"	"	25	7.39	7.57	0.303
"	"	50	15.4	15.8	0.315
"	"	75	22.3	22.8	0.304
"	"	100	26.9	27.5	0.275
$(C_2H_5)_2O$	0	25	13.8	—	0.554
$(CH_3)_2CO$	"	25	9.31	—	0.238
$CH_3(CH_2)_3CH_3$	"	25	33.0	—	1.32
C_6H_5CHO	"	25	2.67	—	0.106

Data for the solubility of Argon in distilled water and in sea water, together with a critical discussion of the literature, are given by Coste, 1917.

One liter of cyclohexanol dissolves 171.21 cc. Argon at 26° and 755 mm Hg. pressure (Cauquil, 1927.).

SOLUBILITY OF ARGON IN AQUEOUS SALT SOLUTIONS AT 25°

(Åkerlof, 1936.)

Salt	Mols Salt per 1000 gms. H_2O	α	Salt	Mols Salt per 1000 gms. H_2O	α
None	$=H_2O$	0.0332	$CaCl_2$	2.95	0.0216
KCl	3.00	0.0220	"	5.37	0.0180
"	4.55	0.0174	$SrCl_2$	2.10	0.0203
NaCl	3.23	0.0216	"	3.56	0.150
"	5.98	0.0149	$BaCl_2$	1.25	0.0185
LiCl	3.35	0.0248	"	1.74	0.0141
"	6.78	0.0187	$MgCl_2$	3.02	0.0248
$NaNO_3$	3.51	0.0204	"	5.02	0.0228
"	7.37	0.0123	$AlCl_3$	0.98	0.0247
$HClO_4$	4.05	0.0411	"	0.56	0.0179
"	9.32	0.0521			

Data for the solubility and diffusion of argon in solid and liquid metals are given by Sieverts and Bergner, 1912.

Palladium, activated by thermic treatment in a vacuum absorbs 319 volumes of argon, Klarmann, 1930

SOLUBILITY OF ARGON IN SEVERAL SOLVENTS AT HIGH PRESSURES

(Sisskind and Kasarnowski, 1931, 1933.)

Solvent	t°	Pressure in Atmospheres	Calc. Bunsen Absorp. Coef. a
Acetone	0	50	0.249
"	0	100	0.254
n Propyl Alcohol	0	50	0.220
n Butyl Alcohol	0	50	0.209
Iso Butyl Alcohol	0	50	0.228
Sec. Butyl Alcohol	0	50	0.210
Iso Amyl Alcohol	0	25	0.210
Iso Amyl Alcohol	0	50	0.210
n Hexyl Alcohol	0	25	0.174 (0.190)
n Octyl Alcohol	0	50	0.163
Sec. Octyl Alcohol	0	25	0.172
Benzyl Alcohol	0	25	0.060
Benzyl Alcohol	0	50	0.060
Cyclohexanol	25	50	0.112
Methyl Ethyl Ketone	0	25	0.222 (0.239)
Methyl Propyl Ketone	0	50	0.234
Diethyl Ketone	0	50	0.237
Methyl Hexyl Ketone	0	50	0.193
Ethyl Propyl Ketone	0	50	0.238
Cyclohexanon	0	50	0.127
"	0	100	0.128
"	25	50	0.124
Benzene	7	50	0.197
"	7	100	0.203
"	7	125	0.204
Toluene	0	25	0.200
"	0	50	0.200
"	0	75	0.214
"	7	50	0.195
Xylene	0	50	0.196 (0.205)
"	0	100	0.211
Cyclohexane	25	50	0.302
Methyl Cyclohexane	25	50	0.311
Benzyl Ether	0	25	0.068
" "	0	50	0.069
" "	0	100	0.072

ACTINIUM EMANATIONS. Ac

SOLUBILITY IN SEVERAL SOLVENTS.

(Hevesy, 1912.)

A method was elaborated for determining the partition coefficient between a gas and a liquid phase. The solubility of actinium emanations was then determined in KCl, H_2O, H_2SO_4, C_2H_5OH, $C_5H_{11}OH$, $(CH_3)_2CO$, C_6H_5CHO, C_6H_6, C_7H_8, petroleum ether and CS_2. The solubility increases in the order named. Close relations are indicated between actinium, thorium and radium.

Experiments are described by Imre, 1927, upon the separation of RaAc by means of distribution studies. Since iron can be removed from its hydrochloric acid solution by extraction with ether, this principle was applied to the separation of RaAc. Nitric acid was substituted for hydrochloric acid. Results are given for the extraction of aqueous nitric acid solutions of thorium by means of ether, and similar results for nitric acid actinium solutions. This method failed to separate RaAc into two components, thus furnishing new evidence of its unity.

ARGENTUM

SILVER, Ag:

SOLUBILITY OF SILVER IN WATER

(Křepelka and Toul, 1929)

Silver of purity sufficient for atomic weight work was employed. Thin leaves of it were placed in contact with highly purified and freshly distilled water in completely filled and tightly stoppered Erlenmeyer flasks, on the one hand and in silver flasks on the other. The flasks thus prepared were kept in the dark at 18°-20°C. and shaken from time to time.

For analysis the water from the vessels was poured into a quartz dish and carefully evaporated in the dark to 60-80 cc. The Ag in this solution was determined by nephelometric comparisons with known standards. Maximum solubility was reached in 21 days and corresponded to

0.035 mg. Ag. per 1000 cc. water.

Silver sheets, the surface of which had been previously reduced by pure dry hydrogen at 400° showed no solubility as measured by nephelometric tests. Hence it follows that the dissolution of silver is caused by its surface oxide, or by oxygen on its surface or dissolved in the water. Measurements made in glass vessels were, on the average 0.003 mg. higher than those made in silver vessels. This difference is probably due to the influence of alkalies dissolved from the glass.

Determinations of the solubility of silver in distilled water are also given by Freudlich and Söllner, 1928. Using 40 sq. cm. of silver surface per 100 cc. of water and a contact period of 3 days, 0.025 mg. Ag per liter were found. The analyses were made by Haber et al, 1926, microclokimastic method.

THE SOLUBILITY OF SILVER IN MERCURY

(Sunier and Hess, 1928: De Right, 1933.)

Highly purified Hg and excess of pure Ag were agitated together by gentle rocking in an evacuated tube provided with a side bulb into which the saturated solution could be filtered through glass wool, by inverting and allowing air to enter the apparatus. Equilibrium was approached from both sides at each temperature. The analyses were made by distilling the mercury from the filtered saturated solution at 200° under vacuum or by volatilizing it in a stream of Hydrogen at 270°-300°, and weighing the residual silver. The results are expressed in terms of gram atoms of Ag per 100 gram atoms of Ag + Hg. The authors discuss previous published determinations.

t°	Atomic Percent Ag	t°	Atomic Percent Ag	t°	Atomic Percent Ag
10	0.048	60	0.190	120	0.587
20	0.066	70	0.241	140	0.797
30	0.088	80	0.288	160	1.053
40	0.114	90	0.352	180	1.356
50	0.147	100	0.419	200	1.708

For equilibrium between metallic Silver and mercury (Silver amalgam) and mixed aqueous solutions of their nitrates, determined for mixtures of the two metals in all proportions, see Reinders, 1906.

Results for the solubility of Ag in Cu, determined by hardness measurements are given by Hansen, 1930; and determinations by the X ray method are given by Agnew and Sacks, 1930.

Data for the distribution of silver between Zn + Pb, Zn + Bi, Al + Pb, Al + Bi, Zn + Tl and Al + Tl are given by Tammann and Schaftmeister, 1924.

Data for the equilibrium between melted silver and the chlorides of Cu and Pb are given by Tubandt and Munzing, 1927.

SILVER ARSENATE Ag_3AsO_4. AsO

One liter H_2O dissolves 0.0085 gm. Ag_3AsO_4 at 20°. (Whitby, 1910.)

SILVER ARSENITE Ag_3AsO_3.

One liter H_2O dissolves 0.0115 gm. Ag_3AsO_3 at 20°. (Whitby, 1910.)

The determinations of Whitby were made by a colorimetric method which was based upon the observation that the color produced by heating a solution of a silver salt with sodium hydroxide and certain organic compounds such as dextrine, starch, sugar etc., is proportional to the amount of silver present.

SILVER BORATE $AgBO_2$. BO

One liter of aqueous solution contains about 9.05 gms. $AgBO_2$ at 25°. (Abegg and Cox, 1903.)

SILVER DIBORATE $Ag_2O.2B_2O_3.2H_2O$

The System $Ag_2O + B_2O_3 + H_2O$ at 19°

(Rollet, 1930)

Gms. per 100 gms. Sat. Solution		Solid Phase	Gms. per 100 gms. Sat. Solution		Solid Phase
Ag_2O	B_2O_3		Ag_2O	B_2O_3	
0.16	0.1	$Ag_2O.2B_2O_3.2H_2O$	0.91	3.51	$Ag_2O.2B_2O_3.2H_2O+B(OH)_3$
0.22	0.75	"	0.70	3.3	$B(OH)_3$
0.33	1.4	"	0.35	2.9	"
0.55	2.2	"	0.0	2.6	

SILVER Tri Antipyrine BORO FLUORIDE $Ag(COC_{10}H_{12}N_2)_3BF_4$

100 cc sat. solution in H_2O contain 17.7 gms. salt at 20°.

(Wilke-Dorfurt and Mureck, 1929)

SILVER BROMIDE AgBr. Br

SOLUBILITY IN WATER.

t°	Gms. AgBr per Liter.	Authority
18(?)	0.00029	(Hahn and Schulze, 1927.)
18	0.00012	(Kolthoff, 1921.)
18	0.000131	(Masaki, 1930.)
20	0.000084	(Bottger—Z. physik. Ch. 46, 602, '03.)
25	0.000137	(Abegg and Cox—Z. physik. Ch. 46, 11, '03.)
100	0.00370	(Böttger—Z. physik. Ch. 56, 93, '06.)

(See also Holleman — Z. physik. Ch. 12, 129, '93; Kohlrausch — *Ibid* 50, 305, '05.)

SOLUBILITY OF SILVER BROMIDE IN WATER AND IN AQUEOUS SOLUTIONS OF ACIDS AND SALTS.

(Bedell, 1938.)

The method (see Bedell, 1937) consisted in alternately adding, dropwise, 0.001 normal solutions of silver hydroxide and hydrobromic acid to 1000cc of water at the chosen temperatures. The point at which a precipitate appeared was determined by observing the diffraction of a beam of light passing through the solution.

t°	Gms. AgBr per liter sat. sol.
20	0.00035
40	0.00066
60	0.00112
80	0.00184

Using the above method, but substituting 0.001 normal silver nitrate or silver sulfate for the hydroxide and various bromides for the hydrobromic acid, the author obtained results, at about 20°, for the solubility of silver bromide in aqueous solutions of KNO_3, $LiNO_3$, $Ba(NO_3)_2$, $Mn(NO_3)_2$, HNO_3, H_2SO_4, $Hg(NO_3)_2$ and $HgSO_4$, varying in concentration between 0.0004 and 0.0252 gms. per liter. The results showed that with the exception of mercuric nitrate and sulfate only a very slight increase in solubility of the AgBr occurred. The increase in solubility with the mercury salts confirms the previously reported existance of compound formation, between silver bromide & mercury salts.

Br

SOLUBILITY OF SILVER BROMIDE IN AQUEOUS AMMONIA SOLUTIONS.

(Longi — Gazz. chim. ital. 13, 87, '83; at 80°, Pohl — Sitzber. Akad. Wiss. Wien, 41, 267, '60)

Solvent.	Gms. AgBr at 12° per		Gms. AgBr at 80° per 1000 Gms. Solvent.
	1000 cc. Solvent.	1000 Gms. Solvent.	
Ammonia Sp. Gr. 0.998 = 5%	0.114	0.114	...
Ammonia Sp. Gr. 0.96 = 10%	3.33–4.0	3.47	...
Ammonia Sp. Gr. 0.986	...	...	0.51* 1.0†

* Dried AgBr. † Freshly pptd.

SOLUBILITY IN AQUEOUS SOLUTIONS OF AMMONIUM BROMIDE AND OF GELATIN.

(Winther, 1923, 1924.)

The determinations were made by measurements of the electromotive force of a series of elements of the type.

$$\mathrm{Ag} \mid 0.1\, n\ \mathrm{AgNO_3} \mid \mathrm{Aq.}\ 10\%\ \mathrm{NH_4NO_3} \mid x \mid \mathrm{Ag},$$

where x is a mixture of Ag Br and of the solution in which its solubility is to be measured. Two identical elements were measured for each solution. The potential, π, very soon attained a constant value which did not change for many hours. The mean value for the exponents of the solubility products in solutions composed of various mixtures of ammonium salts, gelatin and erythrosine, was 11.92. Since the solubility product in all of the solutions had the same value it was concluded that the solubility of silver bromide in water is not altered by the addition of gelatin, erythrosine and small amounts of NH_4I and NH_4Cl. By the addition of bromide the solubility is decreased in accordance with the law of mass action.

Fusion-point data for mixtures of Ag Br + Na Br are given by Zemcznzny, 1926.

Solubility of Silver Bromide in Aqueous Ammonia Solutions.

Results at 15°. (Bodländer, 1892.)			Results at 25°. (Bodländer and Fittig, 1901–02.)		Results at 25°. (Whitney and Melcher, 1903.)	
$d_{15.5}$ of Sat. Sol.	Gms. Mols. per Liter.		Gms. Mols. per 1000 Gms. H_2O.		Concentration per Liter.	
	NH_3.	Ag_2Br_2.	NH_3.	AgBr	G. Mols. NH_3.	G. Atoms Ag.
0.9932	1.085	0.0011	0.1932	0.00060	0.0764	0.000276
0.9853	2.365	0.0031	0.3849	0.00120	0.115	0.000391
0.9793	3.410	0.0050	0.7573	0.00223	0.268	0.000941
0.9720	4.590	0.0074	1.965	0.00692	0.273	0.00107
0.9655	5.725	0.0101	3.024	0.01163	0.450	0.00170
			5.244	0.02443	0.497	0.00159

Solubility of Silver Bromide in Aqueous Solutions of:

Ammonia at 0°.
(Jarry, 1899.)

Grams per 100 cc. Solution.			
NH_3 Gas.	AgBr.	NH_3 Gas.	AgBr.
3.07	0.080	26.27	1.067
4.88	0.096	31.26	1.568
6.69	0.172	33.89	1.987
8.29	0.212	36.52	2.669
11.51	0.349	37.22	2.888
15.32	0.557	37.70	2.930
18.09	0.722	39.26	2.892
19.53	0.741	39.95	2.852

Monomethyl Amine at 11.5°.
(Jarry.)

Gms. per 100 cc. Solution.	
NH_2CH_3.	AgBr.
11.01	0.07
13.17	0.12
15.13	0.16
17.97	0.28
32.58	0.55
35.62	0.73
43.11	1.27
48.44	2.89

Solubility of Silver Bromide in Aqueous Solutions of Methyl Amine and of Ethyl Amine at 25°.

(Bödlander and Eberlein, 1903; Wuth, 1902.)

In Methyl Amine.

Mols. per Liter.			
Total Base.	AgBr.	Free Base.*	
1.017	0.0025	1.012	(B. & E.)
0.508	0.0013	0.505	(B. & E.)
0.203	0.00049	0.202	(B. & E., W.)
0.102	0.00026	0.102	(B. & E.)
0.0947	0.00041	...	(W.)
0.051	0.00012	0.051	(B. & E.)
0.04	0.00034	...	(W.)
0.02	0.00026	...	(W.)

In Ethyl Amine.

Mols. per Liter.			
Total Base.	AgBr.	Free Base.*	
0.483	0.00231	0.478	(B. & E.)
0.200	0.00097	0.198	"
0.100	0.000475	0.099	"
0.103	0.000711	...	(W.)
0.06572	0.000258	...	"
0.05512	0.000193	...	"
0.03942	0.000137	...	"
0.01272	0.0000867	...	"

* The free base is found by subtracting from the total base two mols. of base for each atom of dissolved Ag

Solubility of Silver Bromide in Aqueous Solutions of Mercuric Nitrate at 25°.

(Morse, 1902.)

Mols. $HgNO_3$-(HNO_3) per Liter.	Mols. AgBr per Liter.	Gms. AgBr per Liter.	Mols. $HgNO_3$-(HNO_3) per Liter.	Mols. AgBr per Liter.	Gms. AgBr per Liter.
1	0.03660	6.878	0.025	0.00459	0.863
0.10	0.00873	1.640	0.0125	0.00329	0.618
0.05	0.00639	1.200	0.0100	0.00306	0.575

Since HNO_3 was present in all cases, its influence on the solubility was examined. It was found that no appreciable differences were obtained with concentrations varying between 0.1 and 2 normal HNO_3. Both crystallized and amorphous silver bromide gave identical results.

SOLUBILITY OF SILVER BROMIDE IN AQUEOUS SALT SOLUTIONS.

(Mees and Piper, 1912.)

Aqueous Solution.	t°.	Gms. AgBr per Liter.
Aq. 1 per cent Sodium Thiosulfate	?	2.06
" " Ammonium Thiocyanate	"	0.03
" " Ammonium Carbonate	"	0.004
" " Sodium Sulfate	"	0.055
" " Thiocarbamide	"	1.49

SOLUBILITY OF SILVER BROMIDE IN AQUEOUS SALT SOLUTIONS.

(Valenta, 1894; see also Cohn, 1895.)

Salt Solution.	t°.	Gms. AgBr per 100 Gms. Aq. Solution of Concentration:				
		1: 100.	5: 100.	10: 100.	15: 100.	20: 100.
Sodium Thio Sulphate	20	0.35	1.90	3.50	4.20	5.80
" " Calc. by Cohn	20	0.50	2.40	4.59	6.58	8.40
Sodium Sulphite	25	...	...	0.04	...	0.08
Potassium Cyanide	25	...	6.55	...	...	...
" " Calc. by Cohn	25	...	6.85	...	...	...
Potassium Sulphocyanide	25	...	...	0.73	...	...
Ammonium Sulphocyanide	20	...	0.21	2.04	5.30	...
Calcium Sulphocyanide	25	...	...	0.53	...	...
Barium Sulphocyanide	25	...	...	0.35	...	...
Aluminum Sulphocyanide	25	...	...	4.50	...	...
Thio Carbamide	25	...	...	1.87	...	...
Thio Cyanime	25	0.08	0.35	0.72	...	...

Br

NOTE. — Cohn shows that the lower results obtained by Valenta are due to the excess of solid AgBr used and the consequent formation of the less soluble di salt, $3(AgS_2O_3Na)_2$, instead of the more soluble tri salt, $(AgS_2O_3Na)_2Na_2S_2O_3$.

100 cc. H_2O containing 10 per cent of normal mercuric acetate, $Hg(C_2H_3O_2)_2$ + Aq., dissolve 0.0122 gm. AgBr at 20°.

100 gms. NaCl in conc. aq. solution dissolve 0.474 gm. AgBr at 15°.

100 gms. NaCl in 21 per cent solution dissolve 0.182 gm. AgBr at 15°.

100 gms. KBr in conc. solution dissolve 3.019 gms. AgBr at 15°.

95 gms. NaCl + 10 gms. KBr in conc. aq. solution dissolve 0.075 gm. AgBr at 15°.

(Schierholz, 1890.)

SOLUBILITY OF SILVER BROMIDE IN AQUEOUS POTASSIUM BROMIDE AT 25°.

(Hellwig, 1900.)

Mols. KBr per Liter	2.76	3.68	4.18	4.44	4.864
Gms. KBr per Liter	2.20	7.50	13.50	17.95	26.44

SOLUBILITY OF SILVER BROMIDE IN AQUEOUS SOLUTIONS OF SODIUM SULFITE.

Results at Room Temperature (?). (Mees and Piper, 1912.)				Results at 25°. (Luther and Leubner, 1912a.)	
Gms per Liter		Gms per Liter.		Gms Formula Weights per Liter.	
Na_2SO_3.	AgBr.	Na_2SO_3.	AgBr.	SO_3''.	Ag'.
0.08	0.000746	4.85	0.0329	0.232	0.0025
0.17	0.00210	9.47	0.05264	0.406	0.0023*
0.30	0.00303	17.65	0.116	0.448	0.0023*
0.50	0.00448	38.2	0.265	0.466	0.0053
1.13	0.00865	70.75	0.57	0.474	0.0055
2.08	0.01585	83.75	0.79	0.675	0.0084

These results are for solutions containing 0.01 mol. excess bromide ion per liter.

SILVER BROMIDE

SOLUBILITY OF SILVER BROMIDE IN AQUEOUS SOLUTIONS OF SODIUM THIOSULFATE AT 35°.

(Richards and Faber, 1899.)

Gms. Cryst. Na Thiosulfate per Liter.	Gms. AgBr Dissolved per Gm. of Thiosulphate.	Mols. AgBr Dissolved per Mol. of $Na_2S_2O_3$.
100	0.376	0.496
200	0.390	0.515
300	0.397	0.524
400	0.427	0.564

100 cc. of 3 *n* $AgNO_3$ solution dissolve 0.04 gm. AgBr at 25°. (Hellwig, 1900.)

SOLUBILITY OF SILVER BROMIDE IN AQUEOUS SOLUTIONS OF POTASSIUM THIOCYANATE AT 25°.

(Randall and Halford, 1930)

This system was studied by the authors as a case of equilibrium in a chemical reaction involving formation of a complex ion. The assumed reaction is $AgBr\,s + 2\,CNS^- = Ag(CNS)_2^- + Br^-$, but the sulubility cannot be accounted for by the formation of a single complex ion $Ag(CNS)_2^-$. The results of the analyses of the saturated solutions are expressed in molalities.

Br

Total (KSCN)	(Ag Br)	free (KCNS)
0 2510	0.0011	0.249
0.2702	0.0012	0.267
0.5205	0.0095	0.501
0.5819	0.0085	0.564
0.7577	0.0285	0.701
0.7762	0.0307	0.715
1.0089	0.0663	0.875

SOLUBILITY OF SILVER BROMIDE IN CONCENTRATED SOLUTIONS OF HALOGEN SALTS.

(Dede and Walther, 1927.)

Molecular Composition of Solvent	Wt. in Gms. of 1 Gm. Equiv. of Solvent	Millimols AgBr dissolved in one Gm. Equiv. of Solvent at			
		20°	40°	60°	80°
$KBr+10H_2O$	299.18	22.17	24.06	27.17	31.81
$\frac{1}{2}CaBr_2+10H_2O$	280.12	9.37	11.09	13.18	16.01
$HBr+10H_2O$	261.09	6.86	8.11	9.72	12.15
$KBr+20H_2O$	479.3	3.04	3.78	4.94	6.75
$\frac{1}{2}CaBr_2+20H_2O$	460.3	1.663	2.23	3.19	4.47
$HBr+20H_2O$	441.3	1.312	1.87	2.70	3.94
$KBr+30H_2O$	659.5	1.068	1.521	2.24	3.34
$\frac{1}{2}CaBr_2+30H_2O$	640.4	0.663	1.021	1.60	2.51
$HBr+30H_2O$	621.4	0.605	0.913	1.496	2.31

EQUILIBRIUM BETWEEN MIXED CRYSTALS OF SILVER BROMIDE AND SILVER CHLORIDE AND HALOGEN SOLUTIONS

(Yutzy and Kolthoff, 1937.)

The experiments were made by adding a measured volume of standard $AgNO_3$ solution to mixtures of NaCl and KCl solutions of known composition. After precipitation the solutions were made up to known volumes and the suspensions shaken for various periods of time. The bromide content of the centrifuged supernatant solution was determined by the D'Ans and Höfer method (Z. Angew. Chem. 47 73 1934.) From this the ratio of Ag Br to Ag Cl in the precipitate could be calculated by difference.

The results are given in terms of the mol. percent bromide in the precipitate and the final bromide concentration of the solution. By means of variation in the mode of mixing the constituents is was shown that equilibrium was reached in all cases. The results show the distribution coefficient of bromide between aq. solution and mixed crystals of AgCl+AgBr at 27° and at 98°.

Br

SOLUBILITY OF SILVER BROMIDE IN LIQUID AMMONIA

t°	Gms. AgBr per 100 gms. NH_3	
0	2.40	(Linhard and Stephan, 1933, 1934.)
25	5.92	(Hunt and Boncyk, 1933.)

100 gms. liquid sulfur dioxide dissolve 0.003 gm. AgBr at 0° (Jander and Wickert, 1936; Jander and Ruppold, 1937.

SOLUBILITY OF SILVER BROMIDE IN METHYL AND IN ETHYL ALCOHOL AT 25°.

(Koch, 1930.)

From conductivity and E.M.F. measurements the ratios of the solubilities of silver bromide in water and alcohols were calculated. By means of these figures and previously determined results for the solubility of silver bromide in water the following values were obtained.

Solvent	Mols. AgBr per liter	Gms. AgBr per liter
Water	7.8×10^{-7}	0.000146
CH_3OH	3.0×10^{-8}	0.0000056
C_2H_5OH	3.7×10^{-9}	0.00000013

The solubility product of AgBr in CH_3OH at 25° in equiv. gms. per 1000 gms. CH_3OH is 5.8×10^{-16} (Buckley & Hartley, 1929.)

SILVER BROMIDE THIOSINAMINE $AgBr.NH_2.CS.NHC_3H_5$

SOLUBILITY OF SILVER BROMIDE - THIOSINAMINE (ALLYL THIO CARBAMIDE) IN WATER

(Sheppard and Hudson, 1927.)

The solutions were shaken at constant temperature for 48 hours and the amount of compound dissolved determined by conversion to silver sulfide.

t°	$AgBr.NH_2.CS.NHC_3H_5$ per liter sat. aq. solution	
	Gms.	Gm. Mols. x 10^{-4}
15	0.0446	1.46
25	0.071	2.33
35	0.121	3.94
50	0.293	9.63

FUSION POINT DATA FOR MIXTURES OF SILVER BROMIDE AND OTHER COMPOUNDS

AgBr-AgCl	(Mönkemeyer, 1906.)
AgBr-Ag I	"
$AgBr-AlBr_3$	(Kendall, Crittenden, and Miller, 1923.)
AgBr-KBr	(Sandonnini, 1912; Zemczuzny, 1926)
AgBr-NaBr	(Sandonnini and Scarpa, 1913; Zemczuzny, 1926.)
$AgBr-PbBr_2$	(Matthes, 1911.)

Note.—Freezing or Melting Point Curves as Solubility Data.

When a mixture of two compounds, rendered liquid by elevation of temperature, is gradually cooled, a point will be reached at which one or the other of the constituents will separate as a solid. This point represents the solubility of the one compound in the other. The method involved, differs principally from that ordinarily employed for solubility determinations, in that the composition of the mixture remains constant while the saturation temperature is being approached, instead of the reverse procedure.

A considerable amount of data of this character is available but, after careful consideration, it has been decided that references only will be given to such results in the present volume, except in cases of mixture of well known compounds or of those in which water is one of the constituents.

SILVER BROMATE $AgBrO_3$. BrO

SOLUBILITY IN WATER.

t°.	Gms. $AgBrO_3$ per Liter.	Authority.
20	1.586	(Böttger, 1903.)
24.5	1.911	(Noyes, 1900.)
25	1.68	(Longi, 1883.)
27	1.71	(Whitby, 1910, see note, p. 608.)
25	1.949	(Hill, 1917.)

SOLUBILITY OF SILVER BROMATE IN WATER.

(Reedy, 1921.)

t°.	Gms. $AgBrO_3$ per 100 gms. H_2O.	t°.	Gms. $AgBrO_3$ per 100 gms. H_2O.	t°.	Gms. $AgBrO_3$ per 100 gms. H_2O.
25	0.196	50	0.433	75	0.832
30	0.227	55	0.497	80	0.936
35	0.269	60	0.570	85	1.055
40	0.316	65	0.648	90	1.325
45	0.371	70	0.755		

A transition point near 98°.5 is indicated.

SOLUBILITY OF SILVER BROMATE IN AQUEOUS ACETIC ACID AT 25°.

(Hill, 1917.)

Normality of Aq. Acetic Acid.	Gms. $AgBrO_3$ per Liter.	Normality of Aq. Acetic Acid.	Gms. $AgBrO_3$ per Liter.
0.0498	1.9429	0.4988	1.863
0.0997	1.9379	0.9975	1.8013
0.1995	1.9206	1.8721	1.6178

SOLUBILITY OF SILVER BROMATE IN AQUEOUS AMMONIA AND NITRIC ACID SOLUTIONS AT 25°.

(Longi, 1883.)

	Solvent.	Gms. $AgBrO_3$ per	
		1000 cc. Sol.	1000 Gms. Sol.
Ammonia	Sp. Gr. 0.998 = 5%	35.10	35.54
Ammonia	Sp. Gr. 0.96 = 10%	443.6	462.5
Nitric Acid	Sp. Gr. 1.21 = 35%	3.81	3.12

SOLUBILITY OF SILVER BROMATE AT 24.5° IN AQUEOUS SOLUTIONS OF:

Silver Nitrate (Noyes).

Normal Content.		Gms. per Liter.	
$AgNO_3$.	$AgBrO_3$.	$AgNO_3$.	$AgBrO_3$.
0.0	0.0081	0.0	1.911
0.0085	0.0051	1.445	1.203
0.0346	0.0022	5.882	0.510

Potassium Bromate (N.).

Normal Content.		Gms. per Liter.	
$KBrO_3$.	$AgBrO_3$.	$KBrO_3$.	$AgBrO_3$.
0.0	0.0081	0.0	1.911
0.0085	0.00519	1.42	1.225
0.0346	0.00227	5.78	0.536

SOLUBILITY OF SILVER BROMATE IN AQUEOUS SALT SOLUTIONS AT 25°.

(Dalton, Pomeroy and Weymouth, 1924.)

Constant rotation for at least 16 hours was employed and equilibrium was approached both from above and below.

Salt.	Gm. equiv. salt per 1000 gms. H_2O	Density of sat. sol.	Millimols. $AgBrO_3$ per 1000 gms. H_2O.	Salt.	Gm. equiv. salt per 1000 gms. H_2O.	Density of sat. sol.	Millimols. $AgBrO_3$ per 1000 gms. H_2O.
None (= H_2O) . .	0.0	0.9990	8.062	$Ba(NO_3)_2$ . .	0.025	1.0018	9.088
$KClO_3$	0.025	1.0010	8.716	" . .	0.05	1.0046	9.655
"	0.5	1.0033	9.190	" . .	0.10	1.0098	10.373
"	0.10	1.0074	9.706	Na_2SO_4 . .	0.05	1.0025	9.965
K_2SO_4	0.025	1.0009	9.292	" . . .	0.10	1.0059	10.973
"	0.05	1.0028	10.015	" . . .	1.00	1.0622	18.619
"	0.10	1.0062	11.092	$CaSO_4$ . . .	0.10	1.0017	10.405
$Mg(NO_3)_2$	0.025	1.0003	8.935	" . . .	0.50	1.0492	13.349
"	0.05	1.0018	9.414	$Ce(NO_3)_3$ . .	0.0125	1.0002	8.888
"	0.10	1.0046	10.090	" . .	0.025	1.0014	9.336
$MgSO_4$	0.02	–	8.92	KNO_3	0.040	–	9.12
"	0.051	–	9.67	" . . .	0.100	–	9.92
"	0.100	–	10.30	"	0.200	–	11.06
"	0.1988	–	11.38	"	0.394	–	12.66

SILVER BROMATE $AgBrO_3$

SOLUBILITY OF SILVER BROMATE IN AQUEOUS SOLUTIONS OF SODIUM NITRATE AND SODIUM PICRATE AT 20°.

(Gilbert, 1929.)

Molality of Salt Solution		Molality of dissolved $AgBrO_3$
$NaNO_3$	$NaOC_6H_2(NO_2)_3$	
0.00	0.10	0.00848
0.10	0.00	0.00840
0.05	0.05	0.00838

SOLUBILITY OF SILVER BROMATE IN AQUEOUS SOLUTIONS OF METHYL ALCOHOL AND OF ETHYL ALCOHOL AT 25°.

(Owen, 1933; Newman, 1934.)

Results for Methyl Alcohol

Wt. Percent CH_3OH in Solvent	d_{25} of Solvent	Millimols $AgBrO_3$ per liter Sat. Solution
0.0	0.9989	8.12
10.0	0.9802	5.51
20.0	0.9650	3.79
30.0	0.9492	2.65
40.0	0.9318	1.82
50.0	0.9123	1.24
60.0	0.8908	0.83

Results for Ethyl Alcohol

Wt. percent C_2H_5OH in Solvent	d_{25} of Solvent	Millimols $AgBrO_3$ per liter Sat. Solution
0.0	0.9989	8.12
10.0	0.9804	5.53
20.0	0.9664	3.86
30.0	0.9507	2.78
40.0	0.9315	1.97
50.0	0.9099	1.36

SOLUBILITY OF SILVER BROMATE IN AQUEOUS SOLUTIONS n PROPYL ALCOHOL AND IN ISO PROPYL ALCOHOL AT 25°.

BrO

(Owen, 1933; Newman, 1934.)

Results for n Propyl Alcohol

Wt. Percent C_3H_7OH in Solvent	d_{25} of Solvent	Millimols $AgBrO_3$ per liter Sat. Solution
10	0.9821	5.80
20	0.9674	4.36
30	0.9472	3.31
40	0.9261	2.41
50	0.9051	1.63

Results for iso Propyl Alcohol

Wt. percent $(CH_3)_2CHOH$ in Solvent	Millimols $AgBrO_3$ per liter Sat. Solution
10	5.5
20	3.95
30	2.92
40	2.1
50	1.5

SOLUBILITY OF SILVER BROMATE IN AQUEOUS SOLUTIONS OF ACETONE, MANNITOL AND GLYCINE AT 25°.

(Owen, 1933.)

	In Acetone		In Mannitol		In Glycine	
Wt. Percent Organic Cmpd. in Solvent	d_{25} of aq. Acetone	Millimols $AgBrO_3$ per liter Sat. Sol.	d_{25} of aq. Mannitol	Millimols $AgBrO_3$ per liter Sat. Sol.	d_{25} of aq. Glycine	Millimols $AgBrO_3$ per liter Sat. Sol.
5	—	—	1.0147	8.24	1.0184	12.9
10	0.9845	5.92	1.0328	8.38	1.0395	18.4
15	—	—	1.0513	8.51	1.0613	24.9
20	0.9700	4.29	—	—	—	—
30	0.9537	3.00	—	—	—	—
40	0.9355	2.03	—	—	—	—

SILVER BROMATE $AgBrO_3$

SOLUBILITY OF SILVER BROMATE IN AQUEOUS SOLUTIONS OF ETHYLENE GLYCOL AND OF GLYCEROL AT 25°.

(Owen, 1933.)

Results for Ethylene Glycol			Results for Glycerol		
Wt. Percent $OHCH_2.CH_2OH$ in Solvent	d_{25} of aq. Solvent	Millimols $AgBrO_3$ per liter Sat. Sol.	Wt. Percent $OHCH_2CHOHCH_2OH$ in Solvent	d_{25} of aq. Solvent	Millimols $AgBrO_3$ per liter Sat. Sol.
10	1.0097	7.26	10	1.0207	7.80
20	1.0228	6.50	20	1.0453	7.49
30	1.0362	5.85	30	1.0706	7.15
40	1.0496	5.26	40	1.0971	6.84
50	1.0624	4.70	50	1.1239	6.48
70	1.0851	3.61	60	1.1511	6.08
			70	1.1784	5.59
			80	1.2054	4.94

SILVER METHIONATE $Ag_2.CH_2O_6S_2$

SOLUBILITY IN WATER

(Backer and Terpstra, 1929.)

t°	Gms. $Ag_2CH_2O_6S_2$ per 100 gms. H_2O	Solid Phase
25°	62.5	$Ag_2CH_2O_6S_2.2H_2O$
25°	45.05	$AgCH_2O_6S_2$

SILVER ACETATE CH_3COOAg.

SOLUBILITY IN WATER.

(Nernst, 1889; Arrhenius, 1893; Goldschmidt, 1898; Nauman and Rucker, 1905; Raupenstrauch, 1885; Wright and Thompson, 1884, 1885.)

t°.	Gms. $Ag(C_2H_3O_2)$ per Liter.	t°.	Gms. $Ag(C_2H_3O_2)$ per Liter.	t°.	Gms. $Ag(C_2H_3O_2)$ per Liter.
0	7.22	25	11.2	50	16.4
10	8.75	30	12.1	60	18.9
15	9.4	40	14.1	70	21.8
20	10.4			80	25.2

At 18° one liter sat. solution in water contains 10.03 gms. $AgCH_3COO$ (Larsson and Adell, 1931).

At 25° one liter sat. solution in water contains 11.07 gms. $AgCH_3COO$ (Jaques, 1909); 11.13 gms. (Hill and Simmons, 1909); (Knox and Will, 1919); 11.09 gms, d_{25} sat. sol. = 1.0047 (MacDougall, 1930; MacDougall and Rehner, 1934; MacDougall and Bartsch, 1936; MacDougall and Larson, 1937).

SOLUBILITY OF SILVER ACETATE AT 18° IN AQUEOUS SOLUTIONS OF:

(Larsson and Adell, 1931.)

Sodium Nitrate

Moles per liter Sat. Sol.	
$NaNO_3$	$AgCH_3COO$
0.0	0.0601
0.2	0.0686
0.4	0.0734
0.6	0.0767
0.8	0.0790
1.0	0.0810

Sodium Acetate

Moles per liter Sat. Sol.	
$NaCH_3COO$	$AgCH_3COO$
0.0503	0.0429
0.1005	0.0317
0.2011	0.0223
0.2513	0.0211
0.503	0.0153
1.005	0.0121

SOLUBILITY OF SILVER ACETATE IN AQUEOUS SOLUTIONS OF:

Silver Nitrate.			Sodium Acetate.		
Gms. $AgNO_3$ per Liter.	Gms. CH_3COOAg per Liter at: 10° (Nernst).	19.8° (Arrhenius).	Gms. CH_3COONa per Liter.	Gms. CH_3COOHg per Liter at: 16° (N., N. and R.).	18.6° (A.).
0	10.05	9.85	0	10.05	9.9
5	8.2	7.9	5	6.3	6.6
10	7.0	6.6	10	4.6	4.9
15	6.4	5.5	15	3.8	4.1
20	5.7	4.5	20	3.3	3.5
30	4.4	...	30	...	2.8
40	3.2	...	40	...	2.4

SOLUBILITY OF SILVER ACETATE IN AQUEOUS SALT SOLUTIONS AT 25°. (Jaques, 1910.)

Aq. Solution of;	Gms Salt. per Liter.	Gms. $AgC_2H_3O_2$ per Liter.
Water alone	0	11.08
Cadmium Acetate	1.15	10.39
" "	5.76	8.10
" "	11.52	6.71
" "	57.6	4.33
" "	115.2	3.95
Lead Acetate	1.63	10.69
" "	8.13	9.45
" "	16.26	8.34
" "	81.3	7.26
" "	162.6	5.99

Aq. Solution of:	Gms. Salt per Liter.	Gms. $AgC_2H_3O_2$ per Liter.
Potassium Acetate	2.22	9.60
" "	22.2	4.43
" "	111	2.41
" "	222	2.18
Silver Nitrate	2.77	9.93
" "	5.55	9
" "	11.10	7.41
" "	22.21	5.81
Sodium Acetate	1.97	9.27
" "	19.7	4.21
" "	98.5	2.33
" "	197	2.07

CH

SOLUBILITY OF SILVER ACETATE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE AT 25°.

(MacDougall, 1930).

m KNO_3	d_{25} of Sat. Sol.	m $AgCH_3COO$	c $AgCH_3COO$	m KNO_3	d_{25} of Sat. Sol.	m $AgCH_3COO$	c $AgCH_3COO$
0.0501	1.0077	0.06685	0.06642	0.8021	1.0537	0.08786	0.08449
0.1006	1.0115	0.07281	0.07204	1.0155	1.0658	0.09019	0.08600
0.2001	1.0180	0.07659	0.07547	1.2431	1.0784	0.09214	0.08708
0.3018	1.0241	0.07941	0.07791	1.5437	1.0944	0.09453	0.08828
0.4010	1.0298	0.08171	0.07982	2.0371	1.1186	0.09754	0.08923
0.5013	1.0366	0.08344	0.08124	2.5355	1.1426	0.09997	0.08973
0.6040	1.0417	0.08498	0.08233	3.0139	1.1653	0.10163	0.08960

m = molality or moles of $AgCH_3COO$ per 1000 gms. of water.
c = molarity or moles of $AgCH_3COO$ per 1000 cc. of solution.

SILVER ACETATE, $AgCH_3COO$

SOLUBILITY OF SILVER ACETATE IN AQUEOUS SOLUTIONS OF NITRATES AT 25°.

(MacDougall and Rehner, Jr., 1934.)

In Aqueous Lithium Nitrate

d_{25} of Sat. Solution	Moles per 1000 gms H_2O	
	$LiNO_3$	$AgCH_3COO$
1.0050	0.0	0.06666
1.0067	0.04817	0.07033
1.0097	0.0994	0.07280
1.0143	0.1996	0.07799
1.0185	0.2997	0.08198
1.0226	0.4002	0.08490
1.0269	0.5004	0.08765
1.0314	0.6101	0.09033
1.0395	0.8195	0.09491
1.0461	0.9975	0.09819
1.0561	1.2636	0.1031
1.0649	1.4997	0.1072
1.0925	2.2835	0.1195
1.1002	2.5193	0.1229
1.1172	3.0305	0.1315
1.1444	4.0221	0.1479
1.2050	6.0125	0.1851
1.2560	8.0153	0.2274
1.3007	10.055	0.2768

H

In Aqueous Sodium Nitrate

d_{25} of Sat. Solution	Moles per 1000 gms. H_2O	
	$NaNO_3$	$AgCH_3COO$
1.0086	0.04770	0.07040
1.0108	0.09648	0.07287
1.0162	0.1914	0.07640
1.0216	0.2868	0.08032
1.0269	0.3840	0.08246
1.0310	0.4767	0.08414
1.0371	0.5743	0.08615
1.0470	0.7631	0.08910
1.0578	0.9533	0.09177
1.0629	1.0504	0.09266
1.0718	1.2398	0.09464
1.0857	1.5325	0.09766
1.1038	1.9108	0.09958
1.1246	2.3884	0.1027
1.1458	2.8723	0.1059
1.1846	3.9954	0.1106
1.2628	6.0191	.0.113
1.3212	8.0098	0.1123
1.3753	10.225	0.1109

In Aqueous Calcium Nitrate.

d_{25} of Sat. Solution	Moles per 1000 gms. H_2O	
	$Ca(NO_3)_2$	$AgCH_3COO$
1.0062	0.00499	0.06825
1.0071	0.00993	0.06920
1.0084	0.01996	0.07187
1.0126	0.04980	0.07691
1.0191	0.09970	0.08365
1.0318	0.1996	0.09311
1.0560	0.3985	0.1067
1.0792	0.5985	0.1170
1.1225	0.9962	0.1363
1.1726	1.4916	0.1588
1.2634	2.4958	0.2034
1.3766	3.9871	0.2759

In Aqueous Strontium Nitrate

d_{25} of Sat. Solution	Moles per 1000 gms. H_2O	
	$(Sr(NO_3)_2$	$AgCH_3COO$
1.0063	0.00497	0.06768
1.0071	0.01001	0.06870
1.0090	0.02002	0.07133
1.0134	0.05038	0.07628
1.0229	0.1008	0.08178
1.0402	0.2009	0.08936
1.0727	0.4022	0.1001
1.1046	0.6036	0.1081
1.1645	1.0064	0.1218
1.2338	1.5072	0.1354
1.3575	2.5092	0.1588
1.4605	3.4941	0.1632

In Aqueous Barium Nitrate

d_{25} of Sat. Solution	Moles per 1000 gms. H_2O	
	$Ba(NO_3)_2$	$AgCH_3COO$
1.0050	0.0	0.06666
1.0064	0.005012	0.06796
1.0076	0.01001	0.06910
1.0100	0.01998	0.07127
1.0161	0.05025	0.07597
1.0273	0.1002	0.08104
1.0489	0.2009	0.08831
1.0697	0.3014	0.09361
1.0796	0.3500	0.09572
1.0876	0.3902	0.09755

In Aqueous Lanthanum Nitrate

d_{25} of Sat. Solution	Moles per 1000 gms. H_2O	
	$La(NO_3)_3$	$AgCH_3COO$
1.0060	0.001431	0.06809
1.0073	0.004859	0.07109
1.0085	0.008374	0.07407
1.0122	0.01839	0.08231
1.0228	0.05047	0.1034
1.0389	0.1016	0.1304
1.0715	0.2113	0.1746
1.1210	0.3908	0.2315
1.1613	0.5434	0.2771
1.2558	0.9216	0.3856
1.4571	1.8508	0.6764
1.6277	2.8185	1.0487

SOLUBILITY OF SILVER ACETATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 25°.

(Hill and Simmons, 1909.)

Normality of Aq. HNO_3.	Per cent HNO_3 in Solvent.	d_{25} of Sat. Sol.	Gms. $AgC_2H_3O_2$ per Liter Sat. Sol.
0	0	1.005	11.13
0.50	3.096	1.072	85.31
1	6.128	1.140	161.9
2	11.757	1.267	307.4
4.02	22.386	1.470	549.3
5.03	27.328	1.561	656
6.44	33.813	1.670	792.2

Results are also given for the solubility of $AgC_2H_3O_2 + AgNO_3$ in Aq. HNO_3 at 25°.

SOLUBILITY OF SILVER ACETATE IN AQUEOUS SOLUTIONS OF ACETIC ACID AT 25°.

(Knox and Will, 1919.)

Saturation was secured by constant agitation in a thermostat.

Gm. equiv. CH_3COOH per liter.	Gms. CH_3COOAg per liter.	Gm. equiv. CH_3COOH per liter.	Gms. CH_3COOAg per liter.	Gm. equiv. CH_3COOH per liter.	Gms. CH_3COOAg per liter.
0.0	11.13	5.99	8.72	12.32	5.33
1.00	10.73	6.80	8.29	12.97	4.96
2.00	10.32	8.01	7.73	13.97	4.29
2.98	9.98	8.97	7.31	14.96	3.43
4.19	9.52	9.96	6.78	15.93	2.48
4.98	9.19	11.02	6.15	17.28	1.09

100 gms. sat. solution of silver acetate in acetic acid contain 0.094 gm. CH_3COOAg at 76° and 0.204 gm. at 115°. (Kendall and Adler, 1921.)

SOLUBILITY OF SILVER ACETATE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 25°.

CH

(MacDougall and Bartsch, 1936.)

Wt. Percent C_2H_5OH in Solvent	d_{25} of Sat. Sol.	Moles $AgCH_3COO$ per liter Sat. Sol.	Wt. Percent C_2H_5OH in Solvent	d_{25} of Sat. Sol.	Moles $AgCH_3COO$ per liter Sat. Sol.
5.0	0.9955	0.0577	25.06	0.9616	0.0294
7.62	0.9898	0.0523	29.82	0.9530	0.0251
9.0	0.9882	0.0506	30.05	0.9926	0.0249
15.03	0.9784	0.0413	40.27	0.9323	0.0180
19.96	0.9696	0.03	50.14	0.9102	0.0124

Results are also given for the solubility at 25° of silver acetate in approximately 10, 20 and 30 percent aqueous ethyl alcohol mixtures containing varying concentrations of KNO_3, $NaNO_3$, $LiNO_3$, $Ca(NO_3)_2$, $Sr(NO_3)_2$ and $Ba(NO_3)_2$.

SOLUBILITY OF SILVER ACETATE IN AQUEOUS SOLUTIONS OF ACETONE AT 25°.

(MacDougall and Larson, 1937.)

Wt. Percent $(CH_3)_2CO$ in Solvent	d_{25} of Sat. Sol.	Moles $AgCH_3COO$ per liter Sat. Sol.	Wt. Percent $(CH_3)_2CO$ in Solvent	d_{25} of Sat. Sol.	Moles $AgCH_3COO$ per liter Sat. Sol.
9.27	0.9920	0.0516	20.03	0.9740	0.0322
9.81	0.9910	0.0499	20.50	0.9724	0.0319
10.35	0.9900	0.0481	28.25	0.9592	0.0214
18.83	0.9758	0.0324	29.23	0.9584	0.0213
19.48	0.9748	0.0323	30.02	0.9564	0.0213

Results are also given for the solubility at 25° of silver acetate in approximately 10, 20 and 30 percent aqueous acetone mixtures containing varying concentrations of KNO_3, $NaNO_3$, $Sr(NO_3)_2$ and $Ca(NO_3)_2$.

SILVER ACETATE $AgCH_3COO$.

SOLUBILITY OF SILVER ACETATE IN AQUEOUS SOLUTIONS OF SEVERAL COMPOUNDS AT 25°. (Armstrong and Eyre, 1913.)

Aqueous Solution of:	Gms. Compound per 1000 Gms. H_2O.	Gms. $AgC_2H_3O_2$ per 1000 Gms. Sat. Sol.	Aqueous Solution of:	Gms. Compound per 1000 Gms. H_2O.	Gms. $AgC_2H_3O_2$ per 1000 Gms. Sat. Sol.
Water	0	11.08	Propyl Alcohol	15	9.88
Acetaldehyde	11	10.13	" "	60	8.03
Paraldehyde	11	8.92	Glycerol	9.21	8.66
"	33	9.16	Glycol	15.5	10.86
Isobutyl Alcohol	66.4	7.55	"	62.1	8.44

100 gms. liquid SO_2 dissolve 0.017 gm. $AgCH_3COO$ at 0°. (Jander and Ruppold, 1937.)

SILVER Monochlor ACETATE $AgCH_2ClCOO$.

One liter aqueous solution contains 12.97 gms. $AgCH_2ClCOO$ at 16.9°. (Arrhenius, '93.)

SOLUBILITY OF SILVER MONO CHLOR ACETATE AT 16.9° IN AQUEOUS SOLUTIONS OF:

Silver Nitrate.		Sodium Chlor Acetate.	
Gms $AgNO_3$ per Liter.	Gms. $CH_2ClCOOAg$ per Liter.	Gms. $CH_2ClCOONa$ per Liter.	Gms. $CH_2ClCOOAg$ per Liter.
0.0	12.97	0.0	12.97
9.6	10.05	3.88	10.05
17.0	7.55	7.77	8.16
		15.53	6.02
		31.07	4.19
		58.26	3.26

SOLUBILITY OF SILVER MONO CHLOR ACETATE IN AQUEOUS SOLUTIONS OF BARIUM NITRATE AT 25°.

(MacDougall and Rehner, Jr., 1934.)

d_{25} of Sat. Sol.	Moles per 1000 gms. H_2O		d_{25} of Sat. Sol.	Moles per 1000 gms. H_2O	
	$Ba(NO_3)_2$	$AgCH_2ClCOO$		$Ba(NO_3)_2$	$AgCH_2ClCOO$
1.0097	0.0	0.07832	1.0319	0.09916	0.09493
1.0100	0.00493	0.07995	1.0535	0.2001	0.1035
1.0114	0.00987	0.08180	1.0739	0.2980	0.1099
1.0136	0.01990	0.08340	1.0846	0.3501	0.1131
1.0207	0.05000	0.08878	1.0922	0.3871	0.1151

100 gms. liquid sulfur dioxide dissolve 0.017 gm. $AgCH_3COO$ at 0°. (Jander and Wickert, 1936.)

SILVER Monochlor ACETATE $AgCH_2ClCOO$

SOLUBILITY OF SILVER MONOCHLOR ACETATE IN AQUEOUS SOLUTIONS OF NITRATES AT 25°.

(MacDougall and Rehner, Jr., 1934.)

In Aqueous Lithium Nitrate

d_{25} of Sat. Sol.	Moles per 1000 gms. H_2O	
	$LiNO_3$	$AgCH_2ClCOO$
1.0123	0.05039	0.08199
1.0191	0.2001	0.09026
1.0277	0.4004	0.09772
1.0440	0.8081	0.1081
1.0696	1.5025	0.1186
1.1210	2.9908	0.1436
1.2079	6.0071	0.1648

In Aqueous Sodium Nitrate

d_{25} of Sat. Sol.	Moles per 1000 gms. H_2O	
	$NaNO_3$	$AgCH_2ClCOO$
1.0125	0.04979	0.08004
1.0219	0.1994	0.08923
1.0334	0.3990	0.09617
1.0555	0.7975	0.1059
1.0907	1.4930	0.1170
1.1583	2.9847	0.1320
1.3798	9.9368	0.1568

In Aqueous Potassium Nitrate

d_{25} of Sat. Sol.	Moles per 1000 gms. H_2O	
	$LiNO_3$	$AgCH_2ClCOO$
1.0127	0.05005	0.08306
1.0229	0.1999	0.09112
1.0353	0.3971	0.09825
1.0598	0.7980	0.1087
1.0851	1.2464	0.1183
1.1244	1.9923	0.1316
1.1728	2.9960	0.1440

In Aqueous Calcium Nitrate

d_{25} of Sat. Sol.	1000Moles per 1000 gms. H_2O	
	$Ca(NO_3)_2$	Ag_2CH_2ClCOO
1.0102	0.00499	0.08118
1.0127	0.01996	0.08503
1.0363	0.1996	0.1063
1.0611	0.3985	0.1208
1.1066	0.7958	0.1412
1.1782	1.4916	0.1728
1.3786	3.9871	0.2550

CH

In Aqueous Strontium Nitrate

d_{25} of Sat. Sol.	Moles per 1000 gms. H_2O	
	$Sr(NO_3)_2$	$AgCH_2ClCOO$
1.0100	0.004978	0.08139
1.0133	0.01988	0.08466
1.0279	0.09998	0.09524
1.0452	0.1989	0.1044
1.0786	0.3992	0.1175
1.1103	0.6008	0.1274
1.1407	0.7993	0.1362
1.2394	1.4977	0.1606
1.4180	2.9985	0.1975

In Aqueous Lanthanum Nitrate

d_{25} of Sat. Sol.	Moles per 1000 gms. H_2O	
	$La(NO_3)_3$	Ag_2CH_2ClCOO
1.0103	0.001431	0.8211
1.0129	0.008374	0.08680
1.0268	0.05047	0.1080
1.0752	0.2113	0.1569
1.1226	0.3908	0.1879
1.2098	0.7371	0.2441
1.3149	1.2013	0.3164
1.4465	1.8568	0.4237
1.6080	2.8185	0.5939

SOLUBILITY OF SILVER MONOCHLORO ACETATE IN NITRIC ACID AT 25°.

(Hill and Simmons, 1909.)

Normality of Aq. HNO_3.	Gms. HNO_3 per 100 Gms. Solvent.	d_{25} of Sat. Sol.	Gms. $AgC_2H_2ClO_2$ per Liter.
0	0	1.0095	15.18
0.25	1.564	1.0426	50.33
0.50	3.096	1.0791	91.83
1	6.128	1.1473	167.3
2	11.757	1.2716	310.8
4	22.277	1.4749	549.1
5	27.185	1.5673	659.2

g

SILVER Dipropyl **ACETATE** $AgC_8H_{15}O_2$.

100 gms. H_2O dissolve 0.123 gm. $AgC_8H_{15}O_2$ at 11.7°, and 0.190 gm. at 72°. (Fürth, 1888.)

SILVER Methyl Ethyl **ACETATE** $Ag.CH_3.CH_2CH(CH_3)COO$.

SILVER Diethyl **ACETATE** $Ag[(C_2H_5)_2CH.COO]$.

SILVER Trimethyl **ACETATE** $Ag(CH_3)_3CCOO$.*

SOLUBILITY OF EACH IN WATER.

(Sedlitzky, 1887; Keppish, 1888; Stiassny, 1891.)

t°.	Gms. per 100 Gms. H_2O.			t°.	Gms. per 100 Gms. H_2O.		
	$Ag\,C_5H_9O_2$	$AgC_6H_{11}O_2$.	$AgC_5H_9O_2$.*		$AgC_5H_9O_2$.	$AgC_6H_{11}O_2$.	$AgC_5H_9O_2$.*
0	1.112	0.402	1.10	50	1.602	0.536	1.47
10	1.126	0.413	1.15	60	1.827	0.585	1.57
20	1.182	0.432	1.22	70	2.093	0.643	1.68
30	1.280	0.458	1.22	80	2.402	...	1.80

SILVER Phenyl **ACETATE** $AgC_6H_5CH_2COO$

100 cc. sat. solution in water contain 0.352 gm. $Ag.C_6H_5CH_2COO$ at 25°. (Larson, 1927.)

H **SILVER PROPIONATE** C_2H_5COOAg.

SOLUBILITY IN WATER.

(Raupenstrauch, 1885; Arrhenius, 1893; Goldschmidt, 1898.)

t°.	Gms. $C_3H_5O_2Ag$ per Liter.	t°.	Gms. $C_3H_5O_2Ag$ per Liter.	t°.	Gms. $C_3H_5O_2Ag$ per Liter.
0	5.12	20	8.36 (8.48)	50	13.35
10	6.78	25	9.06	70	17.64
18.2	8.36 (A)	30	9.93 (9.70)	80	20.30

100 cc. sat. solution in H_2O contain 0.9 gm. AgC_2H_5COO at 25°. (Larson, 1927.)

100 cc. sat. solution in H_2O contain 1.353 gm. AgC_2H_5COO at 50°. (Fuhner, 1924.)

SOLUBILITY OF SILVER PROPIONATE IN AQUEOUS SOLUTIONS OF:

(Arrhenius.)

Silver Nitrate at 19.7°.				Sodium Propionate at 18.2°.			
Mols per Liter.		Gms. per Liter.		Mols. per Liter.		Gms. per Liter.	
$AgNO_3$.	$C_3H_5O_2Ag$.	$AgNO_3$.	$C_3H_5O_2Ag$.	$C_3H_5O_2Na$.	$C_3H_5O_2Ag$.	$C_3H_5O_2Na$.	$C_3H_5O_2Ag$.
0	0.0471	0	8.519	0	0.0462	0	8.362
0.0133	0.0415	2.289	7.511	0.0167	0.0393	1.607	7.114
0.0267	0.0379	4.577	6.86	0.0333	0.0345	3.215	6.244
0.0533	0.0307	9.059	5.556	0.0667	0.0258	6.429	4.670
0.100	0.0222	16.997	4.019	0.1333	0.0191	12.859	3.456
				0.2667	0.0131	25.718	2.371
				0.5000	0.0101	48.77	1.828

SOLUBILITY OF SILVER PROPIONATE IN AQUEOUS SOLUTIONS OF PROPIONIC ACID AT 25°.

(Knox and Will, 1919.)

Gm. equiv. C_2H_5COOH per liter.	Gms. C_2H_5COOAg per liter.	Gm. equiv. C_2H_5COOH per liter.	Gm. C_2H_5COOAg per liter.	Gm. equiv. C_2H_5COOH per liter.	Gms. C_2H_5COOAg per liter.
0.00	9.04	2.97	7.60	8.56	4.96
1.00	8.58	4.95	6.78	11.40	3.16
2.00	8.01	6.98	5.78	13.03	3.17

SILVER Acetal **PROPIONATE (LEVULINATE)** $Ag.CH_3COCH_2CH_2COO$.

Solubility in Water.

(Furcht and Lieben, 1909.)

t°.	Gms. per 100 Gms. Sat. Solution.	
8	0.5363 (white salt)	0.5195 (yellow salt)
9	0.5166	0.5372
14–15	0.6078 "	0.6448 "
99.6	3.49	3.70

SILVER BUTYRATE C_3H_7COOAg.

SILVER (Iso)**BUTYRATE** $(CH_3)_2CHCOOAg$.

Solubility of Each Separately in Water.

(Goldschmidt, 1898; Arrhenius, 1893; Raupenstrauch, 1885, Fühner, 1924.)

t°.	Gms. per 100 Gms. H_2O. Butyrate.	Gms. per 100 Gms. H_2O. Iso Butyrate.	t°.	Gms. per 100 Gms. H_2O. Butyrate.	Gms. per 100 Gms. H_2O. Iso Butyrate.
0	0.363	0.796	30	0.561	1.060 (1.1022)
10	0.419	0.874	40	0.647	1.176 (R.)
17.8	0.432 (A.)	...	50	0.742	1.313
18.8	0.445 (A.)	...	60	0.848	...
20	0.484	0.961 (0.9986)	70	0.964	1.670
25	...	... (1.0442)	80	1.14	1.898

Solubility of Silver Butyrate in Aq. Solutions of Silver Acetate, Silver Nitrate and of Sodium Butyrate.

(Arrhenius, 1893)

In Silver Acetate at 17.8°.

G. Mols. per Liter.		Grams per Liter.	
CH_3COOAg.	C_3H_7COOAg.	CH_3COOAg.	C_3H_7COOAg.
0.0	0.0221	0.0	4.32
0.0270	0.0139	4.51	2.71
0.0506	0.0103	8.45	2.01

In Silver Nitrate at 18.8°.

G. Mols. per Liter.		Grams per Liter.	
$AgNO_3$.	C_3H_7COOAg.	$AgNO_3$.	C_3H_7COOAg.
0.0	0.0228	0.0	4.445
0.0667	0.0078	11.33	1.521
0.100	0.0062	17.00	1.209

In Sodium Butyrate at 18.2°.

G. Mols. per Liter.		Grams per Liter.		G. Mols. per Liter.		Grams per Liter.	
C_3H_7COONa.	C_3H_7COOAg.	C_3H_7COONa.	C_3H_7COOAg.	C_3H_7COONa.	C_3H_7COOAg.	C_3H_7COONa.	C_3H_7COOAg.
0.0	0.0224	0.0	4.363	0.0658	0.0091	7.24	1.774
0.0066	0.0199	0.73	3.881	0.1315	0.0060	14.47	1.170
0.0164	0.0169	1.81	3.296	0.263	0.0040	28.96	0.780
0.0329	0.0131	3.62	2.555	0.493	0.0027	54.28	0.526

SILVER FUMARATE $C_4H_2O_4Ag_2$

100 gms H_2O dissolve 0.013 gm. silver fumarate at 30°. (Weiss and Downs, 1923.)

SILVER MALEATE $C_4H_2O_4Ag_2$

100 gms. H_2O dissolve 0.12 gm. silver maleate at 30°. (Weiss and Downs, 1923.)

SILVER MALATE $C_4H_4O_5Ag_2$.

100 gms. H_2O dissolve 0.0119 gms. at 18°. and 0.1216 gm. at 25°.
(Partheil and Hübner, 1903.

SILVER TARTRATE $C_4H_4O_6Ag_2$.

100 gms. H_2O dissolve 0.2012 gm. $C_4H_4O_6Ag_2$ at 18°, and 0.2031 gm. at 25°.
(Partheil and Hübner, 1903.)

Solubility of Silver Tartrate in Water and in Aqueous Solutions of Boric Acid at 18°. (Kolthoff, 1926.)

Solvent.	Normality of sat. sol. in Ag ions.	Gms. $C_4H_4O_6Ag_2$ per liter.
Water	0.0086	1.42
Aq. 0.1 mol. H_3BO_3	0.00148 (?)	2.45 (?)
» 0.5 » »	0.0414	6.87

The above gram quantities were calculated by multiplying the normality of Ag ions by one-half the molecular weight of silver tartrate.

SILVER SUCCINATE $C_4H_4O_4Ag_2$.

CH 100 gms. H_2O dissolve 0.0176 gm. at 18°, and 0.0199 gm. at 25°.
(Partheil and Hübner, 1903.)

SILVER β Methyl **ADIPATE** (Neutral Salt).

100 cc. sat. solution of silver β methyl adipate in water contain 0.12 gm. of the compound at 20°. (Meurisse)

SILVER VALERATES $AgC_5H_9O_2$.

Normal Valerate, $CH_3(CH_2)_3.COOAg$. Iso Valerate, $CH_3.CH(CH_3)_2CH_2COOAg$.

Solubility of Each Separately in Water.
(Fürth, 1888; Sedlitzky, 1887.)

t°.	Gms per 100 Gms. H_2O.		t°.	Gms. per 100 Gms. H_2O.	
	Normal V.	Iso V.		Normal V.	Iso V.
0	0.229	0.177	50	0.474	0.360
10	0.259	0.211	60	0.552	0.401
20	0.300	0.246	70	0.636	0.443
30	0.349	0.283	80	...	0.486
40	0.408	0.321			

100 gms. H_2O dissolve 0.73 gm. silver valerate at 20°. (Markwald, 1899.)

100 cc. sat. aq. solution contains 0.71 gm. dextro silver valerate at 15°.
(Taverne, 1900.)

100 gms. H_2O dissolve 0.476 gms. n $CH_3(CH_2)_3COOAg$ at 50°.
(Kühner, 1924.)

SOLUBILITY OF SILVER VALERATE IN AQUEOUS SOLUTIONS OF SILVER ACETATE, SILVER NITRATE AND OF SODIUM VALERATE.

(Arrhenius, 1893.)

In Silver Acetate at 17.8°.

Mols. per Liter.		Gms. per Liter.	
$C_2H_3O_2Ag$.	$C_5H_9O_2Ag$.	$C_2H_3O_2Ag$.	$C_5H_9O_2Ag$.
0	0.0094	0	1.96
0.0067	0.0070	1.13	1.46
0.0135	0.0057	2.27	1.19
0.0270	0.0037	4.54	0.77
0.0505	0.00265	8.48	0.55

In Silver Nitrate at 16.5°.

Mols. per Liter.		Gms. per Liter.	
$AgNO_3$.	$C_5H_9O_2Ag$.	$AgNO_3$.	$C_5H_9O_2Ag$.
0	0.0094	0	1.96
0.0067	0.0068	1.14	1.42
0.0133	0.0051	2.29	1.07
0.0267	0.0031	4.58	0.65
0.1000	0.0012	17.	0.25

In Sodium Valerate at 18.6°.

Mols. per Liter.		Gms. per Liter.	
$C_5H_9O_2Na$.	$C_5H_9O_2Ag$.	$C_5H_9O_2Na$.	$C_5H_9O_2Ag$.
0	0.0095	0	1.986
0.0175	0.0047	2.17	0.982
0.0349	0.0030	4.32	0.627
0.0698	0.0018	8.65	0.376
0.1395	0.0015	17.31	0.313

SILVER CAPROATES $Ag(C_6H_{11}O_2)$. (Silver hexanoates)

SOLUBILITY OF EACH SEPARATELY IN WATER.

(Keppish, 1888; Stiassny, 1891; Kulisch, 1893; König, 1894; Altschul, 1896)

CH

Results in terms of gms. salt per 100 gms. H_2O.

t°.	Normal Caproate $CH_3(CH_2)_4COOAg$.		2 Methyl Pentan 4 Acid $CH_3CH CH_3 .(CH_2)_2COOAg$.	Methyl 3 Pentan Acid 4 $CH_3.CH_2 .CHCH_3CH_2COOAg$.	4 Methyl Pentan 4 Acid $CH_3(CH_2)_2CH(CH_3) .COOAg$.
0	0.076 (A.)	0.078 (Keppish)	0.168 (König)	0.880 (Kulish)	0.510 (Stiassny)
10	0.085	0.089	0.162	0.858	0.528
20	0.100	0.107	0.163	0.849	0.550
30	0.123	0.131	0.170	0.854	0.574
40	0.154	0.161	0.183	0.871	0.602
50	0.193	0.198	0.203	0.902	0.632
60	0.240	0.243	0.229	0.946	0.666
70	0.295	0.288	0.263	1.003	0.702
80	0.354	...	0.300	1.073	0.742
90	...	...	0.347	1.157	...

100 gms. H_2O dissolve 0.193 gm. n silver caproate, Ag $C_5H_{11}COO$, at 50°. (Fuhner, 1924.)

SILVER CITRATE $C_6H_5O_7Ag_3$.

100 gms. H_2O dissolve 0.0277 gm. $C_6H_5O_7Ag_3$ at 18°, and 0.0284 gm. at 25°. (Partheil and Hübner, 1903.)

SILVER Nitroso β PHENYL HYDROXYLAMINE. Ag $[C_6H_5.N(NO)O]$.

The solubility in water of the precipitated silver salt of nitroso phenylhydroxylamine obtained by adding a solution of "cupferron" ($C_6H_5.N(NO)O.NH_4$), to a solution of a soluble silver salt, was determined at 18° by potentiometric and conductometric methods. The results showed $1.4.10^{-3}$ gm. atoms Ag per liter, equivalent to 0.150 gm. Ag $C_6H_5N(NO)O$ (Pinkus and Martin, 1927.)

SILVER BENZOATE $Ag[C_6H_5COO]$.

SOLUBILITY OF SILVER BENZOATE IN WATER

	Gm. Mol. $Ag[C_6H_5COO]$ per liter	Gms. $Ag[C_6H_5COO]$ per liter	Authority
14.5	—	1.763	(Holleman, 1893.)
18.0	0.01038	2.375	(Larson and Adel, 1931.)
20.0	—	2.17	(Ephriam and Pfister, 1925.)
25.0	0.01144	2.61	(Noyes and Schwartz, 1898.)
25.0	0.01162	2.66	(Kolthoff and Bosch, 1932.)

SOLUBILITY OF SILVER BENZOATE AT 25° IN AQUEOUS SOLUTIONS OF:

(Noyes and Schwartz, 1898.)

CH

Nitric Acid				Chloracetic Acid			
Gms. Mols. per Liter.		Gms. per Liter.		Gms. Mols. per Liter.		Gms. per Liter.	
HNO_3.	C_6H_5COOAg.	HNO_3.	C_6H_5COOAg.	$CH_2ClCOOH$.	C_6H_5COOAg.	$CH_2ClCOOH$.	C_6H_5COOAg.
0	0.01144	0	2.607	0	0.01144	0	2.607
0.004435	0.01395	0.280	3.195	0.00394	0.01385	0.371	3.172
0.00887	0.01698	0.559	3.889	0.00787	0.01612	0.744	3.691
0.00892	0.01715	0.562	3.926	0.01574	0.02093	1.487	4.792
0.01774	0.02324	1.118	5.321				
0.02674	0.03071	1.686	7.031				

One liter of cold alcohol dissolves 0.169 gm. C_6H_5COOAg; one liter of boiling alcohol dissolves 0.465 gm. (Liebermann, 1902.)

SOLUBILITY AT 18° OF SILVER BENZOATE IN AQUEOUS SOLUTIONS OF:

(Larson and Adell, 1931.)

Sodium Nitrate		Potassium Nitrate		Barium Nitrate		Sodium Acetate	
Gm. Mols, per liter		Gm. Mols. per liter		Gm. Mols. per liter		Gm. Mols. per liter	
$NaNO_3$	$Ag\ C_6H_5COO$	KNO_3	$Ag\ C_6H_5COO$	$Ba(NO_3)_2$	$Ag\ C_6H_5COO$	$Na\ CH_3COO$	$Ag\ C_6H_5COO$
0.0	0.01038	0.05	0.01172	0.0	0.01038	0.0	0.01038
0.10	0.01215	0.10	0.01221	0.06	0.01214	0.0099	0.01055
0.30	0.01351	0.30	0.01363	0.08	0.01235	0.0496	0.01196
0.50	0.01422	0.50	0.01424	0.125	0.01306	0.0992	0.01303
1.00	0.01523	0.80	0.01476	0.160	0.01323	0.2974	0.01608
2.00	0.01624	1.00	0.01507	0.20	0.01366		
3.00	0.01610	2.00	0.01593				
		3.00	0.01576				

SILVER BENZOATE

SOLUBILITY OF SILVER BENZOATE IN AQUEOUS SOLUTIONS OF SALTS AT 25°.

(Kolthoff and Bosch, 1932.)

Aq. Solution of:	Gm. Mols. per liter		Aq. Solution of:	Gm. Mols. per liter	
	Salt	$Ag[C_6H_5COO]$		Salt	$Ag[C_6H_5COO]$
KNO_3	0.05	0.01298	Water alone	0.0	0.01102
"	0.09	0.01369	$AgNO_3$	0.01	0.00786
"	0.10	0.01366	"	0.02	0.00576
"	0.25	0.01483	"	0.03	0.00447
"	0.50	0.01590	"	0.04	0.00392
$NaNO_3$	0.50	0.01628	"	0.05	0.00328
$LiNO_3$	0.50	0.01628	"	0.10	0.00248
$Ba(NO_3)_2$	0.50	0.01697	$Na\ C_6H_5COO$	0.01	0.00816
$Mg(NO_3)_2$	0.498	0.01759	"	0.02	0.00585
$Sr(NO_3)_2$	0.668	0.01784	"	0.03	0.00477
$Ca(NO_3)_2$	0.253	0.01633	"	0.04	0.00396
"	0.507	0.01834	"	0.05	0.00347
"	1.013	0.02079	"	0.10	0.00240

SILVER Chloro, Nitro, etc. BENZOATES.

SOLUBILITY OF EACH SEPARATELY IN WATER AT 20°.

(Ephraim and Pfister, 1925.)

Compound.	Formula	Gms anhydrous compound per 100 cc. sat. sol.
Silver 4-Chloro Benzoate...	$C_6H_4ClCOO\ Ag$	0.108
" 4-Methoxy " ...	$C_6H_4.OCH_3.COO\ Ag$	0.0518
" 4-Nitro " ...	$C_6H_4.NO_2.COO\ Ag$	0.170
" 4-Oxy " ...	$C_6H_4.OH.COO\ Ag.3H_2O$	0.279

CH

SILVER SALICYLATE $C_6H_4.OH.COOAg$ 1,2.

One liter sat. aqueous solution contains 0.95 gm. at 23°.

(Holleman, 1893.)

One liter sat. solution in H_2O contains 0.00332 gm. mols., equal to 0.813 gm. $Ag\ C_6H_4OH.COO$ 1, 2 at 18°. (Kolthoff, 1926.)

SILVER HEPTOATE (Önanthylate) $AgC_7H_{13}O_2$.

SOLUBILITY IN WATER.

(Landau, 1893; Altschul, 1896)

t°.	Gms $AgC_7H_{13}O_2$ per 100 Gms. H_2O.		t°.	Gms. $AgC_7H_{13}O_2$ per 100 Gms. H_2O.	
0	0.0635 (Landau)	0.0436 (Altschul)	50	0.1652 (Landau)	0.0858 (Altschul)
10	0.0817	0.0494	60	0.1906	0.1036
20	0.1007	0.0555	70	0.2185	0.1351
30	0.1206	0.0617	80	0.2495	0.1688
40	0.1420	0.0714			

SILVER CINNAMATE $C_6H_5.CH:CHCOOAg$.

100 gms. sat. solution of silver cinnamate in water contain 0.012 gms. $C_6H_5CH:CH\ COOAg$ at 20°.

(Ephraim and Pfister, 1925.)

SILVER α NAPHTHOATE $Ag[C_{10}H_7COO]$

One liter H_2O dissolves 1.67 gm. $Ag[C_{10}H_7COO]$ at 25°. (Larsson, 1927.)

SILVER SULFONATES.

SOLUBILITY OF EACH SEPARATELY IN WATER. (Ephraim and Pfister, 1925 *a*.)

Compound.	Formula.	t°.	Gms. anhydrous compound per 100 cc. sat. sol
Silver anthracene-1-sulfonate..........	$AgC_{14}H_9SO_3$	20	0.059
» » -2- »	»	20	0.0318
» naphthalene-2- »	$AgC_{10}H_7SO_3$	16.5	1.716
» » -5-chlor-1-sulfonate..	$AgC_{10}H_6SO_3Cl$	20	0.551
" phenanthrene-2-sulfonate	$AgC_{14}H_9SO_3$	20	0.099
" " -3- "	"	20	0.20
" " -10- "	"	20	0.52

SILVER HELIANTHATE $C_{14}H_{14}N_3SO_3Ag.2H_2O$.

1000 cc. H_2O dissolve 0.292 gm. $C_{14}H_{14}N_3SO_3Ag.2H_2O$ at 20-25°. (Stark and Dehn, 1918.)

SILVER PALMITATE $CH_3(CH_2)_{14}COOAg$.

CH 1000 cc. sat. solution of silver palmitate in water contain 0.00123 gm. $C_{15}H_{31}COOAg$ at 20°. (Whitby, 1926.)

SILVER STEARATE $CH_3(CH_2)_{16}COOAg$.

1000 cc. sat. solution of silver stearate in water contain 0.00065 gm. $C_{17}H_{35}COOAg$ at 20°. (Whitby, 1926.)

SILVER LAURATE, MYRISTATE, PALMITATE and STEARATE

SOLUBILITY OF EACH, DETERMINED SEPARATELY, IN WATER AND OTHER SOLVENTS AT SEVERAL TEMPERATURES.

(Jacobson and Holmes, 1916.)

Solvent.	t°.	Gms. each Salt per 100 Gms. Solvent.			
		Laurate.	Myristate.	Palmitate.	Stearate.
Water	35	...	0.007	0.004	0.004
"	50	...	0.007	0.006	0.004
Abs. Ethyl Alcohol	25	0.009	0.008	0.007	0.007
" "	50	0.009	0.008	0.007	0.007
Methyl Alcohol	15	0.074	0.063	0.060	0.051
" "	25	0.072	0.067	0.059	0.052
" "	35	0.078	0.071	0.062	0.055
" "	50	0.083	0.073	0.066	0.060
Ether	15	0.010	0.009	0.009	0.007

CN SILVER CYANIDE AgCN

SOLUBILITY OF SILVER CYANIDE IN WATER

t°	Mols. AgCN per liter	Gms. AgCN per liter	Method	Authority
17.5	3.17×10^{-7}	0.000042	Conductivity	(Abegg and Cox, 1903.)
18.0	2.10×10^{-7}	0.000028	Potentiometric	(Masaki, 1930.)
20.0	1.64×10^{-6}	0.00022	Conductivity	(Bottger, 1903.)

SILVER CYANIDE $AgCN$.

SOLUBILITY OF SILVER CYANIDE IN AQUEOUS AMMONIA SOLUTIONS.

(Longi, 1883.)

100 gms. aq. ammonia of 0.998 Sp. Gr. = 5%, dissolve 0.232 gm. $AgCN$ at 12°.
100 gms. aq. ammonia of 0.96 Sp. Gr. = 10%, dissolve 0.542 gm. $AgCN$ at 18°.

One liter aq. 3 *n* $AgNO_3$ dissolves 0.0091 gm. mol. = 1.216 gm. $AgCN$ at 25°.
(Hellwig, 1900.)

Fusion-point data for mixtures of $AgCN + NaCN$ are given by Truthe (1912).

SOLUBILITY OF SILVER CYANIDE IN AQUEOUS SOLUTIONS OF HYDROCYANIC ACID AT 25°.

(Randall and Halford, 1930.)

This system was studied by the authors as a case of equilibrium in a chemical reaction involving the formation of a complex ion. The saturation equilibrium is, therefore, not that of a simple solution. A small concentration of strong acid is produced, but the amount is so small that an accurate determination of the equilibrium constant is difficult. The assumed reaction is $Ag(CN)(s)+HCN(aq.) = H^{+}+Ag(CN)_2^-$. The measurements are expressed in terms of molalities.

m(HCN(aq.))	m($HAg(CN)_2$)	m(HCN(aq.))	m($HAg(CN)_2$)
0.0296	0.000983	0.2275	0.00424
0.1016	0.00204	0.2325	0.00315
0.1596	0.00245	0.3000	0.00375
0.1780	0.00366	0.3625	0.00331
0.1825	0.00246	0.4230	0.00400
0.2124	0.00292	0.4260	0.00511
0.2245	0.00272	0.4465	0.00427

Similar determinations of the solubility of Silver Thiocyanate in aqueous solutions of Potassium Thiocyanate at 25° and the assumed reaction which occurs, is as follows.

$$AgCNS(s) + CNS^- = Ag(CNS)_2^-$$

Original m (KCNS)	m (AgCNS)	m (KCNS (free))
0.312	0.00202	0.310
0.564	0.0121	0.512
0.870	0.0458	0.824
1.124	0.0985	1.026

These results cannot be accounted for by the formation of the single complex ion $Ag(CNS)_2^-$

SOLUBILITY OF SILVER CYANIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CYANIDE AT 25° AND VICE VERSA.

(Bassett and Corbet. 1924.)

Gms. per 100 gms. sat. sol.		Solid. Phase.	Gms per 100 gms sat. sol.		Solid. Phase.
KCN.	AgCN.		KCN.	AgCN.	
41.7	0.00	KCN	20.14	21.66	$KAg(CN)_2$
40.77	6.52	»	8.56	16.11	»
39.91	8.14	»	8.05	15.76	$KAg_2(CN)_3.H_2O$
40.24	10.93	»	8.93	17.73	»
40.44	13.71	$K_3Ag(CN)_4.H_2O$	6.75	13.53	AgCN
37.76	18.92	»	2.36	4.42	»
35.19	25.18	»	1.64	3.27	»
28.43	26.37	$KAg(CN)_2$	1.26	2.31	»
26.67	24.71	»	2.16	trace	»

Note. Due to the difficulty of obtaining KCN free of KOH the saturated solutions were prepared from double salts which could be obtained free of KOH. Saturation was reached by constant rotation in wax bottles, in which an atmosphere of coal gas, washed by passing through solutions of lead acetate and sodium hydroxide, was maintained. Both the liquid and solid phases were analyzed.

100 gms. liquid SO_2 dissolve 0.019 gm. AgCN at 0°. (Jander and Ruppolt, 1937.)

CN

SILVER DICYANIMIDE $AgN(CN)_2$

One liter saturated solution in water contains 0.0064 gm. $AgN(CN)_2$ at 18°-20°, determined by the potentiometric method. (Birchenbach and Huttner, 1930.)

SILVER TRICYAN METHYL $AgN(CN)_3$

One liter saturate solution in water contains 0.013 gm. $AgN(CN)_3$ at 18°-20°, determined by the potentiometric method. (Birckenbach and Huttner, 1930.)

SILVER FERRICYANIDE Ag_3FeCN_6.

One liter H_2O dissolves 0.00066 gm. Ag_3FeCN_6 at 20°.

(Whitby, 1910.)

SILVER SODIUM CYANIDE AgCN.NaCN.

100 gms. H_2O dissolve 20 gms. at 20°, and more at a higher temperature. 100 gms. 85% alcohol dissolve 4.1 gms. at 20°. (Baup, 1858.)

SILVER THALLOUS CYANIDE AgCN.TlCN.

100 gms. H_2O dissolve 4.7 gms. at 0°, and 7.4 gms. at 16°. (Fronmüller, 1878.)

SILVER THIOCYANATE $AgSCN$.

SOLUBILITY IN WATER.

t°.	Gm. AgSCN per Liter.	Authority.
18	0.00017	(Masaki, 1930.)
20	0.00014	(Böttger, 1903.)
21	0.00025	(Whitby, 1910.
25	0.00017	(Küster and Thiel, 1903.)
25	0.0002	(Abegg and Cox, 1903.)
100	0.0064	(Böttger, 1906.)

Additional data for the solubility of AgSCN in water are given by Kirschner (1912.)

SOLUBILITY OF SILVER THIOCYANATE IN AQUEOUS SOLUTIONS OF BARIUM THIOCYANATE AND VICE VERSA AT 25°.

(Occleshaw, 1934.)

Gms. per 100 gms. Sat. Sol.		Solid Phase	Gms. per 100 gms. Sat. Sol.		Solid Phase
$Ba(SCN)_2$	$AgSCN$		$Ba(SCN)_2$	$Ag(SCN)$	
9.68	0.75	AgSCN	44.28	31.67	1:2:2
18.18	4.47	"	47.74	29.81	"
27.00	14 67	"	52.01	29.17	" +1:1:2
32.20	23.24	"	52.61	27.89	1:1:2
34.50	27.99	"	53.23	26.35	"
36.04	33.79	" +1:3:2	54.14	25.01	"
36.78	34.01	1:3:2	55.20	23.91	"
37.13	34.28	"	55.91	22.98	" $+Ba(SCN)_2.3H_2O$
37.49	34.58	"	55.99	22.58	$Ba(SCN)_2.3H_2O$
38.41	35.13	"	57.36	17.04	"
39.02	35.79	"	58.91	12.58	"
39.54	35.76	" +1:2:2	61.39	4.29	"
40.61	34.70	1:2:2	62.61	0.0	"

1.3.2 = $AgSCN.3Ba(SCN)_2.2H_2O$; 1.2.2 = $AgSCN.2Ba(SCN)_2.2H_2O$; 1.1.2 = $AgSCN.Ba(SCN)_2.2H_2O$.

SOLUBILITY OF SILVER THIOCYANATE IN AQUEOUS SOLUTIONS OF AMMONIA AT 25°.

(Gerrick and Wilson, 1932.)

Gm. Mols. per 1000 gms. Sat. Solution		Solid Phase	Gm. Mols per 1000 gms. Sat. Solution		Solid Phase
$[NH_3]$	$[AgCNS]$		$[NH_3]$	$[AgCNS]$	
1.026	0.00517	AgCNS	3.767	0.02031	$AgCNS.NH_3$
1.587	0.00854	"	4.335	0.02284	"
1.840	0.01001	"	4.504	0.02341	"
2.178	0.01234	"	5.27	0.02724	"
2.276	0.01292	"	5.36	0.02771	"
2.440	0.01376	$AgCNS.\frac{1}{2}NH_3.\frac{1}{2}H_2O$(?)	6.60	0.03485	"
2.581	0.01454	"	7.35	0.03966	"
2.848	0.01590	"	7.47	0.04062	"
2.915	0.01635	"	8.94	0.0518	"
3.049	0.01734	"	9.91	0.0620	"
3.217	0.01780	$AgCNS.NH_3$	11.36	0.0620	"
3.325	0.01842	"	14.69	0.1596	"
3.684	0.01991				

The determination of the composition of the solid phases was attended with considerable difficulty and the formula in one case is still uncertain.

SOLUBILITY OF SILVER THIOCYANATE IN AQUEOUS POTASSIUM THIOCYANATE AT 25°. (Hellwig, 1900.)

Mols. KSCN per Liter.	Mols. AgSCN per Liter.	Gms. AgSCN per Liter.	Mols. KSCN per Liter.	Mols. AgSCN per Liter.	Gms. AgSCN per Liter.
0.573	0.0124	2.06	1.12	0.0975	16.18
0.626	0.0168	2.08	1.20	0.120	19.93
1.066	0.0850	14.01	1.25	0.134	22.34

One liter of aqueous 3 *n* $AgNO_3$ dissolves 0.0432 gm. AgSCN at 25.2°. (Hellwig, 1900)

SOLUBILITY OF MIXTURES OF SILVER THIOCYANATE AND POTASSIUM THIOCYANATE IN WATER AT 25°.

(Foote, 1903.)

Gms. per 100 Gms Solution.		Mols. per 100 Mols. H_2O.		Solid Phase.
KSCN.	AgSCN.	KSCN.	AgSCN.	
70·53	. . .	44·36	. . .	KSCN
66·55	9·32	51·13	4·19	KSCN + 2KSCN.AgSCN
64·47	10·62	47·98	4·60	Double Salt 2KSCN.AgSCN = 53.92% KSCN
61·25	11·76	42·07	4·72	
58·34	13·55	38·47	5·23	
53·21	17·53	33·71	6.50	
50·68	20·43	32·52	7·67	2KSCN.AgSCN + KSCN.AgSCN
49·43	20·32	30·29	7·28	Double Salt. KSCN.AgSCN = 36.9% KSCN
32·51	18·34	12·26	4·05	
24·68	16·41	7·77	3·02	
23·86	16·07	7·36	2·90	KSCN.AgSCN + AgSCN

CN

SOLUBILITY AT 25° OF SILVER THIOCYANATE IN AQUEOUS SOLUTIONS OF:

(Occleshaw, 1932.)

Potassium Thiocyanate			Sodium Thiocyanate			Ammonium Thiocyanate		
Gms. per 100 gms. Sat. Solution		Solid Phase	Gms. per 100 gms. Sat. Solution		Solid Phase	Gms. per 100 gms. Sat. Solution		Solid Phase
AgCNS	KCNS		AgCNS	NaCNS		AgCNS	NH_4CNS	
1.29	9.67	AgCNS	1.74	9.19	AgCNS	3.19	10.66	AgCNS
6.69	16.97	"	10.09	17.55	"	14.92	19.57	"
11.39	20.98	"	12.61	17.24	"+1.1.2	30.88	26.86	"
16.10	23.15	"+1.1	11.06	25.42	1.1.2	35.09	28.19	"+1.1
16.68	25.40	1.1	11.14	38.31	"	34.10	31.10	1.1
19.24	35.88	"	11.21	42.49	"	33.44	36.04	"
20.04	43.02	"	11.53	48.51	"	33.29	40.25	"
20.58	50.01	"	12.68	54.36	"	33.14	44.27	"
*20.56	54.09	"	12.72	54.34	"+1.3	33.18	45.13	"+1.5
20.57	50.53	1.2	12.54	54.46	1.3	30.88	46.18	1.5
16.12	55.21	"	12.23	54.78	"	24.80	48.22	"
13.06	59.29	"	12.21	54.80	"+NaCNS	17.16	51.42	"
9.22	66.31	"	9.80	55.42	NaCNS	9.46	57.07	"
9.19	66.88	"+KCNS	5.09	56.94	"	4.48	62.87	"+NH_4CNS
5.12	68.77	KCNS	0.0	58.78	"	3.19	63.37	NH_4CNS
0.0	70.89	"				0.0	64.33	"

1.1 = AgCNS.KCNS
1.2 = AgCNS.2KCNS

1.1.2 = $AgCNS.NaCNS.2H_2O$
1.3 = AgCNS.3NaCNS

1.1 = $AgCNS.NH_4CNS$
1.5 = $AgCNS.5NH_4CNS$

* Metastable

100 gms. liquid sulfur dioxide dissolve 0.014 gm. AgCNS at 0°. (Jander and Wickert, 1936; Jander and Ruppold, 1937.)

The solubility Product of AgSCN in CH_3OH at 25° in equiv. gm. per 1000 gm. CH_3OH is 1.8×10^{-14}; Buckley and Hartley, 1929.

SILVER CYANATE AgCNO

One liter sat. solution in H_2O contains 0.072 gms. AgCNO at 18°-20° determined by the potentiometric method. (Birckenbach and Huttner, 1930.)

SILVER FULMINATE $CAg_2(NO_2)CN$.

One liter of aqueous solution contains 0.075 gm. $C_2Ag_2N_2O_2$ at 13°, and 0.180 gm. at 30°
(Holleman, 1896.)

SILVER CARBONATE Ag_2CO_3.

SOLUBILITY IN WATER.

t°.	Gms. Ag_2CO_3 per Liter.		Authority.
15	0.031		(Kremers, 1852.)
18	0.03	(0.00011 gm. mols.)	(Masaki, 1930.)
25	0.033	(0.00012 gm. atoms Ag.)	(Abegg and Cox, 1903.)
25	0.032	(by potential measurement)	(Spencer and Le Pla, 1909.)
100	0.50		(Joulin, 1873.)
15	0.85	(in H_2O sat. with CO_2)	(Johnson, 1886.)

CO

Data for the solubility product of Silver carbonate are given by Walker, Bray and Johnston, 1927.

100 gms. sat. solution of silver carbonate in water at 18° and in contact with CO_2 at a pressure of 1 atmosphere, contain 0.105 gm. Ag_2CO_3. At a pressure of 56 atmospheres of CO_2, 0.170 gm. Ag_2CO_3 are dissolved. (Haehnel, 1924.)

SILVER OXALATE $Ag_2C_2O_4$.

One liter H_2O dissolves 0.0378 gm. $Ag_2C_2O_4$ at 21°.
(Whitby, 1910.)

One liter H_2O dissolves 0.0416 gm. $Ag_2C_2O_4$ at 25°. Conductivity method.
(Schäfer, 1905.)

One liter H_2O dissolves 0.0265 gm. $Ag_2C_2O_4$ at 9.72°, 0.034 gm. at 18.5° and 0.043 gm. at 26.9°.
(Kohlrausch, 1908.)

One liter H_2O dissolves 0.0342 gm. $Ag_2C_2O_4$ at 18° (Conductivity method.)
(Scholder, Gadenne and Niemann, 1927.)

SOLUBILITY OF SILVER OXALATE IN AQUEOUS NITRIC ACID AT 25°.

(Hill and Simmons, 1909.)

Normality of Aq. HNO_3.	Per cent Conc. of HNO_3.	d_{25} of Sat. Sol.	Gms. $Ag_2C_2O_4$. per Liter.	Normality of Aq. HNO_3.	Per cent Conc. of HNO_3.	d_{25} of Sat. Sol.	Gms. $Ag_2C_2O_4$ per Liter
0.2517	1.574	1.0080	1.345	4.017	22.37	1.1415	17.11
0.5025	3.117	1.0186	2.189	5.564	29.84	1.1996	29.96
0.9806	6.017	1.0339	3.720	5.83	31.085	1.2162	33.88
1.040	11.476	1.0647	7.170				

SILVER CHLORIDE AgCl.

SOLUBILITY OF SILVER CHLORIDE IN WATER.

The results of the determinations of the solubility of silver chloride in water at various temperatures and by such different methods as direct gravimetric analysis, conductometric, colorimetric, nephelometric, photometric (Tyndallometric) and potentiometric, as reported by the following investigators, were plotted on cross section paper and from the average curve so obtained, the values given below were read.

(Thiel, 1900.)
(Abegg and Cox, 1903.)
(Bottger, 1903, 1906.)
(Kohlrausch, 1904, 1908.)
(Whitby, 1910.)
(Melcher, 1910.)
(V. Rossum, 1912.)
(Glowczynski, 1914.)
(Pinkus and Martin, 1927.)
(Pinkus and Berlsolaiko, 1930.)
(Scott and Johnson, 1930.)
(Hahn and Klockmann, 1930.)
(Popoff and Neuman, 1930.)
(Neuman, 1932.)
(Eversole and McLachlan, 1932.)
(Dave and Krishnaswami, 1933.)

t°	Gms. AgCl per liter	t°	Gms. AgCl per liter	t°	Gms. AgCl per liter
0	0.00070	20	0.00155	40	0.0036
5	0.00085	25	0.00195*	45	0.0043
10	0.00105	30	0.0024	50	0.0054
15	0.00125	35	0.0029	100	0.021

The limits of variation in the results at 25° were from 0.00172 to 0.00218 gms. AgCl per liter.

Johnson and Hulett, 1933, showed that samples of silver chloride prepared by precipitation and washing by different procedures, and then used for solubility determinations, yielded saturated solutions in which a varying excess of Cl was present. This is apparently a case of absorption equilibrium and places limitations upon the interpretation of the results of solubility determinations.

SOLUBILITY OF SILVER CHLORIDE IN WATER AND IN SALT SOLUTIONS.

A method was developed by Lorenz and Bergheimer, 1924, which consisted in the alternate addition of drops (each of 0.02 cc.) of 0.005 *n* Na Cl and Ag NO_3 to 500 cc. of water or of solutions of electrolytes illuminated by a beam of light, in such a manner that the first sign of clouding, and the point of permanent opalescence, could be accurately determined. The solubility results calculated from their observations confirmed previous data showing the dependance of the solubility of silver chloride upon temperature. Their values agree in general with published results obtained by other methods and verify the Nernst formula for the solubility influence of electrolytes.

Experiments similar to the above are reported by Bedel, 1937. In this case 0.001 normal solutions of $AgNO_3$ or of Ag_2SO_4 and 0.001 normal solutions of the chlorides of various metals were alternately added dropwise to 1000 cc. of water. The point at which a precipitate appeared was determined by observing the diffraction of a beam of light passing through the solution. The temperature is not stated. The calculated solubility of AgCl in the most dilute solutions varied from $4.93.10^{-4}$ to $4.34.10^{-4}$ gm. AgCl per liter. Augmenting the concentration of the soluble chloride decreased slightly the solubility except in the case of mercury salts which considerably increased the solubility.

SILVER CHLORIDE AgCl.

Experiments are reported by Langdon, 1923-1924, in which the E. M. F. of the cells

$$\mathrm{Ag} \mid 0.1\,n\ \mathrm{AgNO_3} \mid 0.1\,n\ \mathrm{KNO_3} \mid 0.1\,n\ \mathrm{KCl.Hg_2Cl_2} \mid \mathrm{Hg}$$

and

$$\mathrm{Ag} \mid \mathrm{AgCl.KCl} \mid 0.1\,n\ \mathrm{KCl} \mid 0.1\,n\ \mathrm{KCl.Hg_2Cl_2} \mid \mathrm{H_2O}$$

were measured. There was a definite increase in the solubility product with increasing concentration of K Cl. The solubility of freshly formed colloidal silver chloride, whether protected or unprotected, is higher than that of coarse silver chloride, and this solubility gradually decreases to the normal value. The increased solubility of the colloidal Ag Cl probably depends on the amount and concentration of the solutions from which it is formed. Gelatin apparently tends to retard the attainment of the normal solubility.

Experiments by Hahn and Schulze, 1927, failed to confirm the observation of Stas that a less soluble form of AgCl may be obtained under certain conditions.

Very careful determinations by Pinkus and Haurez, 1938, also failed to confirm the observation of Stas. The authors prepared 17 samples of AgCl by wet and dry methods and determined their solubilities in 0.1 normal aqueous KNO_3 solution at 25° using highly refined potentiometric method. The ionic solubility of all the flocculent and crystalline precipitates was 1.58×10^{-5} gm. mols. AgCl per liter. The solubility of the colloidal suspensions varied from 1.60 to 1.65×10^{-5} gm. mols. per liter. Hence the solubility of AgCl is a well defined constant independant of the mode of preparation or the physical structure except in the case of the fine colloidal suspensions which give results 1-5% higher than the flocculent or crystalline solids. Cl

Data for the solubility product of electrolytic AgCl in water at 5°, 15°, 25°, 35° and 45°, determined by a potentiometric method in which heterionic liquid junction potentials are eliminated by extrapolation are given by Owen, 1938.

Comparative determinations of the solubilities of AgCl, AgSCN, AgBr and AgI in water at 25°, showed that if the solubility of AgCl be taken as 1, that of AgSCN is 0.0748, that of AgBr is 0.0550 and that of AgI is 0.00077. (Hill, 1908.)

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF SILVER NITRATE AT 25°.

(Pinkus, Frederic and Shepmans, 1938.)

Fine suspensions of colloidal silver chloride in aqueous solutions of silver nitrate prepared from measured amounts of solutions of $AgNO_3$, of NaCl and of water were agitated in sealed tubes and after attainment of equilibrium, the presence of excess of AgCl was determined by the opalescence or tyndalometric method.

Gm. Mols. per liter		Gm. Mols. per liter	
$AgNO_3$	AgCl	$AgNO_3$	AgCl
0.00005	0.000284	0.05	0.00017
0.00010	0.000143	0.10	0.00029
0.00030	0.00000063	0.20	0.00055
0.0010	0.00000043	0.40	0.00121
0.0050	0.00000037	0.7986	0.00329
0.0100	0.00000049	0.9983	0.00486

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS HYDROCYANIC ACID AT 25°.

(Randall and Halford, 1930.)

This system was studied as a case of equilibrium in a chemical reaction involving formation of a complex ion. The assumed reaction is $AgCl(s) + 2HCN(aq.) = Ag(CN)_2^- + 2H^+ + Cl^-$. The results of the analyses of the saturated solutions are expressed in molalities.

m (HCN(aq.))	m (Acid)	m(Complex)	m (Chloride)
0.0938	0.00303	0.00132	0.00161
0.1831	0.00430	0.00182	0.00258
0.2292	0.00493	0.00199	0.00294

SOLUBILITY OF SILVER CHLORIDE IN VERY DILUTE AQUEOUS SOLUTIONS OF SALTS AND ACIDS AT 25°:

(Popoff and Neuman, 1930; Neuman, 1932.)

The determinations were made by the Tyndallometric method in a manner similar to that employed by Lorenz and Bergheimer, 1924, and by Bedel, 1937 as described above. Every precaution was taken to insure and maintain purity of materials and attainment of saturation. The exact point corresponding to the appearance of a precipitate was found by repeating the observations with solutions having diminishing differences of concentration between the last clear and the first turbid solution as measured by the Tyndall beam. The determinations were made with the highest attainable accuracy.

Cl

Salt	Gm. Mols. per liter		Salt	Gm. Mols. per liter	
	Salt	AgCl		Salt	AgCl
None	0.0	$1.278 \cdot 10^{-5}$	H_2SO_4	$2.207 \cdot 10^{-3}$	$1.384 \cdot 10^{-5}$
$Ba(NO_3)_2$	$0.0064 \cdot 10^{-3}$	1.280 "	"	3.107 "	1.420 "
"	0.03615 "	1.291 "	"	5.402 "	1.485 "
"	0.2111 "	1.309 "	"	7.021 "	1.515 "
"	0.7064 "	1.339 "	"	9.179 "	1.535 "
"	1.499 "	1.372 "	"	10.794 "	1.551 "
"	2.192 "	1.394 "	"	13.495 "	1.580 "
"	3.083 "	1.421 "	KNO_3	0.0128 "	1.280 "
"	4.402 "	1.450 "	"	0.2609 "	1.301 "
"	5.600 "	1.467 "	"	0.509 "	1.311 "
"	8.396 "	1.503 "	"	1.005 "	1.325 "
"	11.193 "	1.526 "	"	4.972 "	1.385 "
"	13.989 "	1.542 "	"	9.931 "	1.427 "
$CaSO_4$	0.0064 "	1.281 "	"	13.695 "	1.453 "
"	0.0317 "	1.287 "	"	16.431 "	1.469 "
"	0.1075 "	1.306 "	"	20.064 "	1.488 "
"	0.5119 "	1.344 "	"	27.376 "	1.516 "
"	1.017 "	1.372 "	"	33.760 "	1.537 "
"	1.522 "	1.395 "	"	40.144 "	1.552 "
"	2.532 "	1.436 "	K_2SO_4	0.0064 "	1.281 "
"	3.037 "	1.467 "	"	0.0364 "	1.291 "
HNO_3	0.0128 "	1.280 "	"	0.2065 "	1.314 "
"	0.7233 "	1.318 "	"	0.7067 "	1.336 "
"	2.864 "	1.352 "	"	1.507 "	1.364 "
"	5.695 "	1.387 "	"	2.207 "	1.386 "
"	9.009 "	1.422 "	"	3.107 "	1.413 "

SILVER CHLORIDE

SOLUBILITY OF SILVER CHLORIDE IN VERY DILUTE AQUEOUS SOLUTIONS OF SALTS AND ACIDS AT 25° (CON.).

Salt	Gm. Mols. per liter	
	Salt	AgCl
H_2SO_4	$0.0064.10^{-3}$	$1.278.10^{-5}$
"	0.0364 "	1.289 "
"	0.2065 "	1.310 "
"	0.7067 "	1.340 "
"	1.507 "	1.371 "
$La(NO_3)_3$	0.00427 "	1.280 "
"	0.07026 "	1.305 "
"	0.1438 "	1.317 "
"	0.5780 "	1.367 "
"	1.155 "	1.404 "
"	1.660 "	1.432 "
"	2.807 "	1.477 "
"	3.826 "	1.505 "
"	5.100 "	1.538 "
"	6.629 "	1.563 "
$La_2(SO_4)_3$	0.00214 "	1.282 "
"	0.00660 "	1.292 "
"	0.0244 "	1.309 "
"	0.1033 "	1.338 "
"	0.2467 "	1.362 "
"	0.4132 "	1.387 "
"	0.6690 "	1.426 "
"	0.9585 "	1.475 "
"	1.2950 "	1.512 "
"	1.9048 "	1.562 "
"	2.2853 "	1.575 "
"	2.6655 "	1.598 "
K_2SO_4	$4.807.10^{-3}$	$1.475.10^{-5}$
"	6.511 "	1.503 "
"	8.593 "	1.526 "
"	10.674 "	1.550 "
"	13.276 "	1.576 "
$MgSO_4$	0.00638 "	1.276 "
"	0.031144	1.286 "
"	0.1065 "	1.301 "
"	0.2206 "	1.319 "
"	0.5067 "	1.340 "
"	1.0069 "	1.377 "
"	1.5072 "	1.402 "
"	2.5072 "	1.438 "
"	3.0073 "	1.454 "
"	5.207 "	1.489 "
"	7.608 "	1.525 "
"	10.008 "	1.544 "
$NaNO_3$	0.01281 "	1.281 "
"	0.2643 "	1.300 "
"	0.5157 "	1.315 "
"	5.039 "	1.384 "
"	10.076 "	1.428

Cl

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AND SEVERAL CHLORIDES AT 25°.

(Pinkus, and Mlle. Timmermans, 1937.)

These authors made use of the tyndallometric method for estimating the minimum amount of silver nitrate which produced a permanent tyndall effect in solutions of hydrochloric acid or chlorides. Equilibrium was assured by rotating the mixtures in sealed tubes. A portion of each was then transferred to Duboscq nephelometric cup and compared under lateral illumination with pure water contained in the other cup. The sources of error in this method and the means for avoiding them are described.

Gm. Mols. per liter of HCl or Chloride in Aq. Solvent	Gm. Mols. per liter of AgCl in aqueous:			
	HCl	KCl	LiCl	NaCl
$2.8.10^{-5}$	—	$0.894.10^{-5}$	—	—
5.0 "	—	0.478 "	—	—
$1.0.10^{-4}$	$0.277.10^{-5}$	0.277 "	$0.277.10^{-5}$	$0.277.10^{-5}$
$1.0.10^{-3}$	0.057 "	0.047 "	0.060 "	0.047 "
2.5. "	0.045 "	0.037 "	0.043 "	0.037 "
$1.0.10^{-2}$	0.057 "	0.046 "	0.049 "	0.047 "
$1.0.10^{-1}$	0.302 "	0.282 "	0.290 "	0.292 "
5.0 "	2.25 "	2.57 "	2.21 "	2.41 "
10.0 "	7.45 "	10.05 "	7.15 "	8.45 "

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF BARIUM CHLORIDE AND OF CALCIUM CHLORIDE.

(Forbes, 1911.)

Aq. Solution of:	t°.	Gms. Equiv. per Liter. $\frac{BaCl_2}{2}$	Gms. Equiv. per Liter. Ag.	Aq. Solution of:	t°.	Gms. Equiv. per Liter. $\frac{CaCl_2}{2}$	Gms. Equiv. per Liter. Ag.
Barium Chloride	25	1.248	0.000186	Calcium Chloride	25	3.264	0.001463
"	25	1.610	0.000339	"	25	3.737	0.002182
"	25	2.676	0.001274	"	25	4.033	0.002802
"	25	3.260	0.002366	"	25	4.538	0.004175
		$\frac{CaCl_2}{2}$		"	25	5.005	0.005823
Calcium Chloride	25	1.748	0.000289	"	1	3.512	0.000964
"	25	2.201	0.000501	"	25	3.320	0.001514
"	25	2.741	0.000900	"	35	3.221	0.001806

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SALT SOLUTIONS.

(Vogel; Hahn; Valenta)

Cl

Salt Solution.	Conc. of Salt.	t°.	Gms. AgCl per 100 Gms. Solution.	
Barium Chloride	27.32%	24.5	0.057	(H.)
Barium Chloride	saturated	ord. temp.	0.014	(Vg.)
Barium Sulphocyanide	10 : 100	25	0.20	(Vl.)
Calcium Sulphocyanide	10 : 100	25	0.15	(Vl.)
Calcium Chloride	41.26%	24.5	0.571	(H.)
Calcium Chloride	saturated	ord. temp.	0.093	(Vg.)
Copper Chloride	"	24.5	0.053	(H.)
Ferrous Chloride	"	"	0.169	(H.)
Ferric Chloride	"	"	0.006	(H.)
Manganese Chloride	"	"	0.013	(H.)
Magnesium Chloride	50 : 100	25	0.50	(Vl.)
Magnesium Chloride	36.35%	24.5	0.531	(H.)
Magnesium Chloride	saturated	ord. temp.	0.171	(Vg.)
Strontium Chloride	"	"	0.088	(Vg.)
Zinc Chloride	"	24.5	0.0134	(H.)
Potassium Chloride	"	ord. temp.	0.0475	(Vg.)
Potassium Chloride	24.95%	19.6	0.0776	(H.)
Potassium Cyanide	5: 100	25	2.75	(Vl.)
Potassium Cyanide	5: 100	25	5.24	(Cohn*)
Potassium Sulphocyanide	10: 100	25	0.11	(Vl.)
Sodium Chloride	saturated	ord. temp.	0.095	(Vg.)
Sodium Chloride	25.95%	19.6	0.105	(H.)

Cohn shows that the lower results obtained by Valenta are due to the excess of AgBr used and consequently formation of the less soluble di salt, $3(AgS_2O_3Na)_2$ instead of the more soluble tri salt $(AgS_2O_3Na)_2Na_2S_2O_3$.

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 25°.

(Forbes, 1911.)

Gms. Equiv. per Liter HCl.	Gms. Equiv. per Liter Ag.	Gms. Equiv. per Liter. HCl.	Gms. Equiv. per Liter. Ag.	Gms. Equiv. per Liter. HCl.	Gms. Equiv. per Liter. Ag.
0.649	0.000032	2.149	0.000374	4.182	0.002147
1.300	0.000126	2.975	0.000814	4.735	0.003168
1.911	0.000266	3.576	0.001358	5.508	0.005126

The determinations of Forbes were made by gradually adding 0.25 *n* and 0.01*n* $AgNO_3$ to the chloride solution and observing the point of initial opalescence.

One liter of	per cent aq. HCl dissolve	gm. AgCl at 21°.	
1		0.0002	(Whitby, '10.)
5		0.0033	
10		(0.0555)0.0740	

NOTE. — The determinations of Whitby were made by a colorimetric method which was based upon the observation that the color produced by heating a solution of a silver salt with sodium hydroxide and certain organic compounds such as dextrin, glycerol, starch, sugar, etc., is proportional to the amount of silver present.

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS HYDROCHLORIC ACID SOLUTIONS AT ORDINARY TEMPERATURE.

(Pierre, 1847; Vogel.)

Solvent.	Gms. AgCl per Liter.	Solvent.	Gms. AgCl per Liter.
Conc. HCl + Aq.	5	100 vol. sat. HCl + 10 vol. H_2O	0.56
1 vol. Conc. HCl + 1 vol. H_2O	1.6	" + 20 "	0.18
Sat. HCl Sp. Gr. 1.165	2.98	" + 30 "	0.09
" " (at b. pt.)	5.60	" + 50 "	0.035

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF CHLORIDES AT 25°.

(Results of Forbes and Cole, 1921.)

To volumes of about 500 cc. of aqueous chloride solutions, less than 0.1 *n* in concentration, maintained at 25° and well stirred, 0.001 *n* Ag NO_3 solution was added in amount just sufficient to cause opalescence. The concentrations are expressed in milliequivalents per liter.

In Aq. NaCl.		In Aq. HCl.		In 0.35 *n* Chloride solutions.		
Total NaCl.	Total Ag.	Total HCl	Total Ag.	Chloride Taken.	Total Chloride.	Total Ag.
3.86	0.00072	4.78	0.00075	HCl	34.1	0.00219
9.24	0.00091	9.38	0.00084	NaCl	36.5	0.00189
17.58	0.00131	17.8	0.00125	NH_4Cl	37.4	0.00162
36.54	0.00189	34.1	0.00219	KCl	36.7	0.00172
88.44	0.00361	74.1	0.00361	RbCl	37.7	0.00181
355.6	0.0174	91.4	0.00426	$\frac{CaCl_2}{2}$	38.6	0.00175
511.2	0.0280	316.7	0.01403	$\frac{SrCl_2}{2}$	36.9	0.0172
974.7	0.0806	681.8	0.0448	$\frac{BaCl_2}{2}$	37.5	0.0157
		779.7	0.0554			
		925.8	0.0719			

Cl

(Results of Kendall and Sloan, 1925.)

In Aq. NaCl. Gm. equiv. per liter.		In Aq. LiCl. Gm. equiv. per liter.		In Aq. $MgCl_2$. Gm. equiv. per liter.	
[NaCl].	$[AgCl]\times10^3$.	[LiCl].	$[AgCl]\times10^3$.	$\frac{1}{2}[MgCl_2]$.	$[AgCl]\times10^3$.
0.90	0.099	0.44	0.100	2.60	0.580
1.10	0.131	1.24	0.180	2.86	0.768
1.39	0.183	1.65	0.281	3.34	1.165
1.61	0.253	2.10	0.605	3.85	1.773
1.93	0.391	2.44	1.010	4.20	2.345
2.22	0.542	2.74	1.480	4.30	2.530
2.87	1.000	3.01	2.458	4.58	3.138
3.16	1.366	3.30	3.278	4.66	3.338
3.82	2.491	3.40	3.925	4.91	4.042
4.39	3.825	3.60	5.084	5.36	5.264
4.81	5.104	3.75	5.922		
5.00	5.882	3.78	6.000		

SOLUBILITY OF SILVER CHLORIDE IN CONCENTRATED SOLUTIONS OF HALOGEN SALTS

(Dede and Walther, 1927.)

Molecular Composition of Solvent	Wt. in Gms. of 1 Gm. Equiv. of Solvent	Millimols AgCl dissolved in one Gm Equiv. of Solvent at: 20°	40°	60°	80°
$\frac{1}{2}CaCl_2+5H_2O$	145.58	4.52	5.96	7.57	9.81
$LiCl+5H_2O$	132.48	2.85	4.19	5.77	7.91
$NH_4Cl+10H_2O$	233.66	1.978	2.91	4.22	6.10
$NaCl+10H_2O$	238.62	1.271	1.913	2.88	4.41
$\frac{1}{2}CaCl_2+10H_2O$	235.66	1.096	1.607	2.41	3.55
$LiCl+10H_2O$	222.56	0.636	1.087	1.775	2.83
$HCl+10H_2O$	216.63	0.599	0.959	1.514	2.285
$KCl+20H_2O$	434.9	0.416	0.733	1.309	2.25
$NH_4Cl+20H_2O$	413.8	0.386	0.683	1.185	2.075
$NaCl+20H_2O$	418.8	0.269	0.504	0.938	1.668
$\frac{1}{2}CaCl_2+20H_2O$	415.8	0.248	0.457	0.841	1.449
$LiCl+20H_2O$	402.7	0.171	0.360	0.712	1.304
$HCL+20H_2O$	396.8	0.175	0.349	0.663	1.200
$KCl+30H_2O$	615.0	0.176	0.368	0.721	1.365
$NH_4Cl+30H_2O$	594.0	0.183	0.367	0.709	1.321
$\frac{1}{2}CaCl_2+30H_2O$	596.0	0.133	0.273	0.548	1.042
$LiCl+30H_2O$	582.9	0.100	0.228	0.481	0.955
$HCl+30H_2O$	577.0	0.099	0.226	0.461	0.903

Cl SILVER CHLORIDE

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF NITRIC ACID

Results at 0.5°C.
Determined Nephelometrically
(Scott and Johnson, 1930.)

Molarity of Aq. HNO_3	Gms. AgCl dissolved per liter
0.00	0.00072
0.11	0.0009
0.24	0.0010
0.49	0.00102
0.99	0.00105

Results at 0°
Determined Nephelometrically
and Potentiometrically
(Johnson and Law, Jr., 1933.)

Molarity of Aq. HNO_3	Gms. AgCl dissolved per liter
0.001	0.00054
0.103	0.00070
0.252	0.00079
0.99	0.00087
15.2	0.00017

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 25°.

(Glowczynski, 1914.)

Mols per Liter.		Gms. per Liter.	
HNO_3.	AgCl.	HNO_3.	AgCl.
0.0005	$1.15 \cdot 10^{-5}$	0.0315	0.001647
0.001	$1.19 \cdot 10^{-5}$	0.063	0.001705
0.01	$1.24 \cdot 10^{-5}$	0.630	0.00176
0.30	$1.57 \cdot 10^{-5}$	18.9	0.00225
1.50(?)	$1.71 \cdot 10^{-5}$	94.5	0.00245

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 25°

(Eversole and McLachlan, 1932.)

The method consisted in noting the first appearance of the Tyndall beam in a series of dilute solutions of suitable reactants under controlled conditions, making use of a tyndallmeter and also of a graduated photo meter. The solutions were sealed in bottles of about 125 cc. capacity made from molded Pyrex tubing. The greatest care was exercised to purify the water and reactants and prevent contamination. By successively increasing the amounts of stock solutions in a total volume of 100 cc. turbidity resulted at a certain point. The solubility value was considered to be between the points at which turbidity failed to appear and that at which it could be seen.

Molarity of HNO_3	Gm. Mols. AgCl per liter x 10^{-5}	Gms. AgCl per liter
0.00	1.49-1.56	0.00218
0.0024	1.41-1.45	0.00205
0.0238	1.51-1.56	0.00219
0.119	1.62	0.00232
0.238	1.70	0.00244
0.524	2.35-2.40	0.00340

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 25°.

Cl

(Pinkus and Shepmans, 1938.)

Fine suspensions of colloidal silver chloride in aqueous solutions of nitric acid, prepared from measured amounts of water and solutions of $AgNO_3$, HCl and HNO_3 were agitated in sealed tubes and, after attainment of equilibrium, the presence of excess AgCl was determined by the opalescence or tyndalometric method.

Gm. Mols. per liter		Gm. Mols. per liter	
HNO_3	AgCl	HNO_3	AgCl
1.278 10^{-5}	1.278 10^{-5}	1.000 10^{-2}	1.427 10^{-5}
5.282 "	1.284 "	4.369 "	1.583 "
1.127 10^{-4}	1.290 "	1.086.10^{-1}	1.722 "
2.865 "	1.300 "	1.094	2.308 "
5.133 "	1.308 "	2.519	2.530 "
1.014.10^{-3}	1.323 "	5.139	2.696 "
4.009 "	1.372 "	8.804	2.743 "

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT DIFFERENT TEMPERATURES.

(Dave and Krishnaswami, 1933.)

Gm. Mols. HNO_3 per liter	Gm. Mols. AgCl per liter x 10^{-5} at:						
	0°	8°	18°	25°	30°	40°	50°
0.11	0.60	—	—	1.51	—	—	—
0.48	0.71	0.89	1.38	1.64	1.84	3.98	7.69
0.81	0.77	—	—	1.68	—	—	—
1.00	0.79	—	—	1.74	—	—	—

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF MERCURIC NITRATE AT 25°.

(Morse, 1902.)

Mols. $HgNO_3(HNO_3)$ per Liter.	Mols. AgCl per Liter.	Gms. AgCl per Liter.	Mols. $HgNO_3(HNO_3)$ per Liter.	Mols. AgCl per Liter.	Gms. AgCl per Liter.
0.0100	0.00432	0.620	0.050	0.00914	1.310
0.0125	0.00499	0.715	0.100	0.01395	2
0.025	0.00690	0.990	1	0.04810	6.896

Since HNO_3 was present in all cases, its influence on the solubility was examined. It was found that no appreciable differences were obtained with concentrations varying between 0.1 and 2 normal HNO_3. Both crystallized and amorphous silver chloride gave identical results.

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT 25°.

(Forbes, 1911.)

Gms. Equiv. per Liter. KCl.	Gms. Equiv. per Liter. Ag.	Gms. Equiv. per Liter. KCl.	Gms. Equiv. per Liter. Ag.
1.111	0.000141	2.850	0.001845
1.425	0.000235	3.081	0.002435
1.713	0.000391	3.424	0.003602
2.022	0.000616	3.843	0.005725
2.396	0.001050	3.325	0.001734 (at 1°)
2.628	0.001390	2.955	0.002786 (at 35°)

(Glowczynski, 1914.)

Mols. per Liter. KCl.	Mols. per Liter. AgCl.	Gms. per Liter. KCl.	Gms. per Liter. AgCl.
$3.16.10^{-5}$	$1.28.10^{-5}$	0.00236	0.001836
$6.32.10^{-5}$	$1.52.10^{-5}$	0.00471	0.002178
$2.0.10^{-4}$	$2.13.10^{-5}$	0.01491	0.003052
$4.0.10^{-4}$	$2.24.10^{-5}$	0.02984	0.003209

The determinations of Glowczynski were made by evaporating the sat. solution with excess of ammonia, dissolving the residue in KCN, separating the Ag electrolytically, dissolving it in HNO_3 and titrating with standard sulfocyanate. The determinations of Forbes were made by gradually adding 0.25 n and 0.01 n $AgNO_3$ to the chloride solution and observing the point of initial opalescence.

Cl

One liter 4 n aq. KCl dissolves 0.00637 gm. mol. = 0.915 gm. AgCl at 25°. (Hellwig, 1900.)

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AND OF SODIUM CHLORIDE AT 25°.

(Pinkus and Berkolaiko, 1930; Pinkus and Haugen, 1936.)

The determinations of Pinkus and Haugen, which are considered more accurate than those of Pinkus and Berkolaiko, were made with freshly precipitated AgCl which was used to saturate two liter portions of solvent kept at 25° and agitated by means of a rotating glass paddle. The saturated solution was filtered through thin discs of gelatinized nitro cellulose and evaporated on a water bath. The Ag in the concentrated solution thus obtained, after addition of KCN was electrolytically deposited. The deposit on the cathode was dissolved in hot dilute HNO_3 or in cold HNO_3 by reverse electrolysis. The Ag in the solution thus obtained was determined with the aid of a Duboscq calorimeter mounted as a nephelometer, using standard silver nitrate solution for comparison.

Gm. Mols. KCl or of NaCl per liter	Gm. Mols. AgCl per liter x 10^{-5} in aqueous: KCl	NaCl
0.0010	0.0317	0.038
0.0025	—	0.0285
0.0100	0.0401	0.0475
0.100	0.275	0.299
0.250	0.773	0.904
0.500	2.43	2.50
0.750	—	5.18
1.000	—	8.73

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT 15°.

(Schierholz — Sitzber. K. Akad. Wiss. (Vienna) 101, 2b, 8 '90.)

Grams per 100 Grams Solution.		Grams per 100 Grams Solution.	
KCl.	AgCl.	KCl.	AgCl.
10.0	0.000	22.47	0.045
14.29	0.004	24.0	0.072
16.66	0.008	25.0	0.084
20.00	0.020		

Sp. Gr. of 25% KCl sol., = 1.179

MIXTURES OF SILVER CHLORIDE AND SILVER HYDROXIDE IN EQUILIBRIUM WITH AQ. POTASSIUM HYDROXIDE SOLUTIONS AT 25°.

(Noyes and Kohr — J. Am. Ch. Soc. 24, 1144, '02.)

Normality of KOH.	Millimols per Liter.		Grams per Liter.		
	KCl.	KOH	KCl.	KOH.	AgCl.
0.333	3.414	347.8	0.255	10.05	0.4896
0.065	0.598	65.0	0.0446	2.00	0.0828

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE.

Cl

(Dave and Krishnaswami, 1935.)

Results at 30°

Gm. Mols. per liter	
KNO_3	$AgCl \times 10^{-5}$
0.10	2.93
0.50	5.15
0.75	5.92
1.00	6.93

Results at Different Temperatures

t°	Gm. Mols. $AgCl \times 10^{-5}$ per liter 0.1 normal KNO_3
0	0.79
8	0.84
18	1.42
25	2.71
40	4.30
50	6.05

A determination by Brown and MacInnes, 1935, of the solubility of silver chloride at 25° in aqueous Potassium Nitrate solution of 0.0286 ionic strength gave an average of 1.569×10^{-5} gm. mols. AgCl per liter. The authors used an improved potentiometric method in which the uncertainty due to the liquid junction was reduced to a minimum. The solution on one side of the liquid junction was kept constant, and together with the electrode, served as a reference half cell, whereas the composition of the solution in the other half cell was progressively changed by the addition of increments of potassium chloride solution. This was, of course, an electrometric titration.

Solubility of Silver Chloride in Aqueous Ammonia Solutions at 25°.

(Whitney and Melcher, 1903.) (Straub, 1911.)

Gm. Mols. NH_3 (total) per Liter.	Gm. Atoms Ag per Liter.	Gm. Mols. NH_3 (total) per 1000 Gms. H_2O.	Gm. Atoms Ag per 1000 Gms. H_2O.	Solid Phase.
0.0282	0.00141	0.0428	0.025	AgCl
0.0288	0.00149	1.688	0.1308	"
0.0590	0.00304	3.782	0.372	"
0.118	0.00621	3.945	0.378	"
0.253	0.0140	5.10	0.574	"
0.397	0.0227	5.33	0.609	"
0.428	0.0249	5.545	0.633	"
0.818	0.0514	6.26	0.754	" $+2AgCl.3NH_3$
0.863	0.0541	6.52	0.775	$2AgCl.3NH_3$
0.896	0.0569	8.28	0.848	"
0.909	0.0584	11.78	0.980	"
0.961	0.0616	12.68	1.030	"
1.991	0.147	12.96	1.090	
2.042	0.151	14.47	1.039	"

Additional data for the above system at 25° are given by Bodländer and Fittig (1901–02). These authors also give results showing the effect of KCl and of $AgNO_3$ on the solubility of AgCl in aqueous ammonia. Determinations at 15° are given by Bodländer (1892).

Cl

Solubility of Silver Chloride in Aqueous Solutions of:

Ammonia at 0°. (Jarry, 1899.) Monomethyl Amine at 11.5°. (Jarry.)

Ammonia: Gms. per 100 Gms. Solution. NH_3 Gas.	AgCl.	NH_3 Gas.	AgCl.	Monomethyl Amine: Gms. per 100 Gms. Solution. NH_2CH_3.	AgCl.
1.45	0.49	28.16	6.50	1.78	0.16
2.94	1.36	29.80	7.09	4.44	0.62
5.60	3.44	30.19	7.25	5.51	0.83
6.24	4	32.43	5.87	7.66	1.32
11.77	4.68	34.56	4.77	13.70	3.29
16.36	5.18	37.48	3.90	18.69	5.43
				36.69	9.93

Solubility of Silver Chloride in Aqueous Solutions of Ammonia.

(Longi, 1883; at 25°, Valenta, 1894; at 80°, Pohl, 1860.)

Solvent.	t°.	Gms. AgCl per 100 Gms. Solvent.
Aq. Ammonia of 0.998 Sp. Gr. = 5%	12	0.233
" 0.96 Sp. Gr. = 10%	18	7.84
" 0.986 Sp. Gr.	80	1.49
" = 3%	25	1.40
" = 15%	25	7.58

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF AMMONIA AT 25°.

(Randall and Halford, 1930.)

This system is a case of equilibrium in a chemical reaction involving formation of a complex ion. The assumed reaction is AgCl (s) + $2NH_4OH(aq) = Ag(NH_3)_2^+ + Cl^- + 2H_2O$. Silver chloride - aqueous ammonia - toluene were rotated at 25° for more than 24 hours and the saturated aqueous layer analyzed for Ag and ammonia and the toluene layer for ammonia. The concentration of the free ammonium hydroxide was calculated by substracting twice the Ag concentration plus twice the calculate ammonia ion from the total ammonia concentration (mols. per 1000 gm. of H_2O in vacuum).

Total molality of:		Calculated (1) Molality of:	
(NH_3)	(Ag)	(NH_4^+)	(NH_4OH)
0.1089	0.005665	0.0015	0.0960
1.3039	0.0895	0.0051	1.1198
1.7100	0.1256	0.0065	1.4525
1.8782	0.1379	0.0068	1.5956
2.1339	0.1628	0.0074	1.8009
2.6400	0.2151	0.0085	2.2014
2.9091	0.2395	1.0090	2.4211

(1) By the method of approximations, on the basis that the formula of the complex ion is $Ag(NH_3)_2^+$.

Cl

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF METHYL AMINE AND OF ETHYL AMINE AT 25°.

(Bodländer and Eberlein, 1903; Wuth, 1902; Euler, 1903.)

Results for Methyl Amine.

Mols. per Liter.		
Total Base.	AgCl.	Free Base.
1.017	0.0387	0.940 (B. & E.)
0.93	0.0335	... (E.)
0.508	0.0178	0.472 (B. & E.)
0.203	0.0068	0.189 "
0.102	0.0036	0.0050 "
0.195	0.00048	... (W.)
0.074	0.00042	... "
0.020	0.00030	... "

Results for Ethyl Amine.

Mols. per Liter.		
Total Base.	AgCl.	Free Base.
0.483	0.0314	0.420 (B. & E.)
0.200	0.0115	0.177 "
0.100	0.0062	0.088 "
0.094	0.0048	... (E.)
0.050	0.0029	0.044 (B. & E.)
0.103	0.00824	... (W.)
0.0551	0.000235	... "
0.0127	0.000114	... "

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE.

(Schierholz, 1890; see also Vogel, 1874; Hahn, 1877.)

Solubility at 15°.

Gms. per 100 Gms. Solution.	
NH_4Cl.	AgCl.
10	0.0050
14.29	0.0143
17.70	0.0354
19.23	0.0577
21.91	0.110
25.31	0.228
28.45	0.340 (24.5)
Sat. at ord. temp.	0.157

Solubility at Different Temperatures.

t°.	Gms. per 100 Gms. Solution.	
	NH_4Cl.	AgCl.
15	26.31	0.276
40	"	0.329
60	"	0.421
80	"	0.592
90	"	0.711
100	"	0.856
110	"	1.053

Sp. Gr. of 26.31% NH_4Cl solution at 15° = 1.08.

One liter aq. sol. containing 0.00053 gm. NH_4Cl dissolves 0.001604 gm. AgCl at 25°.

One liter aq. sol. containing 0.00530 gm. NH_4Cl dissolves 0.002379 gm. AgCl

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE AT 25°.

(Forbes, 1911.)

Gms. Equiv. per Liter.		Gms. Equiv. per Liter.		Gms. Equiv. per Liter.	
NH_4Cl.	Ag.	NH_4Cl.	Ag.	NH_4Cl.	Ag.
0.513	0.000042	2.566	0.001425	4.777	0.0135
0.926	0.000113	2.918	0.002160	4.902	0.01492
1.141	0.000172	3.162	0.002795	5.503	0.02404
1.574	0.000365	3.510	0.004029	5.764	0.03017
2.143	0.000842	4.363	0.009353		

These determinations were made by gradually adding 0.25 *n* and 0.01 *n* $AgNO_3$ to the chloride solution and observing the point of initial opalescence

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF AMMONIUM NITRATE.

(Dave and Krishnaswami, 1955.)

Results at 25°

Gm. Mols. per liter	
NH_4NO_3	$AgCl \times 10^{-5}$
0.10	3.25
0.50	5.23
0.75	6.33
1.00	7.40

Results at Different Temperatures

t°.	Gm. Mols. $AgCl \times 10^{-5}$ per liter of aq. 0.1 normal NH_4NO_3
0	0.68
8	0.82
18	1.44
30	3.28
40	4.84
50	6.75

Cl

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF AMMONIUM AND ALUMINUM SALTS.

(Valenta; see also Cohn, 1895.)

Aq. Salt Solution.	t°.	Gms. AgCl per 100 Gms. Solvent of Concentration:		
		1 : 100.	5 : 100.	10 : 100.
Aluminium Thiocyanate	25	...	...	2.02
Ammonium Carbonate	25	...	...	0 05
" Thiocyanate	20	...	0.08	0.54
" Thiosulfate	20	0.57	1.32	3.92
" "	Calc. by Cohn*	0.64	3.07	5.86

Cohn points out that the lower results of Valenta are due to the excess of AgCl used and consequent formation of the less soluble di salt of thiosulfate.

SOLUBILITY OF SILVER CHLORIDE IN AQ. SODIUM CHLORIDE SOLUTIONS.

(Schierholz; Vogel; Hahn.)

Solubility at 15°.

Gms per 100 Gms. Solution.	
NaCl.	AgCl.
10.0	0.0025
14.29	0.0071
18.18	0.0182
21.98	0.0439
23.53	0.0706
25.64	0.103
26.31	0.127

Sp. Gr. of 26.31% NaCl sol. = 1.207.

Solubility at Different Temperatures

t°	Gms AgCl per 100 Gms. Solution in:	
	14% NaCl	20.3% NaCl.
15	0.007	0.128
30	0.011	0.132
40	0.014	0.158
50	0.023	0.184
70	0.042	0.263
80	0.054	0.315
90	0.069	0.368
100	0.090	0.460
109	0.107 (104°)	0.571

Solubility at 20°, 50°, and 90° (Calc. from Original).

(Barlow — J. Am. Chem. Soc 28, 1446, '06)

Gms. NaCl per 100 cc. Solution.	Gms. AgCl dissolved per 100 cc. Solution at: 20°.	50°.	90°.	Gms. NaCl per 100 cc. Solution.	Gms. AgCl dissolved per 100 cc. Solution at: 20°.	50°.	90°.
3.43	0.00018	0.0016	0.0067	11.5	0.0031	0.0124	0.0436
4.60	0.00025	0.0025	0.0100	15.3	0.0090	0.0191	0.0732
5.75	0.00047	0.0034	0.0135	23.0	0.0313	0.0889	0.1706
7.67	0.00125	0.0058	0.0236				

Results are also given for the solubility of silver chloride in aqueous sodium chloride solutions containing hydrochloric acid.

Solubility of Silver Chloride in Aqueous Sodium Chloride at 25°.

(Forbes, 1911.)

Gms. Equiv. per Liter. [NaCl].	$[Ag] \times 10^3$.	Gms. Equiv. per Liter. [NaCl].	$[Ag] \times 10^3$.	Gms. Equiv. per Liter. [NaCl].	$[Ag] \times 10^3$.
0.933	0.086	2.272	0.570	3.747	2.462
1.190	0.130	2.658	0.851	3.977	2.879
1.433	0.184	2.841	1.040	4.363	3.810
1.617	0.245	3.270	1.583	4.535	4.298
1.871	0.348	3.471	1.897	5.039	6.039

Cl

Solubility of Silver Chloride in Aq. Sodium Nitrate Solutions.

t°.	Gms. per 100 Gms. H_2O: $NaNO_3$.	AgCl.	t°.	Gms. per 100 Gms. H_2O. $NaNO_3$.	AgCl.
5	0.787	0.00086	15-20	0.393	0.00096
18	0.787	0.00146	"	0.787	0.00133
30	0.787	0.00233	"	2.787	0.00253
45-55	0.787	0.00399		(Mulder)	

One liter aq. 3 *n* $AgNO_3$ dissolves 0.0056 gm. mols. = 0.8 gm. AgCl at 25°. (Hellwig, 1900.)

Solubility of Silver Chloride in Aqueous Solutions of Sodium Nitrate.

(Dave and Krishnaswami, 1933.)

Results at 25° Gm. mols. per liter $NaNO_3$	$AgCl \times 10^{-5}$	Results at 30° Gm. mols. per liter $NaNO_3$	$AgCl \times 10^{-5}$	t°	Results at Different Temperatures Gm. mols. $AgCl \times 10^{-5}$ per liter of aq. 0.1 normal $NaNO_3$
0.05	7.35	0.0001	1.69	0	1.35
0.10	10.1	0.001	1.91	8	3.00
0.50	13.5	0.01	2.80	18	4.94
0.75	15.5	0.10	10.1	25	10.1
1.0	17.1			30	10.1
3.0	17.5			40	10.2
sat.	18.4			50	10.8

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SODIUM SULFITE SOLUTIONS AT 25°.

(Luther and Leubner, 1912.)

Gms. Formula Weight per Liter.		Gms. Formula Weight per Liter.	
SO_3''.	Ag'.	SO_3''.	Ag'.
0.080	0.011	0.483	0.059 *
0.106	0.017	0.470	0.070
0.220	0.033	0.652	0.103
0.234	0.036	0.890	0.140
0.478	0.057 *	0.937	0.142

* These results are for solutions containing 0.05 mol. excess chloride ion per liter.

The AgCl was prepared by precipitating dilute $AgNO_3$ with alkali chloride at the b. pt. The resulting solid corresponded to the granular modification of Stas. About one hour constant agitation was allowed for attainment of equilibrium.

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM THIOSULFATE, ETC.

(Valenta; Cohn; Richards and Faber, 1899.)

Salt Solution.	t°.	Gms. AgCl per 100 Gms. Aq. Solutions of Concentration:				
		1 : 100.	5 : 100.	10 : 100.	15 : 100.	20 : 100.
Sodium Sulfite	25	...	...	0.44	...	0.95
Sodium Thiosulfate	20	0.40	2	4.10	5.50	6.10
" " Calc. by Cohn.*		0.38	1.83	3.50	5.02	6.41
Sodium Thiosulfate	35	...	...	...	...	9.08†
Thiocarbamide	25	...	...	0.83	...	...
Thiocyanimine	25	0.40	1.90	3.90	...	...

† Gms. per 100 cc. solution (R. and F.).

* Cohn points out that the lower results of Valenta are due to the excess of AgCl used and consequent formation of the less soluble di salt of the thio sulfate.

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS STRONTIUM CHLORIDE AT 25°.

(Forbes, 1911.)

Gms. Equiv. per Liter.		Gms. Equiv. per Liter.		Gms. Equiv. per Liter.	
$\frac{SrCl_2}{2}$.	$Ag \times 10^3$.	$\frac{SrCl_2}{2}$.	$Ag \times 10^3$.	$\frac{SrCl_2}{2}$.	$Ag \times 10^3$.
0.550	0.033	1.818	0.348	3.494	2.018
0.989	0.092	2.140	0.510	4.152	3.594
1.359	0.173	2.476	0.747	5.216	8.174
1.572	0.236	2.992	1.252	5.775	12.040

The determinations were made by gradually adding 0.25 *n* and 0.01 *n* $AgNO_3$ to the chloride solution and observing the point of initial opalescence.

One liter of 4.777 *n* $ZnCl_2$ solution dissolves 0.000364 mol. AgCl at 25°.

(Forbes, 1911.)

SOLUBILITY OF SILVER CHLORIDE IN METHYL AND IN ETHYL ALCOHOL AT 25°.

(Koch, 1930.)

From conductivity and E.M.F. measurements the ratios of the solubilities of silver chloride in water and alcohols were calculated, By means of these figures and previously determined results for the solubility of silver chloride in water the following estimates were made:

Solvent	Mols AgCl per liter	Gm. AgCl per liter
Water	1.3×10^{-5}	0.001863
CH_3OH	3.9×10^{-7}	0.0000559
C_2H_5OH	9.6×10^{-8}	0.0000138

The solubility product of AgCl in Ch_3OH at 25° in equiv. gm. per 1000 gm CH_3OH is 8.9×10^{-14} (Buckley and Hartley, 1929.).

SOLUBILITY OF SILVER CHLORIDE IN PYRIDINE.

(Kahlenberg and Wittich, 1909.)

t°.		Gms. AgCl per 100 Gms. Pyridine.	Solid Phase.	t°.	Gms. AgCl per 100 Gms. Pyridine.	Solid Phase.
−57	Eutec.	...	$AgCl.2C_5H_5N+C_5H_5N$	0	5.35	AgCl
−49		0.77	$AgCl.2C_5H_5N$	10	3.17	"
−35		0.99	"	20	1.91	"
−30		1.36	"	30	1.20	"
−25		1.80	"	40	0.80	"
−22		2.20	"	50	0.53	"
—	tr. pt.	2.75	" $+AgCl.C_5H_5N$	60	0.403	"
−20		3.75	$AgCl.C_5H_5N$	70	0.32	"
−18		3.85	"	80	0.25	"
−10		4.35	"	90	0.22	"
− 5		5.05	"	100	0.18	"
− 1		5.60	"	110	0.12	"

SOLUBILITY OF SILVER-CHLORIDE IN PYRIDINE SOLUTIONS OF BERYLLIUM CHLORIDE AT 15°.

(Schmidt, 1929.)

Gms. per liter of C_5H_5N Solution		Gm. mols. per liter of C_5H_5N sol.		Solid Phase
$BeCl_2$	AgCl	$BeCl_2$	AgCl	
7.99	44.2	0.10	0.308	AgCl
15.98	62.7	0.20	0.438	"
23.98	97.7	0.30	0.682	"
31.97	141.1	0.40	0.985	"
39.97	179.7	0.50	1.254	"
47.96	211.7	0.60	1.477	"
55.96	246.7	0.70	1.722	"
63.95	287.7	0.80	2.008	"
71.95	322.0	0.92	2.247	"
79.94	356.0	1.00	2.484	"
102.32	449.2	1.28	3.130	"

SILVER CHLORIDE

SOLUBILITY OF SILVER CHLORIDE IN LIQUID AMMONIA.

t°		Gms. AgCl per 100 gms. NH_3	
-33.9	(d sat. sol.=0684)	0.215	(Johnson and Krumboltz, 1933.)
0		0.28	(Linhard and Stephan, 1933, 1934.)
25.0		0.83	(Hunt and Boncyk, 1933.)

100 gms. liquid sulfur dioxide dissolve less than 0.001 gm. AgCl at 0°. (Jander and Wickert, 1936; Jander & Ruppolt, 1937.)

SILVER CHLORIDE - THIO UREA SALTS

SOLUBILITY OF EACH IN WATER

Silver Chloride .3 Thio urea
" " .5 "
(Walter, Adler and Reimer, 1934.)

Silver Chloride Thiosinanime (allyl thio carbamide)
(Sheppard and Hudson, 1927.)

Cl

t°	Formula	Gms. Cmpd. per liter	t°	Formula	Gms. Cmpd. per liter
15-20	$AgCl.3(NH_2.CS.NH_2)$	23.70	15	$AgCl.NH_2CSNHC_3H_5$	0.0517
15-20	$AgCl.5(NH_2.CS.NH_2)$	786.34	25	"	0.0816
			35	"	0.1313
			50	"	0.4578

Fusion point data are given for the following mixtures:

AgCl + Ag I	(Mönkemeyer, 1906; Bergmann and Gönke, 1926.)
AgCl + Ag_2S	(Truthe, 1912; Sandonnini, 1912.)
AgCl + $BeCl_2$	(Schmidt, 1929.)
AgCl + CsCl	(Sandonnini and Scarpa, 1912; Sandonnini, 1914.)
AgCl + HgCl	(Jänecke, 1923.)
AgCl + $HgCl_2$	(Bergmann and Gonke, 1926.)
AgCl + KI	(Rostkowski, 1929 (a).)
AgCl + LiCl	(Sandonnini, 1911 (a); 1914.)
AgCl + $MgCl_2$	(Menge', 1911.)
AgCl + NH_4Cl	(Jänecke, 1923.)
AgCl + NaCl	(Botta, 1911; Sackur, 1913; Sandonnini, 1911, 1914; Zemeznznz, 1926.)
AgCl + $PbCl_2$	(Matthes, 1911; Tries, 1914; Pelabon and Lande, 1928.)
AgCl + TlCl	(Sandonnini, 1911, 1914; Biltz and Friedrich, 1924.)

ClO SILVER CHLORITE $AgClO_2$

SOLUBILITY OF SILVER CHLORITE IN WATER.

(Levi, 1923.)

t°	Gms. $AgClO_2$ per 100 gms. sat. sol.	t°	Gms. $AgClO_2$ per 100 gms. sat. sol.
0	0.17	50	0.88
18	0.44	75	1.40
35	0.60	100	2.11

SILVER CHLORATE $AgClO_3$.

100 gms. cold water dissolve 10 gms. $AgClO_3$ (Vauquelin); 20 gms. $AgClO_3$ (Wächter).

SILVER PerCHLORATE $AgClO_4.H_2O$.

SOLUBILITY OF SILVER PERCHLORATE IN WATER. (Hill, 1922.)

t°.	d of sat. sol.	Gms. $AgClO_4$ per 100 gms. sat. sol.	Solid Phase.	t.	d of sat. sol.	Gms. $AgClO_4$ per 100 gms. sat. sol.	Solid Phase.
— 0.16....	–	0.96	Ice	0..	2.667	81.3	$AgClO_4.H_2O$
— 3.0.....	–	26.55	»	25..	2.806	84.5	»
—10.0.....	–	45.2	»	43..	–	86.5	»+$AgClO_4$
—24.0.....	–	60.3	»	50..	2.995	87.2	$AgClO_4.H_2O$ (unst.)
—40.0.....	–	70.4	»	75..	3.022	88.1	$AgClO_4$
—58.2Eutec..	2.315	73.9	»+$AgClO_4.H_2O$	99..	3.069	88.8	»

C10

The following additional determinations in this system by Smith and Ring, 1937, supplement the above results by Hill.

t°	d_4 (vac. corr.) of sat. sol.	Gms. $AgClO_4$ per 100 gms. sat. sol.	t°	d_4 (vac. corr.) of sat. sol.	Gms. $AgClO_4$ per 100 gms. sat. sol.
0	2.7251	82.07	25	2.8487	84.78
10	2.7594	82.88	30	2.8825	85.59
20	2.8163	84.04	35	2.9173	86.21

SOLUBILITY OF SILVER PERCHLORATE IN AQUEOUS SOLUTIONS OF PERCHLORIC ACID.

(Smith and Ring, 1937.)

Results at 0°			Results at 25°		
d_0 sat. solution	Gms. $HClO_4$ per 100 gms. solvent	Gms. $AgClO_4$ per 100 gms. sat. sol.	d_{25} of sat. sol.	Gms. $HClO_4$ per 100 gms. solvent	Gms. $AgClO_4$ per 100 gms. sat. sol
1.7520	60.16	17.41	1.7790	60.00	21.611
1.6987	64.31	7.931	1.7066	64.08	11.765
1.7107	68.08	4.151	1.6993	68.02	6.080
1.7575	73.60	2.136	1.7436	73.60	3.011

100 gms. furfural dissolve approx. 40.0 gms. $AgClO_4$ at about 20°.

100 gms. cellosolve (mono ethyl ether of ethylene glycol) dissolve approx. 125.0 gms. $AgClO_4$ at about 20°. (Chaney and Mann, 1931.)

SILVER Per CHLORATE

Equilibrium in the System Silver Perchlorate, Aniline and Water at 25°.

(Hill and Macy, 1924.)

d of sat. sol.	Gms. per 100 gms. sat. sol. $AgClO_4$.		Solid Phase.	d of sat. sol.	Gms. per 100 gms. sat. sol. $AgClO_4$.		Solid Phase.
	$AgClO_4$.	$C_6H_5NH_2$.			$AgClO_4$.	$C_6H_5NH_2$.	
1.063	5.00	95.00	1.6	1.066	8.32	trace	1.3+1.2
–	7.18	91.56	»	1.086	10.7	»	1.2
–	8.00	90.00	»	–	21.39	»	»
1.096	8.48	88.92	»	1.294	28.55	»	»
1.106	9.42	86.34	»	–	53.71	»	»
1.001	trace	4.57	»	–	57.13	»	»+1.1
–	»	trace	»+1.3	1.859	60.02	»	1.1
1.007	1.02	»	1.3	–	70.00	»	»
1.018	2.53	»	»	2.634	81.3	»	»
–	5.94	»	»	»	84.22	»	» +$AgClO_4.H_2O$
1.059	7.03	»	»	2.806	84.5	0.0	$AgClO_4.H_2O$

1.6=$AgClO_4.6C_6H_5NH_2$; 1.3=$AgClO_4.3C_6H_5NH_2$; 1.2=$AgClO_4.2C_6H_5NH_2$; 1.1=$AgClO_4.C_6H_5NH_2$.

The following results are given for the distribution (Binodal) curve.

Aqueous Phase.			Aniline Phase.		
% $AgClO_4$.	% $C_6H_5NH_2$.	% H_2O.	% $AgClO_4$.	% $C_6H_5NH_2$.	% H_2O.
0.0	3.66	96.34	0.0	94.78	5.22
–	–	–	2.70	92.48	4.82
–	–	–	6.29	89.40	4.31
trace	5.57	95.43	9.42	86.34	4.24

C10

Data are then given for the composition of the ternary solutions in the invariant and monovariant equilibria at — 58.8° to + 66°, and selected isotherms in this range of temperatures are shown schematically by means of triangular diagrams.

Solubility of Silver Perchlorate in Aniline. (Hill and Macy, 1924.)

t°.	d of sat. sol.	Gms. $AgClO_4$ per 100 gms. sat. sol.	Solid Phase.	t°.	d of sat. sol.	Gms. $AgClO_4$ per 100 gms. sat. sol	Solid Phase.
— 6.15 m. pt.	–	0.00	$C_6H_5NH_2$	55.0....	1.281	30.9	1.6
— 6.6.....	1.030	0.74	»+1.6	48.3 tr. pt.	–	33.0	»+1.3
+25.0.....	1.063	5.0	1.6	58.1....	1.101	35.0	1.3
40.0.....	–	11.4	»	66.6 tr. pt.	–	38.4	»+1.2
50.1.....	–	17.0	»	88.0....	–	40.0	1.2
60.52*...	–	27.06	»	48.0 m. pt.	–	100.0	$AgClO_4$

* Congruent m. pt., For 1.6, 1.3 and 1.2, see above.

Solubility in the System Silver Perchlorate, Benzene and Water at 25°.

(Hill, 1922.)

d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase.	d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase.
	$AgClO_4$.	C_6H_6.			$AgClO_4$.	C_6H_6.	
2.806	84.45	0.0	$AgClO_4.H_2O$	1.200	31.92	67.03	$AgClO_4.C_6H_6$
2.823	84.28	1.19	»	1.197	31.45	67.54	»
–	84.1	1.7	»+$AgClO_4.C_6H_6$	1.123	25.40	73.90	»
2.806	83.98	1.68	$AgClO_4.C_6H_6$	1.021	15.37	84.29	»
2.808	83.93	1.36	»	1.000	13.90	85.82	»
2.747	83.12	1.55	»	–	10.65	89.13	»
2.644	81.39	1.41	»	0.960	10.45	89.34	»
–	75.53	7.75	»	0.949	9.55	90.26	»
2.103	69.27	15.81	»	0.947	9.01	90.84	»
1.978	65.69	22.32	»	0.9367	8.28	91.60	»
1.851	62.01	28.14	»	0.9332	7.31	92.58	»
1.562	51.89	43.18	»	0.9259	6.84	93.08	»
1.462	46.80	50.34	»	0.9221	6.18	93.77	»
1.358	42.57	55.53	»	0.9205	5.96	94.00	»
1.254	35.20	63.52	»	0.906	5.00	95.00	»

DISTRIBUTION CURVE FOR THE SYSTEM SILVER PERCHLORATE, BENZENE AND WATER AT 25°. (Hill, 1922.)

The components were weighed into a small cylinder and rotated at 25° untill equilibrium was established. Samples of each layer were titrated for their silver content. The benzene and water were determined indirectly. For this purpose a weighed amount of each solution was treated with an excess of anhydrous silver perchlorate and agitated at 25° untill equilibrium was reached. The silver perchlorate now present in the solution was determined by titration and the point corresponding to this composition on the 25° solubility curve (see preceding page), was taken as giving the relative proportions of water and benzene present. The volumes of both phases in the original experiment were read in the calibrated cylinder, so that the water and benzene content of the phase L_2 was known by subtraction of the composition of L_1 from the known total composition.

COMPOSITION OF CONJUGATED SOLUTIONS.

C10

Lower layer L_2.				Upper layer L_1.			
	Gms. per 100 gms. mixture				Gms. per 100 gms. mixture		
d_{25}	$AgClO_4$.	C_6H_6.	H_2O.	d_{25}.	$AgClO_4$.	C_6H_6.	H_2O.
–	0.00	0.08	99.92	–	0.00	99.95	0.061
1.628	50.81	0.10	49.09	0.869	0.030	99.91	0.06
1.821	59.30	1.00	39.70	0.870	0.052	99.89	0.06
2.050	67.73	1.96	30.31	0.873	0.25	99.69	0.06
2.127	70.52	3.76	25.72	0.879	0.77	99.17	0.06
2.071	69.31	11.17	19.51	0.881	1.55	98.37	0.076
1.749	60.06	26.15	13.78	0.881	1.59	98.32	0.090
1.653	57.88	30.74	11.38	0.882	1.74	–	–
1.566	54.22	36.36	9.42	0.884	1.85	–	–
1.442	46.95	47.57	5.47	0.891	2.90	97.00	0.0969
1.348	41.74	55.00	3.26	0.903	4.28	95.61	0.119
1.296	38.80	58.62	2.57	0.916	5.80	94.05	0.148
1.218	35.28	63.23	1.49	0.937	8.42	91.41	0.168
1.200	31.92	67.03	1.04	0.960	10.42	89.34	0.21
1.162	31.12	68.06	0.82	0.983	13.58	86.13	0.287

Data are also given for the composition of the ternary solutions of the invariant (Quintuple points) and monovariant equilibrium at — 58°.4 to 145°, and selected isotherms in this range of temperatures are shown schematically by means of triangular diagrams.

SOLUBILITY OF SILVER PERCHLORATE IN BENZENE. (Hill, 1922.)

t°.	d of sat. sol.	Gms. $AgClO_4$ per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. $AgClO_4$ per 100 gms. sat. sol.	Solid Phase.
5.48	–	0.00	C_6H_6	115.5	50.5	$AgClO_4.C_6H_6$
5.12	0.909	3.44	" + $AgClO_4.C_6H_6$	138.5	60.0	"
25.0	0.906	5.00	$AgClO_4.C_6H_6$	140.0	62.6	$AgClO_4$ (unstable)
50.0	0.896	10.07	"	145.0	63.0	" + $AgClO_4.C_6H_6$
80.3	1.164	32.2	"	159.0	64.6	$AgClO_4$
92.0	–	40.1	"	160	65.6	"

SOLUBILITY OF SILVER PERCHLORATE IN BENZENE CONTAINING SMALL AMOUNTS OF WATER AT 25°. (Hill, 1923.)

Gms. H_2O per 100 gms. $C_6H_6 + H_2O$ mixture.	Gms. $AgClO_4$ per 100 gms. sat. sol.	Gms. H_2O per 100 gms. $C_6H_6 + H_2O$ mixture.	Gms. $AgClO_4$ per 100 gms. sat. sol.
0.00 (= pure C_6H_6)	4.981	0.1407	8.351
0.0384	5.900	0.1648	8.928
0.0547	6.267	0.1810	9.316
0.0798	6.892	0.1868	9.475
0.1110	7.639	0.2070	9.938

One liter of benzene in contact with one liter of water containing 2.325 gms. $AgClO_4$ dissolves less than 0.0000506 gm. $AgClO_4$ at 25°. (Hill, 1921.)

EQUILIBRIUM IN THE SYSTEM SILVER PERCHLORATE, PYRIDINE AND WATER AT 25°.

(Macy, 1925.)

Constant agitation was employed for obtaining saturation. Highly purified materials were used.

d of sat. sol.	Gms. per 100 gms. sat. sol. $AgClO_4$.	Gms. per 100 gms. sat. sol. C_5H_5N.	Solid Phase.	d of sat. sol.	Gms. per 100 gms. sat. sol. $AgClO_4$.	Gms. per 100 gms. sat. sol. C_5H_5N.	Solid Phase.
1.201	20.9	79.1	1.4	–	10.76	0.0	4.9
1.185	19.5	69.9	»	1.156	17.0	0.0	»
1.170	17.8	65.9	»	–	17.4	0.0	»
1.135	14.5	60.0	»	1.186	20.0	0.0	» +1.2
1.093	9.8	51.0	»	–	20.2	0.0	1.2
1.060	6.6	42.4	»	–	35.6	0.0	»
1.014	1.3	20.6	»	–	54.6	0.0	»
1.005	0.48	5.38	»	–	77.0	0.0	»
1.002	0.40	3.8	» +4.9	–	84.3	0.0	» +$AgClO_4.H_2O$
1.065	7.0	trace	4.9	2.806	84.5	0.0	$AgClO_4.H_2O$

SOLUBILITY OF SILVER PERCHLORATE IN PYRIDINE. (Macy, 1925.)

At the lower temperatures a Beckmann freezing-point apparatus was used.

C10

t°.	d of. sat. sol.	Gms. $AgClO_4$ per 100 gms. sat. sol.	Solid Phase.	t°	d of. sat. sol.	Gms. $AgClO_4$ per 100 gms. sat. sol.	Solid Phase.
-40.3 f. pt.	–	0.0	C_5H_5N	60.4...	–	34.5	1.4
-41.5....	–	4.0	»	66.8...	–	41.1	»
-43.0....	–	7.2	» +1.4	68.0...	–	41.7	» +4.9
-35.0....	–	8.3	1.4	71.0...	–	42.4	4.9
-11.5....	1.118	12.23	»	75.0...	–	43.0	»
- 1.3....	1.139	14.53	»	86.3...	–	45.8	»
+25.0....	1.201	20.90	»	95.6...	–	47.8	» +1.2
36.1....	1.221	24.52	»	110....	–	50.0	1.2
49.2....	1.278	29.4	»	144-147.	–	–	» +$AgClO_4$

$1.4 = AgClO_4.4\,C_5H_5N$; $4.9 = 4\,AgClO_4.9\,C_5H_5N$; $1.2 = AgClO_4.2\,C_5H_5N$.

A few determinations made with Kahlbaum's pyridine gave results about 1.5 % higher than the above, due possibly to the presence of homologues of pyridine.

EQUILIBRIUM IN THE SYSTEM SILVER PERCHLORATE, TOLUENE AND WATER AT 25°

(Hill and Miller, Jr., 1925.)

Results for solutions in contact with:

	$AgClO_4$.				$AgClO_4.H_2O$.		
d of sat. sol.	Gms. per 100 gms. sat. sol. $AgClO_4$.	Gms. per 100 gms. sat. sol. $C_6H_5.CH_3$.	Gms. per 100 gms. sat. sol. H_2O.	d of sat. sol.	Gms. per 100 gms. sat. sol. $AgClO_4$.	Gms. per 100 gms. sat. sol. $C_6H_5.CH_3$.	Gms. per 100 gms. sat. sol. H_2O.
1.525	50.30	49.70	0.0	1.675	56.66	41.51	1.92
1.580	52.54	46.86	0.60	–	56.95	40.07	2.86
1.606	53.49	45.49	1.02	1.696	57.44	38.96	3.67
1.628	54.75	43.84	1.41	1.702	57.56	38.72	3.86
1.639	54.92	43.66	1.42	1.710	57.96	37.98	4.12
1.672	56.65	41.46	1.89	1.709	58.11	37.72	4.16
1.675	56.66	41.42	1.92	1.715	58.34	37.32	4.19

The authors made a complete investigation of the ternary system and found seven invariant 5-phase points and twenty 4-phase equilibria between the temperatures —94° and +91°.75. The numerical data for these are given. The system shows, in addition to the solubility curves for the three solid phases (silver perchlorate, its hydrate and its compound with toluene), two binodal curves, one of which is submerged and does not reach any of the two component axes at any temperature. The intersection of the two binodal curves, at certain points which are not their plait points, gives rise to a 3-liquid system which is stable from —24°.1 to above +90°.

SILVER PerCHLORATE

DISTRIBUTION (BINODAL) CURVES FOR THE SYSTEM SILVER PERCHLORATE, TOLUENE AND WATER AT 25°. (Hill and Miller, Jr, 1925.)

Results for the conjugate Solutions. (Showing mutual Solubility of Toluene and Water as affected by the presence of Silver perchlorate).

Upper layer L_1.				Lower Layer L_2.			
	Gms. per 100 gms. mixture.				Gms. per 100 gms. mixture.		
d_{25}.	$AgClO_4$.	$C_6H_5CH_3$.	H_2O.	d_{25}.	$AgClO_4$.	$C_6H_5CH_3$.	H_2O.
0.854...	0.0	100.0	0.0	1.344...	33.34	0.0	66.64
0.850...	0.0	100.0	0.0	1.436...	39.37	0.0	60.03
0.852...	0.0	100.0	0.0	1.730...	55.21	1.59	43.20
0.914...	7.37	92.48	0.19	2.360...	75.57	2.1	22.33
1.307...	39.35	56.93	3.70	2.360...	75.57	2.1	22.33
1.372...	43.44	52.01	4.55	2.389...	76.09	2.2	21.71
1.442...	45.88	49.65	4.77	2.421...	76.28	2.25	21.47
1.491...	49.07	45.98	4.95	2.480...	78.00	2.4	20.6
1.574...	54.08	40.47	5.45	— ..	80.64	2.45	16.91
1.715 ..	58.34	37.32	4 34	2.830...	84.29	2.52	13.19

The following results were obtained for the submerged binodal curve at 25°

d_{25}.	$AgClO_4$.	$C_6H_5CH_3$.	H_2O.	d_{25}.	$AgClO_4$.	$C_6H_5CH_3$.	H_2O.
0.914...	7.37	92.48	0.19	1.307...	39.35	56.95	3.70
0.930...	8.97	91.73	0 30	1.261...	36.26	60.69	3.05
0.951...	11.00	88.64	0.36	1.210...	32.18	65.54	2.28
1.005...	16.04	83.17	0.79	— ...	26.67	71.73	1.60
— ...	21.0	77.9	1.1	— ...	21	77.9	1.1

SOLUBILITY OF SILVER PERCHLORATE IN TOLUENE.

C1O

(Hill and Miller, Jr, 1925.)

t°.	d of sat. sol.	Gms. $AgClO_4$ per 100 gms. sat. sol	Solid Phase.	t°.	d of sat. sol.	Gms. $AgClO_4$ per 100 gms. sat. sol.	Solid Phase.
—75.3...	0.854	0.0	$AgClO_4.C_7H_8$	18.....	1.417	44.11	$AgClO_4.C_7H_8$
—24.1...	0.920	6.01	»	22.6 tr. pt.	—	—	» + $AgClO_4$
0.....	1.129	26.41	»	25.....	1.523	50.30	$AgClO_4$
16....	1.375	42.0	»	50.....	1.576	52.68	»
16.5...	1.388	42.89	»	75.....	1.665	54.60	»

Data for the lowering of the freezing-point, especially the eutectic temperature, of mixtures of acetic acid and benzene by the addition of $AgClO_4$ are given by Anders, 1933.

SILVER Antipyrine Per**CHLORATE** $[Ag(COC_{10}H_{12}N_2)_3]ClO_4$

100 gms. sat. solution in water contains 10.94 gms. of the salt at 20°. (Wilke-Dörfurt and Schliephake, 1929.)

SILVER CHROMATE Ag_2CrO_4.

CrO

One liter of water dissolves 0.026 gm. Ag_2CrO_4 at 18°, and 0.020 gm. at 25°. (Abegg and Cox, 1903; Kohlrausch, 1904–05.)

One liter H_2O dissolves 0.029 gm. Ag_2CrO_4 at 25°. (Schäfer, 1905.)

One liter of H_2O dissolves 0.0142 gm. Ag_2CrO_4 at 0.26°; 0.0225 gm. at 14.8°, 0.036 gm. at 30.7° and 0.084 gms. at 75°. (Kohlrausch, 1908.)

One liter H_2O dissolves 0.0256 gm. at 18°, 0.0341 gm. at 27° and 0.0534 gm. at 50°, determined by a colorimetric method (see Note, p. 608). (Whitby, 1910.)

SOLUBILITY OF SILVER CHROMATE IN AQUEOUS AMMONIA AT 25°.

(Sherrill and Eaton, 1907.)

Mols. NH_4OH per Liter	0.01	0.02	0.04	0.08
Mols. × 10^3 Ag_2CrO_4 per Liter	2.004	4.169	8.595	17.58

SOLUBILITY OF SILVER CHROMATE IN AQUEOUS NITRIC ACID AT 25°.

(Sherrill and Russ, 1907)

Mols. HNO_3 per Liter.	Milliatoms per Liter. Cr.	Ag.	Solid Phase.	Mols. HNO_3 per Liter.	Milliatoms per Liter. Cr.	Ag.	Solid Phase.
0.01	3.157	6.315	Ag_2CrO_4	0.06	6.833	...	Ag_2CrO_4
0.015	3.730	...	"	0.07	7.333	...	"
0.02	4.177	8.356	"	0.075	7.477	14.85	" $+Ag_2Cr_2O_7$
0.025	4.567	...	"	0.08	7.260	15.45	"
0.03	5.200	...	"	0.10	5.647	19.01	"
0.04	5.803	11.62	"	0.13	4.293	23.89	"
0.05	6.380	...	"	0.14	3.948	25.63	"

One liter 65% aqueous alcohol dissolves 0.78 × 10^{-4} gms. equivalents = 0.0129 gm. Ag_2CrO_4 at room temp. (?). (Guerini, 1912)

SILVER CHROMATE Ag_2CrO_4.

CrO

Silver nitrate solutions were added to excess of various mixtures of potassium chromate and iodate dissolved in water, and the distribution of silver between CrO_4 and IO_3 determined at various temperatures and after various lengths of time. (Ramann and Sallinger, 1921.)

SOLUBILITY OF SILVER CHROMATE IN AQUEOUS SOLUTIONS OF NITRATES AT 100°.

(Carpenter, 1886.)

Solvent.	Gms. Salt per 100 cc. H_2O.	Gms. Ag_2CrO_4 per 100 cc. Solution.
Water	0	0.064
Sodium Nitrate	50	0.064
Potassium Nitrate	50	0.192
Ammonium Nitrate	50	0.320
Magnesium Nitrate	50	0.256

SILVER (Di) CHROMATE $Ag_2Cr_2O_7$.

One liter of aqueous solution contains 0.00019 gm. mol. or 0.083 gm. $Ag_2Cr_2O_7$ at 15°. (Mayer, 1903.)

SOLUBILITY OF SILVER DICHROMATE IN AQUEOUS NITRIC ACID AT 25°.

(Sherrill and Russ, 1907.)

Mols. HNO_3 per Liter.	Milliatoms per Liter. Cr.	Ag.	Solid Phase.
0	32.20	5.390	$AgCrO_4+Ag_2Cr_2O_7$
0.01	25.06	6.131	" "
0.02	20.21	7.148	" "
0.04	13.59	9.529	" "
0.06	11.10	11.1	$Ag_2Cr_2O_7$
0.08	11.1	11.1	"
0.08+0.1 $AgNO_3$	6.625	...	"

At the lower concentrations some of the dichromate is converted into solid chromate.

SILVER FLUORIDE $AgF.2H_2O$.

SOLUBILITY IN WATER.

(Guntz and Guntz, Jr., 1914.)

t°.	Gms. AgF per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. AgF per 100 Gms. H_2O.	Solid Phase
−14.2 Eutec.	60	Ice+$AgF.4H_2O$	25	179.5	$AgF.2H_2O$
+18.5	165	$AgF.4H_2O$	28.5	215	"
18.65	169.5	" +$AgF.2H_2O$	32	193	"
20	172	$AgF.2H_2O$	39.5	222	" +AgF
24	178	"	108	205	AgF

Two unstable hydrates, $AgF.H_2O$ and $3AgF.5H_2O$ were also obtained.

100 gms. H_2O dissolve 181.8 gms. AgF at 15.8°, $d_{15.8}$ of Sat. Sol. = 2.61. (Gore, 1870.)

The following additional determinations in this system by Jahn-Held and Jellinek, 1936, supplement the above results by Guntz and Guntz Jr.

t°	Mols. AgF per 1000 gms. H_2O	Gms. AgF per 100 gms. sat. sol.	Solid Phase	t°	Mols. AgF per 1000 gms. H_2O	Gms. AgF per 100 gms. sat. sol.	Solid Phase
−0.03	0.01	0.13	Ice	0	6.76	46.18	$AgF.4H_2O$
−0.182	0.05	0.63	"	+10	9.43	54.50	"
−0.984	0.30	3.67	"	15	11.33	58.98	"
−1.583	0.50	5.97	"	18.65	13.36	62.89	"+$AgF.2H_2O$
−2.936	1.00	11.26	"	20	13.45	63.23	$AgF.2H_2O$
−5.676	2.00	20.24	"	25	13.97	64.23	"
−8.69	3.00	27.57	"	30	14.97	65.53	"
−11.8	4.00	33.70	"	35	16.07	67.10	"
−14.2	4.73	37.51	"+$AgF.4H_2O$	39.5	17.5	68.95	"+AgF
−10.0	5.24	39.96	$AgF.4H_2O$	45.0	17.26	68.65	AgF
				50.0	17.01	68.35	"

F

The authors also give density determinations of aqueous AgF solutions of varying concentrations.

SOLUBILITY OF SILVER FLUORIDE IN AQUEOUS SOLUTIONS OF HYDROFLUORIC ACID AT 0° AND AT 24°.

(Guntz and Guntz, Jr., 1914.)

Results			Results at 24°.		
Gms. per 100 Gms. H_2O.		Solid Phase.	Gms. per 100 Gms. H_2O.		Solid Phase.
AgF.	HF.		AgF.	HF.	
87.5	0.40	$AgF.4H_2O$	178	0	$AgF.2H_2O$
89.4	2.60	"	178.5	1.73	"
93.8	3.97	"	177.65	5.42	"
118.5	9.60	"	179.5	10	"
156	14	" +$AgF.2H_2O$	189.5	13.4	"
159	17.2	$AgF.2H_2O$	191.5	14.3	" +AgF(?)
185	24	"	207	0.15	$3AgF.5H_2O$
189	25.7	AgF	206.2	1.25	"
188	29.5	"	202.5	7.9	"
196	39.8	"	198.6	12.65	"
142.1	52	$AgF.2H_2O$	195.5	11.7	$AgF.H_2O$
121.75	57.2	"	194.5	13	"
94.93	66.57	"	189.5	18.8	$3AgF.5H_2O$+AgF(?)
173.75	0.4	$3AgF.5H_2O$	193	36.6	AgF
174	3.6	"	193.5	16	

Additional determinations at other temperatures are given.

100 cc. sat. solution of silver fluoride in liquid HF contains 33.0 gms. AgF at −15° (Fredenhagen and Cadenbach, 1930; Fredenhagen, 1931, 1933.).

SILVER Germano **FLUORIDE** Ag_2GeF_6

100cc sat. solution of silver germano fluoride in water contain 88.03 gm. Ag_2GeF_6 at 30°. (Müller, 1927.)

SILVER Phospho **FLUORIDE** Ag_2PO_3F

One liter sat. solution in water contains 0.0593 gm. mol. Ag_2PO_3F at 20°. (Lange, 1929.)

SILVER IODIDE AgI.

One liter of aqueous solution contains 0.0000028 gm. AgI at 20°–25°.
(Average of several determinations by Kohlrausch, Abegg and Cox, etc., Holleman gives higher figures.)

One liter of water dissolves 0.0000253 gm. AgI at 60°, determined by a chain cell method (Sammet, 1905). This author also gives data for the solubility of AgI in 1 *n* and 0.1 *n* KI solutions at 60°.

The solubility product of silver iodide is given by Ruff, 1929, as 1.0×10^{-16}.

1 SOLUBILITY OF SILVER IODIDE IN WATER AND IN AQUEOUS SOLUTIONS OF ACIDS AND SALTS.

(Bedell, 1938.)

The method (See Bedell, 1937) consisted in alternately adding, dropwise, 0.001 normal solutions of silver hydroxide and hydroiodic acid to 1000cc of water at the chosen temperature. The point at which a precipitate appeared was determined by observing the diffraction of a beam of light passing through the solution.

t°	Gm. AgI per liter sat. solution
20	0.000034
40	0.000060
60	0.000094
80	0.000137

Using the above method, based upon determination of the appearance of a precipitate of AgI by means of a beam of light, the author found that concentrations of HNO_3, H_2SO_4, KOH, KNO_3, $LiNO_3$, $Ba(NO_3)_2$ and $Mn(NO_3)_2$, varying between 0.000016 and 0.0026 gm. per liter, did not sensibly affect the solubility of the AgI.

SOLUBILITY OF SILVER IODIDE IN AQUEOUS AMMONIA.

Per cent Concentration of Aq. Ammonia.	*d* of Aq. Ammonia.	t°.	Gms. AgI per Liter.	Authority.
7	0.971	16	0.045	(Ladenburg, 1902.)
10	0.960	12	0.035	(Longi, 1883.)
20	0.926	16	0.166	(Baubigny, 1908.)

Baubigny used a sealed tube and noted the first appearance of crystallization of AgI in mixtures of known compositions.

Solubility of Silver Iodide in Aqueous Mercuric Nitrate at 25°.

(Morse, 1902.)

Mols. $Hg(NO_3)_2$ per Liter.	Mols. AgI per Liter.	Gms. AgI per Liter.	Mols. $Hg(NO_3)_2$ per Liter.	Mols. AgI per Liter.	Gms. AgI per Liter.
0.010	0.00340	0.800	0.050	0.00740	1.737
0.0125	0.00358	0.841	0.100	0.01161	2.730
0.025	0.00476	1.118	1	0.10700	25.160

Since HNO_3 was present in all cases its influence on the solubility was examined. It was found that no appreciable differences were obtained with concentrations varying between 0.1 and 2 *n* HNO_3. Both crystallized and amorphous silver iodide gave identical results.

Solubility of Silver Iodide in Aqueous Salt Solutions.

(Valenta, 1894; Cohn, 1895.)

Aq. Salt. Solution.	t°.	Gms. AgI per 100 Gms. Aq. Sol. of Concentration:				
		1 : 100.	5 : 100.	10 : 100.	15 : 100.	20 : 100.
Sodium Thiosulfate	20	0.03	0.15	0.30	0.40	0.60
" "	Calc. by Cohn.*	0.623	2.996	5.726	8.218	10.493
Potassium Cyanide	25	...	8.28	...	...	...
" "	Calc. by Cohn.*	...	8.568	...	...	...
Sodium Sulfite	25	...	...	0.01	...	0.02
Ammonium Thiocyanate	20	...	0.02	0.08	0.13	...
Calcium "	25	...	...	0.03	...	...
Barium "	25	...	...	0.02	...	...
Aluminium "	25	...	...	0.02	...	...
Thiocarbamide	25	...	...	0.79	...	...
Thiocyanime	25	0.008	0.05	0.09	...	...

Solubility of Silver Iodide in Aqueous Solutions of Potassium Cyanide at 25°.

(Randall and Halford, 1930.)

This system is a case of equilibrium in a chemical reaction involving the formation of a complex ion. The assumed reaction is $Ag\,I(s) - 2CN^- = Ag(CN)_2^- - I^-$. Sufficient NaOH was added to repress the hydrolysis of the cyanide

Results for Precipitated AgI

Molality of:	
Total (CN^-)	(AgI)
0.01837	0.00866
0.03676	0.01778
0.05521	0.02666
0.07337	0.03549

Results for Crystallized AgI

Molality of:		Molality of:	
Total (CN^-).	(AgI)	Total (CN^-)	(AgI)
0.0208	0.0102	0.195	0.0913
0.0405	0.0191	0.261	0.1217
0.0836	0.0391	0.318	0.1474
0.146	0.0684	0.398	0.1840

Solubility of Silver Iodide in Aqueous Solutions of Potassium Thiocyanate at 25°.

(Randall and Halford, 1930.)

Molality of:			Molality of:		
Total (KBCN)	(AgI)	free KCNS	Total (KSCN)	(AgI)	free KCNS
0.202	0.00002	0.202	0.608	0.000040	0.608
0.315	0.000014	0.315	0.710	0.000097	0.710
0.425	0.000067	0.425	0.765	0.000146	0.765
0.500	0.000051	0.500	1.009	0.000163	1.008

SOLUBILITY OF SILVER IODIDE IN AQUEOUS SOLUTIONS OF POTASSIUM IODIDE AND OF SILVER NITRATE AT 25°.

(Hellwig, 1900.)

In Aq. KI Solutions.

Mols. KI per Liter	Mols. AgI per Liter.	Gms. AgI per Liter.
0.335	0.000363	0.0853
0.586	0.00218	0.512
0.734	0.0044	1.032
1.008	0.0141	3.32
1.018	0.0148	3.47
1.406	0.0535	12.55
1.486	0.0658	15.46
1.6304	0.102	24.01
1.937	0.198	46.42

In Aq. $AgNO_3$ Solutions.

Mols. $AgNO_3$ per Liter.	Mols. AgI per Liter.	Gms. AgI per Liter.	Solid Phase.
0.20	0.000289	0.068	AgI
0.35	0.000532	0.121	"
0.50	0.00127	0.299	"
0.70	0.00362	0.850	"
1.215	0.0131	3.08	Ag_2INO_3
1.63	0.0267	6.26	"
2.04	0.0458	10.9	"
2.54	0.0678	16.1	$Ag_3I(NO_3)_2$
3.75	0.141	33.2	"
4.69	0.227	53.2	"
5.90	0.362	85	"

SOLUBILITY OF SILVER IODIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE, POTASSIUM BROMIDE AND OF POTASSIUM IODIDE AT 15°.

(Schierholz, 1890.)

I

In Sodium Chloride.

Gms. per 100 Gms. Solution NaCl.	AgI.
26.31	0.0244
25.00	0.00072

In Potassium Bromide.

Gms. per 100 Gms. Solution KBr	AgI
30.77	0.132

In Potassium Iodide.

Gms. per 100 Gms. Solution. KI.	AgI.
59.16	53.13
57.15	40.0
50.0	25.0
40.0	13.0
33.3	7.33
25.0	2.75
21.74	1.576
20.0	0.80

100 gms. sat. silver nitrate solution dissolve 2.3 gms. AgI at 11°, and 12.3 gms. at b. pt.

100 gms. pyridine dissolve 0.10 gm. AgI at 10°, and 8.60 gms. at 121°.

(von Laszcynski, 1894.)

SOLUBILITY OF SILVER IODIDE IN AQUEOUS SODIUM IODIDE AT 25°.

(Krym, 1909.)

Gms. per 100 Gms. H_2O. NaI.	AgI	Solid Phase.	Gms. per 100 Gms. H_2O. NaI	AgI	Solid Phase.
59.29	21.21	AgI	226	120.9	$AgI.NaI.3\frac{1}{2}H_2O+NaI$
67.47	28.52	"	222.7	112.1	NaI
134.1	99.54	"	214.7	90.84	"
156.9	124.6	"	203.9	59.48	"
179.8	150	" $+AgI\,NaI\,3\frac{1}{2}H_2O$	194.5	31.10	"
196.3	134.8	$AgI\,NaI\,3\frac{1}{2}H_2O$	185.52	0	"
223.7	122	"			

The above table was calculated from the original results which are expressed in mols. per 1000 mols. H_2O.

SOLUBILITY OF SILVER IODIDE IN METHYL AND IN ETHYL ALCOHOL AT 25°.

(Koch, 1930.)

From conductivity and E.M.F. measurements, the ratios of the solubilities of silver iodide in water and alcohols were calculated. By means of these figures and previously determined results for the solubility of silver iodide in water, the following values were obtained.

Solvent	Mols. AgI per liter	Gms. AgI per liter
Water	1.0×10^{-8}	2.348×10^{-6}
CH_3OH	6.2×10^{-9}	1.519×10^{-6}
C_2H_5OH	2.1×10^{-10}	0.049×10^{-6}

The solubility product of AgI in CH_3OH at 25° in equiv. gm. per 1000 gm. CH_3OH is 6.0×10^{-19} (Buckley and Hartley, 1929.).

SOLUBILITY OF SILVER IODIDE IN ACETONE SOLUTIONS OF POTASSIUM IODIDE AND OF SODIUM IODIDE AT 25°.

I

(Koch, 1930a.)

Results for KI Solutions		Results for NaI Solutions	
Gms. KI per 100 gms. acetone	Gms. AgI per 100 gms. sat. sol.	Gms. NaI per 100 gms. acetone	Gms. AgI per 100 gms. sat. sol.
0.69	2.802	0.272	1.235
1.27	5.020	0.824	3.656
		1.910	8.034

The above table was prepared from the authors results which are given in terms of Gm. Mols. of KI or NaI per 800 gms. acetone, and gms. of residue obtained by evaporating a given weight of the saturated solution. The analysis of this residue showed it to consist in all cases of approx. 3 mols. of AgI per 1 mol. of KI or of NaI.

SOLUBILITY OF SILVER IODIDE IN LIQUID AMMONIA AND IN LIQUID SULFUR DIOXIDE.

t°	Solvent	Gms. AgI per 100 gms. solvent	Authority
0	NH_3	530.9	(Linhard and Stephan, 1933, 1934.)
25	NH_3	206.84	(Hunt and Boncyk, 1933.)
0	SO_2	0.017	(Jander and Wickert, 1936.)
			(Jander and Ruppold, 1937.)

SILVER IODIDE THIOSINAMINE (Allyl thiocarbamide)

One liter saturated solution in water contains 0.000088 gm. AgI. $NH_2.CS.NHC_3H_5$ at 25° and 0.0778 gm. at 50° (Sheppard and Hudson, 1927.)

Fusion point data have been determined for the following mixtures:

AgI + CsCl	(Raditschew, 1930.)
AgI + CuCl	"
AgI + HgI_2	(Steger, 1903.)
AgI + KCl	(Rostkowski, 1929 (2).)
AgI + LiCl	(Raditschew, 1930.)
AgI + NaI	(Sandonnini and Scarpa, 1913.)
AgI + PbI_2	(Germann and Metz, 1931.)
AgI + RbCl	(Raditschew, 1930.)

SILVER IODATE $AgIO_3$.

One liter of aqueous solution contains 0.04 gm. or 0.00014 gm. mol. at 18°–20°, and 0.05334 gm. or 0.000189 gm. mol. at 25°.

(Longi; Böttger; Kohlrausch; Noyes and Kohr, 1902.)

The solubility of silver iodate in water determined by a colorimetric method, was found by Whitby (1910) to be 0.039 gm. $AgIO_3$ per liter at 20°. Determinations reported by Sammet (1905) made by a chain cell method, gave 0.0611 gm. $AgIO_3$ per liter at 25° and 0.1849 gm. at 60°.

One liter of H_2O dissolves 0.0275 gm. $AgIO_3$ at 9.43°, 0.039 gm. at 18.4° and 0.0539 gm. at 26.6°. (Kohlrausch, 1908.)

SOLUBILITY OF SILVER IODATE IN AQUEOUS SOLUTIONS OF AMMONIA AND OF NITRIC ACID AT 25°.

(Longi, 1883.)

100 gms. aq. ammonia of 0.998 Sp. Gr. = 5% dissolve 2.36 gms. $AgIO_3$.
100 gms. aq. ammonia of 0.96 Sp. Gr. = 10% dissolve 45.41 gms. $AgIO_3$.
100 gms. aq. nitric acid of 1.21 Sp. Gr. = 35% dissolve 0.096 gm. $AgIO_3$.

SOLUBILITY OF SILVER IODATE IN AQUEOUS SALT SOLUTIONS AT 75°.

(Baxter, 1926.)

Constant agitation in sealed tubes was employed and equilibrium was approached from above and from below.

Salt.	Millimols. salt per 1000 gms. H_2O.	Millimols. $AgIO_3$ per 1000 gms. H_2O.	Salt.	Millimols. salt per 1000 gms. H_2O.	Millimols. $AgIO_3$ per 1000 gms. H_2O.
None (= H_2O)...	0.0	0.8403	K_2SO_4.....	2.0	0.9024
$KClO_3$..........	2.0	0.8661	"	5.0	0.9603
"	5.0	0.8900	"	10.0	1.0241
"	10.0	0.9143	"	20.0	1.1110
"	20.0	0.9503	"	50.0	1.2932
"	50.0	1.0183	$Ba(NO_3)_2$...	0.5	0.8646
"	100.0	1.0882	" ...	1.0	0.8717
KNO_3..........	1.0	0.8547	" ...	2.0	0.8973
"	2.0	0.8660	" ...	5.0	0.9322
"	5.0	0.8875	" ...	10.0	0.9664
"	10.0	0.9158	$MgSO_4$.....	0.2	0.8522
"	20.0	0.9570	"	0.5	0.8698
"	50.0	1.0365	"	1.0	0.8855
"	100.0	1.1258	"	2.0	0.9111
K_2SO_4..........	0.5	0.8555	"	5.0	0.9629
"	1.0	0.8760	"	10.0	1.0201
			"	20.0	1.0928

SILVER IODATE $AgIO_3$.

IO

SOLUBILITY OF SILVER IODATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 25°.

(Hill and Simmons, 1909.)

Normality of Aq. HNO_3.	Gms. $AgIO_3$ per Liter.	Normality of Aq. HNO_3.	Gms. $AgIO_3$ per Liter.
0	0.0503	1	0.2067
0.125	0.0864	2	0.3319
0.250	0.1075	4	0.6985
0.500	0.1414	8	1.587

The solubility of the amorphous modification of $AgIO_3$ is considerably higher than that of the crystalline, but the amorphous product rapidly becomes crystalline and correct results are soon obtained.

SILVER PERMANGANATE $AgMnO_4$

MnO

SOLUBILITY OF SILVER PERMANGANATE IN AQUEOUS SOLUTIONS OF SILVER PERCHLORATE AT 20°.

(Hein and Daniel, 1937.)

Gm. Mols. per liter	
$AgClO_4$	$AgMnO_4$
0.00	0.04066 (= 9.222 gms.)
0.0565	0.0068
0.6106	0.0049
0.7595	0.0045
1.0096	0.0043
1.1106	0.0036

SOLUBILITY OF SILVER PERMANGANATE IN AQUEOUS SOLUTIONS OF SILVER NITRATE AT 20°.

(Hein and Daniel, 1937.)

Gm. Mols. per liter		Gm. Mols. per liter		Gm. Mols. per liter	
$AgNO_3$	$AgMnO_4$	$AgNO_3$	$AgMnO_4$	$AgNO_3$	$AgMnO_4$
0.00	0.04066	0.3516	0.0100	2.1067	0.0113
0.0592	0.0268	0.4613	0.0095	2.6888	0.0132
0.1170	0.0172	0.5748	0.0092	3.1650	0.0150
0.1767	0.0143	0.6944	0.0088	3.6224	0.0176
0.1782	0.0138	0.8089	0.0083	6.0616	0.0344
0.2348	0.0124	1.1516	0.0084	8.3662	0.0538
0.2891	0.0109	1.6909	0.0091	9.0373	0.0627

SILVER NITRATE $AgNO_3$

SOLUBILITY OF SILVER NITRATE IN WATER.

(Kazantzev, 1923, 1925; results above 100° by Benrath, Gjedebo, Schiffero and Wunderlich, 1937; results for eutectic by Middleberg, 1903; figures in parentheses from curve given by the results of Greenish and Smith, 1903; Schreinemaker and de Baat, 1910(a); Masson 1911 and Bailey, 1930.)

t°		Gms. $AgNO_3$ per 100 gms. sat. sol.	t°	Gms. $AgNO_3$ per 100 gms. sat. sol.
-7.3	(Eutectic)	47.1	112	91.6
0		55.6 (54.0)	114	92.1
10		63.3 (61.8)	124	93.7
15	(d_{18}= 2.1196)	66.65(65.5)	134	94.5
20		69.5 (68.6)	149	95.6
25		71.8 (71.0)	161	96.6
30	(d_{25}= 2.3921)	74.0 (73.2)	170	97.6
35		76.0 (75.4)	173	98.0
50		80.2	186	98.8
75		85.5	198	99.4
100		90.0	209 (m.pt.)	100.0

An accurate determination by Cohen, de Meester and Moesveld, 1924, gave 73.82 gms. $AgNO_3$ per 100 gms. sat. sol. at 30°.

SOLUBILITY OF SILVER NITRATE IN AQUEOUS SOLUTIONS OF BARIUM NITRATE AT 30° AND VICE VERSA.

(de Baat, 1916.)

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
$AgNO_3$.	$Ba(NO_3)_2$.	Solid Phase.	$AgNO_3$.	$Ba(NO_3)_2$.	Solid Phase.
0.0	10.4	$Ba(NO_3)_2$	44.11	4.57	$Ba(NO_3)_2$
8.07	7.36	»	61.87	3.58	»
20.69	5.77	»	71.62	2.57	» +$AgNO_3$
26.17	5.05	»	73.06	0.68	$AgNO_3$
41.39	4.69	»	73.00	0.0	»

SOLUBILITY OF SILVER NITRATE IN AQUEOUS NITRIC ACID AT 30°.

(Masson, 1911.)

d_{30} of Sat. Sol.	Gm. Mols. per Liter.		Gms. $AgNO_3$ per Liter.	d_{30} of Sat. Sol.	Gm. Mols. per Liter.		Gms. AgNO per Liter.
	HNO_3.	$AgNO_3$.			HNO_3.	$AgNO_3$.	
2.3921	0	10.31	1752	1.4980	4.497	2.590	440.1
2.2754	0.4042	9.36	1591	1.4195	5.992	1.698	288.6
2.1243	0.962	8.08	1373	1.3818	8.84	0.843	143.2
1.9402	1.698	6.54	1111	1.3976	12.53	0.347	58.96
1.7052	2.834	4.526	769.1				

100 gms. $2HNO_3.3H_2O$ dissolve 3.33 gms. $AgNO_3$ at 20°, and 16.6 gms. at 100°.
100 gms. conc. HNO_3 dissolve 0.2 gm. $AgNO_3$. (Schultz, 1860.)

Solubility of Silver Nitrate in Aqueous Solutions of Nitric Acid

(Kasantzev, 1923, 1925.)

Results at 15°.

d_{15} of sat. sol.	Gms. per 100 gms. sat sol. HNO_3.	Gms. per 100 gms. sat sol. $AgNO_3$.
2.1196	0.0	66.65
2.0703	0.6	64.9
1.9847	1.5	61.4
1.8745	3.0	55.6
1.6436	7.25	44.2
1.4414	15.2	28.4
1.4001	18.4	23.8
1.3528	28.7	14.5
1.3533	38.8	8.9
1.4016	59.3	3.0
-	72.3	1.3

Results at Several Temperatures.

Gms. HNO_3 per 100 gms. sat. sol.	Gms. $AgNO_3$ per 100 gms. sat. solution at 0°.	15°.	30°.	50°.	100°.
5.0	38.2	50.5	59.1	67.9	80.5
10.0	27.8	38.3	46.8	56.2	71.3
15.0	21.1	29.0	36.8	46.0	62.3
20.0	16.2	22.0	28.9	36.7	54.0
30.0	10.1	13.7	17.7	23.3	38.7
40.0	6.4	8.5	11.2	14.3	25.7
50.0	4.0	5.2	7.0	8.6	15.7
60.0	2.1	3.0	3.9	5.8	9.6
70.0	–	1.4	2.3	3.3	–
80.0	–	0.8	0.9	1.5	–
95,0	–	1.2	1.2	1.2	–
96.5	-	1.3	–	–	-

Solubility of Silver Nitrate in Aqueous Solutions of Potassium Nitrate at 30° and Vice Versa.

(Schreinemakers, 1908–09.)

NO

Gms. per 100 Gms. Sat. Sol. KNO_3.	$AgNO_3$.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. KNO_3.	$AgNO_3$.	Solid Phase.
31.3	0	KNO_3	17.38	57.85	$AgNO_3.KNO_3$
30.45	11.51	"	13.44	65.08	"
29.22	23.59	"	11.22	69.01	" $+AgNO_3$
26.58	39.09	"	5.53	71.65	$AgNO_3$
25.02	46.38	" $+AgNO_3.KNO_3$	0	73	"

Solubility of Mixtures of Potassium Nitrate and Silver Nitrate in Water.

(Etard, 1894.)

t°.	Gms. per 100 Gms. Sol. KNO_3.	$AgNO_3$.	t°.	Gms. per 100 Gms. Sol. KNO_3.	$AgNO_3$.	t°.	Gms. per 100 Gms. Sol. KNO_3.	$AgNO_3$.
0	13.5	43	30	26.8	49.4	80	36.2	55.1
10	19	44.7	40	29.6	51.5	100	38.3	55.3
20	23	47	50	32	54	120	40	55.6
25	25	48	60	33.5	54.8	140	41.5	55.8

Solubility of Mixed Crystals of Potassium Nitrate and Silver Nitrate in Water at 25°.

(Herz, 1905; Fock, 1897.)

Gms. per Liter. $AgNO_3$.	KNO_3.	Mg. Mols. per Liter. $AgNO_3$.	KNO_3.	Mol. Per cent $AgNO_3$ in Solution.	Mol. Per cent $AgNO_3$ in Solid Phase.
45.9	321.8	270	3180	7.83	0.2896
110.7	322.6	651.3	3184	16.96	0.6006
176.8	333.7	1040	3298	23.97	0.9040
259.6	364	1528	3597	29.81	1.054
365.6	456.4	2151	4511	32.28	1.604
507.9	387.2	2988	3816	43.85	2.439
745.9	398.6	4388	3960	52.70	8.294

SOLUBILITY OF MIXTURES OF SILVER NITRATE AND AMMONIUM NITRATE IN WATER AT VARIOUS TEMPERATURES.

(Schreinemakers and deBaat, 1910.)

t°.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.	t°.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
	$AgNO_3$.	NH_4NO_3.			$AgNO_3$.	NH_4NO_3.	
− 7.3	47.1	0	Ice+rb. $AgNO_3$	109 6	67.9	32.1	D+rb. $AgNO_3$
−10.7	44.52	8.43	"	0	22.13	44.87	D+rb. NH_4NO_3
−14.9	42	16.8	Ice+D+rb. $AgNO_3$	18	27.07	49.22	"
−14.8	39.51	18.79	" +D	30	29.76	52.50	"
−18.7	15.99	37.3	" +D+β rb. NH_4NO_3	±32	...	...	D+rb. NH_4NO_3+ α+rb. NH_4NO_3
−17.4	0	41.2	" +rb. NH_4NO_3	40	32.63	52.22	D+α rb. NH_4NO_3
0	50.36	19.59	D+rb. $AgNO_3$	55	36.6	52.38	"
18	55.36	22.06	"	85.4	...	...	D+rb. NH_4NO_3+ rbd. NH_3NO_3
30	58.89	23.42	"	101.5	47.5	52.5	D+rbd. NH_3NO_3
55	63.32	26.12	"				

D = $NH_4NO_3.AgNO_3$. rb. = rhombic. rbd. = rhombohedric.

SOLUBILITY OF AMMONIUM NITRATE IN AQUEOUS SOLUTIONS OF SILVER NITRATE AND VICE VERSA AT 30°.

(Schreinemakers and deBaat, 1910.)

NO

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
$AgNO_3$.	NH_4NO_3.		$AgNO_3$.	NH_4NO_3.	
0	70.1	NH_4NO_3	45.85	34.47	D
12.51	63.59	"	52.45	28.86	"
21.31	58.64	"	57.93	24.33	"
27.75	54.12	"	58.88	23.42	D+$AgNO_3$
29.76	52.5	NH_4NO_3+D	63.27	15.62	$AgNO_3$
35.62	45.44	D	69.08	6.59	"
41.09	39.60	"	73	0	"

D = $NH_4NO_3.AgNO_3$.

Results are also given by Schreinemakers (1908–09) for the reciprocal solubility of ammonium nitrate and silver nitrate in aqueous alcohol solutions at 30°.

SIMULTANEOUS SOLUBILITY OF SILVER NITRATE AND SILVER NITRATE IN AQUEOUS 51.6 PERCENT C_2H_5OH AT 30°.

(Schreinemakers, 1908–09.)

Gms. per 100 Gms. Sat. Solution.		Solid Phase.
KNO_3.	$AgNO_3$.	
4.8	0	KNO_3
4.55	5.15	"
4.11	16.47	"
4.26	21.28	" +$AgNO_3.KNO_3$
2.62	36.94	$AgNO_3.KNO_3$+$AgNO_3$
0	37	$AgNO_3$

SOLUBILITY OF MIXED CRYSTALS OF SILVER NITRATE AND SODIUM NITRATE IN AQUEOUS ETHYL ALCOHOL.

(Hissink, 1900.)

Results at 25° in Aq. C_2H_5OH of d_{20} = 0.945 (37 wt. %).				Results at 50° in Aq. C_2H_5OH of d_{17} = 0.859 (75 wt. %).			
Gms. per 100 Gms. Sol.		Wt. per cent in Mix Crystals.		Gms. per 100 Gms. Sol.		Wt. per cent in Mix Crystals.	
$AgNO_3$.	$NaNO_3$.	$AgNO_3$.	$NaNO_3$	$AgNO_3$.	$NaNO_3$.	$AgNO_3$.	$NaNO_3$.
47.32	0.0	100	0.0	29.78	0.0	100	0.0
44.01	8.78	99.1	0.9	27.9	2.5	99.5	0.5
36.78	20.42	42.9	57.1	26.4	4.2	99.3	0.7
29.97	23.2	33.6	66.4	23.0	6.3	42.9	57.1
24.56	24.82	27.6	72.4	18.3	7.1	31.0	69.0
8.02	26.41	9.9	90.1	9.5	8.3	17.5	82.5
0.0	26.77	0.0	100.0	0.0	8.54	0.0	100.0

Very extensive data for equilibrium in the system silver nitrate, succinic acid nitrile and water are given by Middelberg (1903). This author first gives data for the ternary systems and then results for isotherms of the ternary system at 0°, 12°, 20°, 25° and 26.5°. A number of determinations for higher temperatures are also given. The following compounds of succinic nitrile and silver nitrate were identified: $C_2H_4(CN)_2.4AgNO_3$, $C_2H_4(CN)_2.2AgNO_3$, $C_2H_4(CN)_2.AgNO_3$, $2C_2H_4(CN)_2.AgNO_3.H_2O$, and $4[2C_2H_4(CN)_2.AgNO_3]H_2O$. Additional data for this system are also given by Timmermans (1907).

NO

EQUILIBRIUM IN THE SYSTEM SILVER NITRATE, GUANIDINE NITRATE AND WATER AT 25°.

(Slotkin, 1927.)

Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.	
$CH_5N_3.HNO_3$	$AgNO_3$	$CH_5N_3.HNO_3$	$AgNO_3$
0.0	72.0	2.3	22.2
1.1	70.9	6.5	13.9
0.05	71.96	12.4	8.6
0.4	67.1	12.2	8.7
0.4	57.0	12.7	7.2
1.0	48.9	12.7	6.3
1.0	34.7	13.9	0.0

The solid phase $2AgNO_3.CH_5N_3.HNO_3$ was obtained.

SOLUBILITY OF SILVER NITRATE IN AQUEOUS ETHYL ALCOHOL.

(Eder, 1878.)

Sp. Gr. of Aq. Alcoholic Mixture.	Volume per cent Alcohol.	Gms. $AgNO_3$ per 100 Gms. Aq. Alcohol at:		
		15°.	50°.	75°.
0.815	95	3.8	7.3	18.3
0.863	80	10.3	...	42.0
0.889	70	22.1	...	...
0.912	60	30.5	58.1	89.0
0.933	50	35.8	...	...
0.951	40	56.4	98.3	160.0
0.964	30	73.7	...	...
0.975	20	107.0	214.0	340.0
0.986	10	158.0	...	...

EQUILIBRIUM IN THE SYSTEM SILVER NITRATE, PHENOL AND WATER AT 25°.

(Bailey, 1930.)

d_{25} of sat. solution	Gms. per 100 gms. sat. sol.		Gms. per 100 gms. residue		Solid Phase
	$AgNO_3$	C_6H_5OH	$AgNO_3$	C_6H_5OH	
2.317	71.0	0.0	—	—	$AgNO_3$
2.297	70.8	1.1	96.1	0.4	"
2.283	69.9	3.9	94.7	0.5	"
2.170	66.0	13.6	92.2	2.7	"
2.093	63.0	18.6	90.0	5.0	"
1.878	54.1	34.1	85.9	10.0	"
1.812	51.4	39.0	85.3	10.7	"
1.736	47.0	46.2	92.2	5.8	"
1.688	44.6	50.9	89.7	8.5	"
1.633	42.4	57.6	—	—	"
—	9.3	86.6	2.6	96.2	C_6H_5OH
—	24.0	76.0	—	—	"
—	0.0	95.7	—	—	"
—	1.4	9.6	1.1	66.9	Two liquid layers
—	3.4	12.8	3.5	60.6	
—	5.3	19.0	5.6	47.8	
—	6.0	31.0	(Critical point)		

NO

SOLUBILITY OF SILVER NITRATE IN PHENOL, DETERMINED BY THE FUSION POINT METHOD.

(Bailey, 1930.)

t°	Gms. $AgNO_3$ per 100 gms. mixture	Solid Phase	t°	Gms. $AgNO_3$ per 100 gms. mixture	Solid Phase
35.5	11.9	C_6H_5OH	16.0	41.5	$AgNO_3$
27.2	22.1	"	30.2	43.2	"
11.4	31.8	"		metastable	
0.0	37.5	" + $AgNO_3.2C_6H_5OH$	-5.3	39.0	$AgNO_3 + C_6H_5OH$
1.4	39.8	$AgNO_3$ + "	+7.6m.pt	47.4	$AgNO_3.2C_6H_5OH$

DISTRIBUTION OF SILVER NITRATE BETWEEN WATER AND ANILINE AT 15-17°

(Frumkin and Kulvarskaja, 1924.)

Concentration of $AgNO_3$ in			Concentration of $AgNO_3$ in		
H_2O layer (C_1).	$C_6H_5NH_2$ layer (C_2).	$\frac{C_2}{C_1}$.	H_2O layer (C_1).	$C_6H_5NH_2$ layer (C_2).	$\frac{C_2}{C_1}$.
0.00533	0.900	173	0.00051	0.0190	37
0.00187	0.198	106	0.00020	0.00695	23
0.00082	0.067	82	0.00012	0.00170	14

The authors do not define the terms in which the concentration is expressed.

SOLUBILITY OF SILVER NITRATE IN ANHYDROUS ACETIC ACID.

(Davidson and Geer, 1933.)

The determinations were made by the synthetic or freezing-point method. Large stoppered test tubes provided with a thermometer and stirrer were used.

t°	Mol. percent $AgNO_3$ in sat. sol.	Gms. $AgNO_3$ per 100 gms. CH_3COOH	t°	Mol. percent $AgNO_3$ in sat. sol.	Gms. $AgNO_3$ per 100 gms. CH_3COOH
30	0.0274	0.0776	64	0.1035	0.2932
36	0.0398	0.1127	78	0.1332	0.3776
40	0.0439	0.1244	81	0.1361	0.3858
54	0.0708	0.2005	93	0.1940	0.5503

No compound of silver nitrate and acetic acid could be isolated.

Results for the systems $AgNO_3 + NH_4NO_3 + CH_3COOH$ at temperatures between 40° and 90° and for $AgNO_3 + LiNO_3 + CH_3COOH$ at 30° are given by Davidson and Geer, 1938.

SOLUBILITY OF SILVER NITRATE IN SEVERAL SOLVENTS. (Müller R., 1924.)

Very carefully dehydrated solvents were employed and saturation was obtained by constant shaking in sealed tubes.

NO

Solvent.	Gms. $AgNO_3$ per 100 cc. solvent at 0°.	20°.	25°.	Solvent.	Gms. $AgNO_3$ per 100 cc. solvent at 0°.	20°.	25°.
Methyl alcohol....		2.84	-	Pyridine.....	30.02	–	45.24
Ethyl alcohol.....	–	1.67	-	Quinoline....		–	5.58
Iso amyl alcohol..		–	0.54	Aniline......	–	18.5	-
Iso propyl alcohol.	–	1.38	-	Acetonitrile..		–	138.2
Ethyl acetate.....	–	2.42	–	Benzonitrile..	–	15.4	–
Acetone..........	–	0.50					

100 gms. abs. methyl alcohol dissolve 3.72 gms. $AgNO_3$ at 19°. (de Bruyn, 1892.)
100 gms. abs. ethyl alcohol dissolve 3.10 gms. $AgNO_3$ at 19°. "

100 gms. of a mixture of 1 vol. (95%) alcohol + 1 vol. ether dissolve 1.6 gms. $AgNO_3$ at 15°.

100 gms. of a mixture of 2 vols. (95%) alcohol + 1 vol. ether dissolve 2.3 gms. $AgNO_3$ at 15°.

100 gms. H_2O sat. with ether dissolve 88.4 gms. $AgNO_3$ at 15°. (Eder, 1878.)

100 gms. acetone dissolve 0.35 gm. $AgNO_3$ at 14°, and 0.44 gm. at 18°. (von Lasczynski, 1894; Naumann, 1904.)

SOLUBILITY OF SILVER NITRATE IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms. per 100 Gms. Solvent.	Authority.
Acetonitrile (anhydrous)	18	290	(Naumann and Schier, 1914.)
"	ord. temp.	about 150	(Scholl and Steinkopf, 1906.)
Benzonitrile	18	about 105	(Naumann, 1914.)
Benzene	35	0.022	(Linebarger, 1895.)
"	40.5	0.044	
Hydrazine (anhydrous)	ord. temp.	1 (with decomp.)	(Welsh and Broderson, 1915.)

SOLUBILITY OF SILVER NITRATE IN ORGANIC SOLVENTS (cont.)

Aniline	18	22.0	(Koch, 1928.)
Acetonitrile	25	111.8	(Muller, Raschka and Wittmann, 1928.)
Acetophenone	25	0.007	" " "
Ethyl cyano acetate	18	35.0	(Koch, 1928.)
Phenyl aceto nitrile	18	75.0	"
Propionitrile	18	180.0	"
Methyl ethyl ketone	25	0.22	(Muller, Raschka and Wittmann, 1928.)
Piperidine	25	4.67	" " "
Toluidine	25	0.012	" " "
Glycol	25	49.67	" " "

SOLUBILITY OF SILVER NITRATE IN PYRIDINE.

(Kahlenberg and Brewer, 1908.)

t°.	Gms. $AgNO_3$ per 100 Gms. C_5H_5N.	Solid Phase.	t°.	Gms. $AgNO_3$ per 100 Gms. C_5H_5N.	Solid Phase.
−48.5 m. pt.	0	C_5H_5N	45	62.26	$AgNO_3.3C_5H_5N$
−50.5	3	"	46	63.09	"
−53	6	"	47	66.35	"
−59	9	"	48	70.85	"
−65 Eutec.	...	"$+AgNO_3.6C_5H_5N$	48.5 tr. pt.	...	"$+AgNO_3.2C_5H_5N$
−51.25	11.1	$AgNO_3.6C_5H_5N$	45	69.85	$AgNO_3.2C_5H_5N$
−44	11.7	"	50	72.25	"
−40	12.2	"	60	78.60	"
−35	12.6	"	70	89.10	"
−30	13.9	"	80	121.21	"
−25	17.6	"	87	215.02	"
−24 tr. pt.	...	"$+AgNO_3.3C_5H_5N$	80	228.5	"
−22	18.8	$AgNO_3.3C_5H_5N$	74	230.6	"
−10	20.03	"	74	225.4	"
0	22.34	"	80	230.4	"
+10	27.21	"	87	237.1	"
20	33.64	"	90	241.9	"
30	40.86	"	100	253.8	"
40	53.52	"	110	271.4	"

The following additional determinations are given by Muller, R, 1932.

t°	Gms. $AgNO_3$ per 100 gms. sat. sol.	Solid Phase
-30	19.58	$AgNO_3.C_6H_5N + AgNO_3.3C_6H_5N$
0	19.57	"
+ 3	21.20	$AgNO_3.3C_6H_5N$
5	22.86	"
11	26.03	" $+ AgNO_3.2C_6H_5N$
30	26.60	"
35	38.03	$AgNO_3.2C_6H_5N$
40	49.80	"
44	57.70	" + Ag metal
100	57.74	" "

The author does not refer to the previous determinations of Kahlenberg and Brewer.

100 gms. liquid ammonia dissolve 86.04 gms. $AgNO_3$ at 25° (Hunt and Boncyk, 1933.)

Fusion-point data have been determined for the following mixtures:

$AgNO_3 + CdCl_2$ (Bergmann, 1926.)
$AgNO_3 + CdI_2$ "
$AgNO_3 + CsNO_3$ (Palkin, 1928.)
$AgNO_3 + HgBr_2$ (Bergmann, 1926.)
$AgNO_3 + HgCl_2$ "
$AgNO_3 + HgI_2$ "
$AgNO_3 + LiNO_3$ (Palkin, 1926.)
$AgNO_3 + KNO_3$ (Usso, 1904.)
$AgNO_3 + NH_4NO_3$ (Flavitzkii, 1909, Zawidski, 1904.)
$AgNO_3 + Pb(NO_3)_2$ (Glass, Laybourn and Madgri, 1932.)
$AgNO_3 + RbNO_3$ (Palkin, 1926.)
$AgNO_3 + TlNO_3$ (Van Eyk, 1905.)

SILVER NITRITE $AgNO_2$.

SOLUBILITY IN WATER.

(Creighton and Ward, 1915.)

t°.	Gms. $AgNO_2$ per Liter.	t°.	Gms. $AgNO_2$ per Liter.	t°.	Gms. $AgNO_2$ per Liter.
0	1.55	20	3.40	40	7.15
10	2.20	25	4.14	50	9.95
15	2.75	30	5	60	13.63

NO

The determinations by Abegg and Pick (1906) are slightly higher than the above at temperatures below 20°. Single determinations agreeing well with the above are given by Ley and Schaefer (1906), and by von Niementowski and von Roszkowski (1897).

One liter sat. solution in water contains 3.611 gms. $AgNO_2$ at 21° (Bureau, 1937.)

SOLUBILITY IN AQUEOUS SOLUTIONS OF SILVER NITRATE AT 18°.

(Naumann and Rucker, 1905.)

Mols. per Liter		Grams per Liter.		Mols. per Liter		Grams per Liter.	
$AgNO_3$.	$AgNO_2$.	$AgNO_3$.	$AgNO_2$.	$AgNO_3$.	$AgNO_2$.	$AgNO_3$.	$AgNO_2$.
0.0000	0.02067	0.000	3.184	0.02067	0.01435	3.512	2.201
0.00258	0.01975	0.439	3.042	0.04134	0.01168	7.024	1.799
0.00517	0.01900	0.878	2.926	0.08268	0.00961	14.048	1.480
0.01033	0.01689	1.756	2.601				

SOLUBILITY OF SILVER NITRITE IN AQUEOUS SOLUTIONS OF SILVER NITRATE AND OF POTASSIUM NITRITE AT 25°.

(Creighton and Ward, 1915.)

In Aqueous $AgNO_3$.			In Aqueous KNO_3.		
Mols. $AgNO_3$ per Liter.	Dissolved $AgNO_2$ per Liter.		Mols. KNO_3. per Liter.	Dissolved $AgNO_2$ per Liter.	
	Mols. =	Gms.		Mols.	Gms.
0	0.0269	4.135	0	0.0269	4.135
0.00258	0.0260	3.991	0.00258	0.0259	3.974
0.00588	0.0244	3.735	0.00588	0.0249	3.820
0.01177	0.0224	3.432	0.01177	0.0232	3.560
0.02355	0.0192	2.943	0.02355	0.0203	3.119
0.04710	0.0164	2.498	0.04710	0.0181	2.765

Additional determinations of the solubility of silver nitrite in aqueous silver nitrate solutions at 25° are given by Abegg and Pick (1905).

SOLUBILITY OF MIXTURES OF SILVER NITRITE AND BARIUM NITRITE IN WATER AT 13.5°.

(Oswald, 1914.)

Gms. per 100 Gms. H_2O.		Solid Phase.
$Ba(NO_2)_2$.	$AgNO_2$.	
64	10.2	$AgNO_2 + BaAg_2(NO_2)_4.H_2O$
75.6	9.5	$Ba(NO_2)_2 + BaAg_2(NO_2)_4.H_2O$

One liter aqueous 0.02 *n* $NaNO_2$ dissolves 3.185 gms. $AgNO_2$ at 25°.
" " " 0.20 *n* " " 3.016 " " "
" " " 0.20 *n* $NaNO_3$ " 4.956 " " "

(Ley and Schaefer, 1906; see also p. 660.)

100 gms. H_2O sat. with both salts contain 10.9 gms. $AgNO_2$ + 78.3 gms. $Sr(NO_2)_2$ at 14°. (Oswald, 1912, 1914.)

100 gms. acetonitrile dissolve about 23 gms. $AgNO_2$ at ord. temp. and about 40 gms. at the boiling-point (81.6°). (Scholl and Steinkopf, 1906.)

SOLUBILITY OF MIXTURES OF POTASSIUM NITRITE AND OF SILVER NITRITE IN WATER.

(Oswald, 1914.)

Results at 13.5°. Gms. per 100 Gms. H_2O.		Results at 25°. Gms. per 100 Gms. H_2O.		Solid Phase in Each Case.
KNO_2.	$AgNO_2$.	KNO_2.	$AgNO_2$.	
18	2.36	23.1	5.3	$AgNO_2+K_2Ag_2(NO_2)_4.H_2O$
276	26.3	279	39.3	$KNO_2+K_2Ag_2(NO_2)_4.H_2O$

Of the two layers obtained by mixing an equal volume or more of 96% ethyl alcohol with a nearly saturated aqueous solution of KNO_2, the lower contains 71.9% KNO_2 and the upper, alcoholic, 6.9%. With methyl alcohol there is no separation into two layers. (Donath, 1911.)

SILVER OXIDE Ag_2O

O

SOLUBILITY OF SILVER OXIDE IN WATER

t°	Gm. Equiv. Ag per liter sat. sol.	Authority
18	0.000114	(Laue, 1927.)
18(?)	0.000080	(Jellinek and Gordon, 1924.)
19.4	0.000108	(Remy, 1925.)
20	0.00012	(Laue, 1927.)
20	0.00012	(Mathur and Dhar, 1931.)
20	0.000185	(Whitby, 1910.)
20	0.000181	(Noyes and Kohr;
25	0.000216	(Bottger; Agegg and Cox.)
25	0.000139	(Laue, 1927.)
25	0.000222	(Johnston, Cuta and Garrett, 1933.)
25	0.000216	(Rebiere, 1915.)
25	0.000295	"
30	0.00021	(Mathur and Dahr, 1931.)
40	0.000312	" "
50	0.000368	" "
50	0.000297	(Rebiere, 1915
50	0.000389	"
60	0.000415	(Mathur and Dhar, 1931.)
70	0.00045	" "
80	0.00048	" "

The above results, were determined by many different methods including gravimetric, calorimetric, conductometric, potentiometric and combinations of these. When plotted on cross section paper, and an average curve drawn through them, the following approximate values are obtained.

t°	Gm. Equiv. Ag. per liter	Gm. Ag_2O per liter	t°	Gm. Equiv. Ag. per liter	Gm. Ag_2O per liter
10	0.00006	0.007	40	0.00030	0.035
15	0.00010	0.0116	50	0.00036	0.042
20	0.00015	0.0174	60	0.00041	0.049
25	0.00019	0.022	70	0.00045	0.052
30	0.00023	0.027	80	0.00048	0.055

Britton and Robinson, 1932, state that computations of the solubility product of silver hydroxide, from the glass electrode PH values, leads to results in agreement with previous data.

SOLUBILITY OF SILVER OXIDE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE AT 25°.

Results of:
(Mathur and Dhar, 1931.)

Normality of Aq. NaOH	Gm. Ag_2O per liter	Gm. Equiv. Ag_2O per liter $\times 10^{-4}$
0.0002	0.0093	0.87
0.001	0.0016	0.15
0.01	0.0010	0.10
0.10	0.0032	0.30
0.506	0.0098	0.91
1.03	0.0162	1.50
2.26	0.0309	2.86
5.20	0.0457	4.23

Results of:
(Johnston, Cuta and Garrett, 1933.)

Normality of Aq. NaOH	Gm. Equiv. Ag_2O per liter $\times 10^{-4}$
0.0012	0.329
0.010	0.076
0.020	0.062
0.05	0.110
0.117	0.26
0.40	0.73
1.17	2.00
2.33	3.7
6.6	5.4

Results similar to the above by Johnston, Cuta and Garrett, 1933, for aqueous KOH and $Ba(OH)_2$ solutions, show that, within experimental error, the solubility of Ag_2O is identical in equivalent concentrations of OH^-. The solubility passes through a minimum of $0.06 \cdot 10^{-4}$ gm. equivalents of Ag_2O per liter at approximately 0.015 normal alkali. These authors also give results showing that in alkaline solutions, $Ba(NO_3)_2$, KNO_3 and K_2SO_4, do not appreciably influence the solubility of Ag_2O.

Results for the solubility of Ag_2O in aqueous KNO_3 solutions are given by Mather and Dhar, 1931.

SOLUBILITY OF SILVER OXIDE IN AQUEOUS SOLUTIONS OF AMMONIA.

(Olmer, 1924.)

Saturation was obtained by agitation for two hours at room temperature and allowing the solution to stand for exactly 24 hours.

Gm. Mols. NH_3 per liter.	Gm. Atoms Ag per liter.	Ratio $\frac{NH_3}{Ag}$.	Gm. Mols. NH_3 per liter.	Gm. Atoms Ag per liter.	Ratio $\frac{NH_3}{Ag}$.
0.294	0.088	3.340	2.941	0.848	3.468
0.588	0.181	3.248	3.521	0.986	3.571
0.882	0.258	3.418	4.049	1.092	3.708
1.176	0.355	3.312	4.056	1.191	3.741
1.471	0.456	3.225	5.001	1.304	3.835
1.765	0.526	3.355	5.469	1.363	4.012
2.059	0.585	3.519	5.76	1.369	3.93
2.353	0.710	3.314			

SOLUBILITY OF SILVER OXIDE IN AQUEOUS AMMONIA AT 25°.

(Whitney and Melcher, 1903.)

Mols. NH_3 (Total) per Liter.	Gm. Atoms Ag per Liter.	Mols. NH_3 (Total) per Liter.	Gm. Atoms Ag per Liter.	Mols. NH_3 (Total) per Liter.	Gm. Atoms Ag per Liter.
0.220	0.0658	0.733	0.224	1.147	0.343
0.469	0.134	0.876	0.257	1.498	0.454
0.684	0.205	0.915	0.276	1.522	0.470

SOLUBILITY OF SILVER OXIDE IN AQUEOUS SOLUTIONS OF AMMONIA AT 25°.

(Randall and Halford, 1930.)

This system was studied as a case of equilibrium in a chemical reaction involving formation of a complex ion. The assumed reaction is $\frac{1}{2} Ag_2O(s) + 2NH_4OH(aq.) = Ag(NH_3)_2^+ - OH^- - 3/2\ H_2O$.

Molality of: Total base	Molality of: $(Ag(NH_3)_2^+)$	Molality of: (NH_4OH)	Molality of: Total base	Molality of: $(Ag(NH_3)_2^+)$	Molality of: NH_4OH
0.05302	0.01155	0.01838	0.3200	0.07535	0.09494
0.05532	0.01282	0.01667	0.3540	0.07787	0.1231
0.05821	0.01338	0.01806	0.6519	0.1525	0.1945
0.06173	0.01406	0.01955	0.6767	0.1582	0.2021
0.1479	0.03499	0.04289	0.8673	0.2033	0.2574
0.1575	0.03606	0.04932	0.9518	0.2225	0.2841
0.2456	0.05787	0.07198	1.2304	0.2888	0.3642
0.3155	0.07352	0.09490			

The molality of the free ammonium hydroxide is equal to the molality of the total base less three times the molality of the silver constituent.

SOLUBILITY OF SILVER OXIDE IN AQUEOUS SOLUTIONS OF METHYL AMINE.

(Olmer, 1924.)

The flasks were agitated from time to time and allowed to stand 24 hours.

Gm. Mols CH_3NH_2 per liter.	Gm. Atoms Ag per liter.	Ratio $\frac{CH_3NH_2}{Ag}$.	Gm. Mols CH_3NH_2 per liter.	Gm. Atoms Ag per liter.	Ratio $\frac{CH_3NH_2}{Ag}$.
0.440	0.104	4.230	3.556	0.759	4.685
1.412	0.340	4.153	5.716	0.954	5.991
2.095	0.504	4.156	8.230	0.885	9.299
3.279	0.731	4.485	9.333	0.658	14.18

SOLUBILITY OF SILVER OXIDE IN AQUEOUS SOLUTIONS OF ETHYL AMINE AND OF METHYL AMINE AT 18°.

(Euler, 1903.)

In Aqueous Ethyl Amine. Normality of Aq. Amine.	In Aqueous Ethyl Amine. Normality of Dissolved Ag.	In Aqueous Methyl Amine. Normality of Aq. Amine.	In Aqueous Methyl Amine. Normality of Dissolved Ag.
0.100	0.0322	0.100	0.0221
0.50	0.160	0.500	0.118
1	0.314	1	0.228

SOLUBILITY OF SILVER OXIDE IN MIXTURES OF WATER AND ALCOHOL AT 25°.

(Klosky and Woo, 1926.)

Carefully purified materials were used. Saturation was secured by constant stirring for 10 hours. The dissolved Ag_2O was determined by adding a small amount of 0.1 *n* K Cl and measuring the turbidity produced, against known standards.

Wt. % C_2H_5OH in solvent.	Gms Ag_2O per liter sat. sol.	Wt. % C_2H_5OH in solvent.	Gms. Ag_2O per liter sat. sol.
0.0	0.0262	45.70	0.0174
10.95	0.0197	64.00	0.0145
22.92	0.0181	77.00	0.0120
34.30	0.0176	91.50	0.0091

SILVER PHOSPHATE Ag_3PO_4.

One liter of water dissolves 0.00644 gm. at 20°. (Böttger, 1903.)

SILVER Per **RHENATE** $AgReO_4$

One liter of water dissolves 3.2 gms. $AgReO_4$ at 20°, as determined by conductivity measurements. (Noddack, 1929.)

SILVER Diamine Per**RHENATE** $A[Ag(NH_3)_2]$ ReO_4

Re

One liter of ammonia of d = 0.930 dissolve 16.18 gms. $[Ag(NH_3)_2]$ ReO_4 at 20°. (Wilke-Dörfurt and Gunzert, 1933.)

SILVER SULFIDE Ag_2S

S

SOLUBILITY OF SILVER SULFIDE IN WATER.

Critical reviews of the published determinations of the solubility of metal sulfides in water are given by Kolthoff, 1931, and by Ravitz, 1936. Kolthoff calls attention to the incorrectness of the results of Weigel, 1907, and recommends that his results be omitted from reliable tables of solubility data. He gives an improved list of solubilities and solubility products but made no attempt to correct for activities. Ravitz made a careful study of the results of previous investigators and recalculated their results with the aid of recent activity data. His preferred value for silver sulfate at 10° is - One liter sat. solution in water contains 4.29×10^{-16} gm. mols. Ag_2S. The solubility product is 1.04×10^{-54}. At 25°, one liter sat. solution in water contains 2.48×10^{-15} gm. mols. Ag_2S. The solubility product is 3.28×10^{-52}.

Fusion-point determinations are reported for the following mixtures:

$Ag_2S + Cu_2S$	(Schwarz and Romero, 1927.)
$Ag_2S + Cu_2S + PbS$	" "
$Ag_2S + PbS$	" "
$Ag_2S + SiS_2$	(Cambi, 1912.)
$Ag_2S + Tl_2S$	(Huber, 1921.)
$Ag_2S + ZnS$	(Friedrich, 1908.)

SILVER SULFATE Ag_2SO_4.

SO

SOLUBILITY IN WATER.
(Barre, 1911.)

t°.	Gms. Ag_2SO_4 per 100 Gms. Sat. Sol.	t°.	Gms. Ag_2SO_4 per 100 Gms. Sat. Sol.	t°.	Gms. Ag_2SO_4 per 100 Gms. Sat. Sol.
0	0.57	30	0.88	70	1.21
10	0.69	40	0.97	80	1.28
20	0.79	50	1.05	90	1.34
25	0.834	60	1.14	100	1.39

The result at 25° is the average of the very accurate and closely agreeing determinations of Hill and Simmons (1909), Rothmund (1910) and Harkins (1911). Earlier determinations, differing somewhat from the above, are given by Euler (1904), Wright and Thompson (1884), Wentzel (   ) and Drucker (1001).

More recent very careful determinations of the Solubility of Silver Sulfate in Water at 25°, gave the following results:

Gm. Mols. Ag_2SO_4 per 1000 gms. H_2O	Gms. Ag_2SO_4 per 100 gms. sat. sol.	Authority
0.026888	0.8315	(Chloupek and Danes, 1932.)
0.02676	0.8275	(Åkerlof and Thomas, 1934.)

SOLUBILITY OF SILVER SULFATE AT 25° IN AQUEOUS SOLUTIONS OF:

(Akerlof and Thomas, 1934.)

Sulfuric Acid	
Mols. H_2SO_4 per liter aq. solvent	Mols. Ag_2SO_4 per 1000 gms. sat. sol. (solvent?)
0.0050	0.02615
0.1000	0.02919
0.2510	0.03115
0.5000	0.03315
0.7500	0.03416
1.000	0.03468
1.250	0.03481
1.500	0.03522
1.750	0.03428
2.000	0.03376
2.500	0.03269
2.973	0.03092

Copper Sulfate	
Mols. $CuSO_4$ per liter aq. solvent	Mols. Ag_2SO_4 per 1000 gms. sat. sol. (solvent?)
0.1061	0.02587
0.2160	0.02711
0.3262	0.02856
0.4465	0.03018
0.5634	0.03170
0.6789	0.03314
0.8224	0.03482
0.9426	0.03613
1.097	0.03770
1.235	0.3899

Magnesium Sulfate	
Mols. $MgSO_4$ per liter aq. solvent	Mols Ag_2SO_4 per 1000 gms. sat. sol. (solvent?)
0.1237	0.02488
0.3017	0.02636
0.4011	0.02789
0.6266	0.02948
0.7986	0.03093
0.9711	0.03222
1.143	0.03335
1.348	0.03442
1.545	0.03525
1.718	0.03569
1.973	0.03618

Zinc Sulfate	
Mols. $ZnSO_4$ per liter aq. solvent	Mols. Ag_2SO_4 per 1000 gms. sat. sol. (solvent?)
0.1225	0.02567
0.2528	0.02715
0.3855	0.02885
0.5256	0.03058
0.6784	0.03234
0.8285	0.03399
0.9601	0.03529
1.152	0.03707
1.322	0.03842
1.507	0.03971

Results are also given for the solubility at 25° of silver nitrate in aqueous solutions of mixtures of: $Al_2(SO_4)_3$ + $ZnSO_4$, $CdSO_4$ + $MgSO_4$, H_2SO_4 + $MgSO_4$ and Li_2SO_4 + $MgSO_4$.

SOLUBILITY OF SILVER SULFATE AT 25° IN AQUEOUS SOLUTIONS OF:

(Chloupek and Danes, 1932.)

Potassium Nitrate		Potassium Sulfate		Ammonium Sulfate	
Mols. KNO_3 per liter aq. solvent	Mols. Ag_2SO_4 per 1000 gms. sat. sol.	Mols. K_2SO_4 per liter aq. solvent	Mols. Ag_2SO_4 per 1000 gms. sat. sol.	Mols. $(NH_4)_2SO_4$ per liter aq. solvent	Mols. Ag_2SO_4 per 1000 gms. sat. sol.
0.03	0.029463	0.01	0.025759	0.01	0.025810
0.06	0.031368	0.02	0.025016	0.02	0.025083
0.15	0.036396	0.05	0.024218	0.05	0.024269
0.6	0.05284	0.10	0.024301	0.10	0.024315
1.5	0.07645	0.20	0.025861	0.20	0.025642
		0.50	0.03266	0.50	0.03092
		sat.	0.03737	1.00	0.03950

The results in aqueous solutions of potassium nitrate and potassium sulfate are in good agreement with those of Harkins, 1911.

SOLUBILITY OF SILVER SULFATE IN AQUEOUS SOLUTIONS OF AMMONIUM SULFATE.

(Barre, 1911.)

Results at 33°. Gms. per 100 Gms. Sat. Sol. $(NH_4)_2SO_4$.	Results at 33°. Gms. per 100 Gms. Sat. Sol. Ag_2SO_4.	Results at 51°. Gms. per 100 Gms. Sat. Sol. $(NH_4)_2SO_4$.	Results at 51°. Gms. per 100 Gms. Sat. Sol. Ag_2SO_4.	Results at 75°. Gms. per 100 Gms. Sat. Sol. $(NH_4)_2SO_4$.	Results at 75°. Gms. per 100 Gms. Sat. Sol. Ag_2SO_4.	Results at 100°. Gms. per 100 Gms. Sat. Sol. $(NH_4)_2SO_4$.	Results at 100°. Gms. per 100 Gms. Sat. Sol. Ag_2SO_4.
8.85	1.101	8.90	1.362	8.80	1.758	9.23	2.221
15.90	1.331	16.27	1.680	15.23	2.155	15	2.626
22.22	1.500	22.43	1.887	22.30	2.490	22.01	3.075
27.25	1.585	32.10	2.061	28.25	2.734	27	3.325
30.80	1.619	35.38	2.095	32	2.823	34.90	3.663
35.88	1.627	39.03	2.082	35.82	2.889	38.70	3.772
39.46	1.600	42.37	2.055	41.16	2.929	44.15	3.854
43.22	1.557	45.05	2.026	46.46	2.902	47.63	3.867

A series of determinations at 16.5° is also given.

SOLUBILITY OF SILVER SULFATE IN AQUEOUS NITRIC ACID AT 25°.

(Hill and Simmons, 1909.)

Normality of Aq. HNO_3.	Per cent Conc. of Aq. HNO_3.	d_{25} of Sat. Sol.	Gms. Ag_2SO_4 per Liter.	Normality of Aq. HNO_3.	Per cent Conc. of Aq. HNO_3.	d_{25} of Sat. Sol.	Gms. Ag_2SO_4 per Liter.
0	0	1.0054	8.35	4.209	23.33	1.1956	73.212
1.0046	6.154	1.061	34.086	5.564	29.84	1.2456	84.609
2.0452	12.005	1.1069	49.010	8.487	42.37	1.3326	94.671
4.017	22.37	1.1871	71.166	10.034	48.77	1.3676	90.806

SO

SOLUBILITY OF SILVER SULFATE IN AQUEOUS SOLUTIONS OF ACIDS AND SALTS AT 25°.

(Swan, 1899.)

Acid or Salt	Gm. Equiv. per Liter.	Gms. Dissolved Ag_2SO_4 per Liter.	Acid or Salt.	Gm. Equiv. per Liter.	Gms. Dissolved Ag_2SO_4 per Liter.
HNO_3	0	8.41	H_2SO_4	0	8.41
"	0.01589	9.33	"	0.02902	8.55
"	0.03178	10.18	"	0.05802	8.68
"	0.06357	11.83	"	0.10526	8.86
$KHSO_4$	0.05264	8.13	K_2SO_4	0.02718	7.93
"	0.10526	8.07	"	0.05434	7.68

SOLUBILITY OF SILVER SULFATE IN AQUEOUS SOLUTIONS OF SALTS AT 25°.

(Harkins, 1911.)

Salt.	Gm. Equiv. Salt per Liter.	d_{25} Sat. Sol.	Gms. Ag_2SO_4 per Liter	Salt.	Gm. Equiv. Salt per Liter.	d_{25} of Sat. Sol.	Gms. Ag_2SO_4 per Liter.
KNO_3	0	...	8.344	$AgNO_3$	0.09961	1.0137	2.644
"	0 024914	1.0072	8.996	K_2SO_4	0.025024	1.0064	7.899
"	0.049774	1.0092	9.531	"	0.050044	1.0079	7.694
"	0.09987	1.0034	10.435	"	0.100	1.0112	7.49
$Mg(NO_3)_2$	0.024764	1.0073	9.267	"	0.20003	1.0180	7.531
"	0.049595	1.0094	10.029	$MgSO_4$	0.020022	1.0061	8.140
"	0.09946	1.0133	11.334	"	0.050069	1.0079	7.941
$AgNO_3$	0.024961	1.0065	6.095	"	0.10004	1.0105	7.740
"	0.04986	1.0084	4.487	"	0.20005	1.0164	7.733

One liter of aqueous solution in contact with a mixture of silver sulfate and silver acetate contains 3.95 gms. Ag_2SO_4 + 8.30 gms. CH_3COOAg at 17°. Sp. Gr. of solution = 1.0094. (Euler, 1904.)

SOLUBILITY OF SILVER SULFATE AT 25° IN AQUEOUS SOLUTIONS OF:

(Drucker, 1901.)

Sulfuric Acid.				Potassium Sulfate.			
Mols. per Liter.		Gms. per Liter.		Mols. per Liter.		Gms. per Liter.	
Ag_2SO_4.	H_2SO_4.	Ag_2SO_4.	H_2SO_4.	Ag_2SO_4.	K_2SO_4.	Ag_2SO_4.	K_2SO_4.
0.0260	0.02	8.11	0.98	0.0246	0.02	7.67	1.74
0.0264	0.04	8.23	1.96	0.0236	0.04	7.36	3.49
0.0271	0.10	8.45	4.90	0.0231	0.10	7.20	8.72
0.0275	0.20	8.58	9.81	0.0232	0.20	7.24	17.44

SOLUBILITY OF SILVER SULFATE IN AQUEOUS POTASSIUM SULFATE SOLUTIONS.

(Barre, 1911.)

Results at 33°.		Results at 51°.		Results at 75°.		Results at 100°.	
Gms. per 100 Gms. Sat. Sol.		Gms. per 100 Gms. Sat. Sol.		Gms. per 100 Gms. Sat. Sol.		Gms. per 100 Gms. Sat. Sol.	
K_2SO_4.	Ag_2SO_4.	K_2SO_4.	Ag_2SO_4.	K_2SO_4.	Ag_2SO_4.	K_2SO_4.	Ag_2SO_4.
3.22	0.863	3.20	1.023	3.12	1.273	3.23	1.488
5.62	0.940	5.61	1.127	5.73	1.406	5.60	1.675
8.37	1.046	8.40	1.247	8.43	1.554	8.45	1.890
10.41	1.117	10.55	1.340	10.55	1.665	11.30	2.115
11.80	1.177	13.16	1.450	13.17	1.806	15.07	2.410
		14.37	1.524	17.06	2.021	18.58	2.677

Results at 14.5° are also given.

SO

SOLUBILITY OF SILVER SULFATE IN AQUEOUS SODIUM SULFATE SOLUTIONS.

(Barre, 1910, 1911)

Results at 33°.		Results at 51°.		Results at 75°.		Results at 100°.	
Gms. per 100 Gms. Sat. Sol.		Gms. per 100 Gms. Sat. Sol.		Gms. per 100 Gms. Sat. Sol.		Gms. per 100 Gms. Sat. Sol.	
Na_2SO_4.	Ag_2SO_4.	Na_2SO_4.	Ag_2SO_4.	Na_2SO_4.	Ag_2SO_4.	Na_2SO_4.	Ag_2SO_4.
0.25	0.861	0.25	1.032	0.20	1.215	0.50	1.341
0.98	0.816	1.02	0.995	0.98	1.210	1.01	1.363
2.01	0.832	1.90	1.017	1.96	1.238	1.94	1.418
3	0.867	2.92	1.053	2.98	1.296	3.02	1.494
5.34	0.972	5.40	1.173	5.37	1.458	5.33	1.651
10.05	1.150	10.11	1.379	9.81	1.697	10.15	2.012
20.00	1.448	20.25	1.705	19.98	2.075	25.45	2.351
29.55	1.570	29.23	1.802	29.66	2.138	34.72	2.012
39.44	1.462	39.30	1.540	38.94	1.603	38.93	1.687
46.976	0.932	44.46	0.882	41.36	1.156	40.16	1.158

Results at 14.5° and at 18° are also given.

SOLUBILITY IN SILVER SULFATE IN AQUEOUS 0.5 *n* SOLUTIONS OF VARIOUS COMPOUNDS AT 25°.

(Rothmund, 1910.)

Aq. 0.5 *n* Solution of:	Gms. Dissolved Ag_2SO_4 per Liter.	Aq. 0.5 *n* Solution of:	Gms. Dissolved Ag_2SO_4 per Liter.	Aq. 0.5 *n* Solution of:	Gms. Dissolved Ag_2SO_4 per Liter.
Methyl Alcohol	7.764	Glycerol	8.202	Acetonitrile	16.37
Ethyl Alcohol	7.109	Mannitol	9.262	Glycocol	13.50
Propyl Alcohol	6.798	Grape Sugar	8.418	Acetic Acid	7.857
Amyl Alc. (tert.)	6.36	Urea	9.448	Phenol	11.81
Acetone	6.86	Dimethylpyrone	6.736	Chloral	7.266
Ether	6.424	Urethan	7.078	Methylal	6.393
Formaldehyde	7.078	Formamide	8.42	Methyl Acetate	6.61
Glycol	8.076	Acetamide	7.794		

Fusion-point data for $Ag_2SO_4 + Na_2SO_4$ are given by Nacken (1907).

$Ag_2SO_4 + K_2SO_4$ (Naken, 1907a.)

$Ag_2SO_4 + H_2SO_4$ (Kendall and Davidson, 1921.)

SILVER THIOSULFATE $Ag_2S_2O_3$

EQUILIBRIUM IN THE SYSTEM SILVER THIOSULFATE, SODIUM THIOSULFATE AND WATER AT 25°.

(Bassett and Lemon, 1933.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$Na_2S_2O_3$	$Ag_2S_2O_3$		$Na_2S_2O_3$	$Ag_2S_2O_3$	
0.29	0.55	$NaAg_2(S_2O_3)_2 \cdot H_2O$	32.40	19.36	$Na_5Ag_3(S_2O_3)_4 \cdot 2H_2O$
0.43	0.75	"	33.90	18.02	"
0.51	0.88	" + $NaAg(S_2O_3) \cdot H_2O$	35.98	17.76	" + $Na\ Ag(S_2O_2)_3 2H_2O$
0.53	0.91	" "	36.13	17.75	"
0.61	1.05	" "	36.49	15.81	$Na_2Ag(S_2O_3) \cdot 2H_2O$
0.63	1.04	$NaAg(S_2O_3) \cdot H_2O$	38.28	12.52	"
1.82	2.46	"	41.48	8.90	"
5.28	5.46	"	42.27	8.13	"
12.54	10.98	"	43.31	7.30	" + $Na_2S_2O_3 \cdot 5H_2O$
20.04	17.42	"	42.99	7.07	& $Na_2S_2O_3 \cdot 5H_2O$
27.24	21.64	"	43.06	5.50	"
27.56	21.91	" + $Na_5Ag_3(S_2O_3)_4 \cdot 2H_2O$	42.92	1.66	"
27.79	21.87	$Na_5Ag_3(S_2O_3)_4 \cdot 2H_2O$	43.15	0.0	

This system has also been studied by Brintzinger and Eckart, 1937, for the purpose of learning by dialysis experiments, the character of the ions in the solutions in contact with the several solid phases.

SILVER SELENIDE Ag_2Se

Se

Fusion point data for mixtures of Ag_2Se and Bi_2Se_3 are given by Pelabon, 1908.

SILVER SELENATE Ag_2SeO_4

SOLUBILITY OF SILVER SELENATE IN WATER.

(Meyer and Hinke, 1932.)

t°	20.4	30	40	50	100
Gms. Ag_2SeO_4 per 1000 gms. H_2O	0.016	0.026	0.029	0.033	0.053

SILVER *o* and *p* Xylol **SELENATES** $(CH_3)_2(1.2)C_6H_3(4)SeO_3Ag$ and $(CH_3)_2(1.4)C_6H_3(4)SeO_3Ag.H_2O$.

100 gms. H_2O dissolve 1.29 gms. of the ortho compound at 23°.
" " " 3.02 " " anhydrous para compound at 18°.
(Anschutz, Kallen and Riepenkröger, 1919.)

SILVER SELENO CYANIDE AgSeCN

One liter sat. solution in H_2O contains $4.0 \cdot 10^{-6}$ gm. AgSeCN at 18-20° as determined by E.M.F. measurements. (Birckenbach and Huttner, 1930.

SILVER VANADATE $Ag_6V_4O_{13}$.

VO

One liter of aqueous solution contains 0.047 gm. at 14°, and 0.073 gm. at 100°. (Carnelly, 1873.)

The solubility product $[Ag^+]\ [VO_3^-]$ is 5×10^{-7} (Britton and Robinson, 1930.)

ALUMINUM Al

SOLUBILITY OF METALLIC ALUMINUM IN MILK.

(Quam, 1929.)

Polished plates of aluminum immersed in milk kept in motion for periods of one-half hour at different temperatures showed no loss in weight up to 70° C. and 0.122 and 0.174 milligrams per sq. decimeter of surface at 80° and 95° respectively.

ALUMINUM BROMIDE $AlBr_3$.

SOLUBILITY IN SEVERAL ORGANIC SOLVENTS.

(Menschutkin, 1909–10.)

(Determinations by Synthetic Method.)

In Benzene.

t°.	Gms. $AlBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
5.7 m. pt.	0	C_6H_6
4.5	10	"
3	20	"
1.8 Eutec.	27.4	$(C_6H_6+AlBr_3)$
10	35.3	$AlBr_3$
20	46.5	"
30	59	"
40	70	"
60	83	"
80	91.2	"
90	95.3	"
96	100	"

In Para Xylene.

t°.	Gms. $AlBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
14 m. pt.	0	$p\ C_6H_4(CH_3)_2$
12.5	11.4	
10.2 Eutec.	25	$AlBr_3+p\ C_6H_4(CH_3)_2$
20	35.7	$AlBr_3$
30	47.2	"
40	61.2	"
50	72.2	"
60	79.6	"
80	90.9	"
90	95.4	"
96	100	"

In Toluene.

t°	Gms. $AlBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−15	16.1	$AlBr_3$
0	23.7	"
10	32.1	"
20	42.5	"
30	56	"
40	68.8	"
50	76.5	"
70	87.2	"
90	95.7	"
96	100	"

In Benzoyl Chloride.

t°.	Gms. $AlBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−0.5 m. pt.	0	C_6H_5COCl
−2.5	11.7	
−5 Eutec.	22.2	$C_6H_5COCl+AlBr_3.C_6H_5COCl$
20	33.7	$AlBr_3.C_6H_5COCl$
40	42.6	"
60	51.6	"
80	60.5	"
90 m. pt.	65.5	"
80	68.9	"
60	71.8	"
30	75.8	"
7 Eutec.	78.8	$AlBr_3.C_6H_5COCl+AlBr_3$
20	80.6	$AlBr_3$
50	85.6	"
80	93.2	"
96	100	"

Reciprocal solubilities determined by the method of lowering of the freezing-point (see footnote, page 1) are given by Kahlukow and Sachanow (1909) for mixtures of **Aluminum Bromide** and each of the following compounds: aniline, benzene, benzonitrile, methylbenzoate, *p* bromaniline, bromobenzene, methylene bromide, *p* dibromobenzene, dimethylaniline, diphenylamine, methylaniline, naphthaline, nitrobenzene,p yridine, toluene and *p* xylene. Similar data for mixtures of **Aluminum Bromide** and dimethylpyrone are given by Plotników (1911).

SOLUBILITY OF ALUMINUM BROMIDE IN SEVERAL ORGANIC SOLVENTS (*Con.*)

(Determinations by Synthetic Method.)

In Benzophenone.

t°.	Gms. $AlBr_3$ per 100 Gm. Sat. Sol.	Solid Phase.
48 m. pt.	0	$(C_6H_5)_2CO$
45	12	"
42	19	"
38 Eutec.	24.7	" $+AlBr_3.(C_6H_5)_2CO$
60	30.9	$AlBr_3.(C_6H_5)_2CO$
80	36.4	"
100	42.2	"
120	49	"
130	53	"
142 m. pt.	59.5	"
130	64	"
100	69	"
70	72.2	"
50	74	"
38 Eutec.	75	" $+AlBr_3$
50	78	$AlBr_3$
80	88	"
90	93.5	"
96	100	"

In Ethylene Bromide.

t°.	Gms. $AlBr_3$ per 100 Gm. Sat. Sol.	Solid Phase.
10 m. pt.	0	$C_2H_4Br_2$
6	11.5	"
2	21.3	"
−2 Eutec.	29.7	$C_2H_4Br_2+AlBr_3$
10	36.1	$AlBr_3$
20	42.1	"
30	48.7	"
40	56	"
50	63.7	"
60	71.5	"
70	79.1	"
80	86.8	"
90	94.5	"
96	100	"

In Nitrobenzene.

t°.	Gms. $AlBr_3$ per 100 Gm. Sat. Sol.	Solid Phase.
5.5 m. pt.	0	$C_6H_5NO_2$
0	18	"
−5	28.8	"
−15 Eutec.	42	" $+AlBr_3.C_6H_5NO_2$
0	44.3	$AlBr_3.C_6H_5NO_2$
30	49.4	"
60	56.7	"
80	63.6	"
87 m. pt.	68.4	"
80	71.3	"
60	73.9	"
40	76.4	"
20 Eutec.	78.9	" $+AlBr_3$
40	82.4	$AlBr_3$
60	85.8	"
80	89.8	"
93	96.6	"
96	100	"

In *o* Chloronitrobenzene.

t°.	Gms. $AlBr_3$ per 100 Gm. Sat. Sol.	Solid Phase.
32.5 m. pt.	0	*o* $C_6H_4ClNO_2$
25	21.8	"
13.8 Eutec.	37.5	" $+AlBr_3$.*o* $C_6H_4ClNO_2$
30	43.1	$AlBr_3$.*o* $C_6H_4ClNO_2$
56	50.3	"
70	57.6	"
83.5 m. pt.	62.9	"
70	67	"
40	73.7	"
21 Eutec.	77.5	" $+AlBr_3$
40	80.6	$AlBr_3$
60	84	"
80	88.6	"
90	93.4	"
96	100	"

SOLUBILITY OF ALUMINUM BROMIDE IN SEVERAL ORGANIC SOLVENTS (*Con.*).

(Determinations by Synthetic Method.)

In *m* Chloronitrobenzene.

t°.	Gms. AlBr₃ per 100 Gms. Sat. Sol.	Solid Phase.
44.5 m. pt.	0	*m* $C_6H_4ClNO_2$
40	18.9	"
35.5 Eutec.	27.8	" + $AlBr_3.m\,C_6H_4ClNO_2$
50	34.8	$AlBr_3.m\,C_6H_4ClNO_2$
70	44.5	"
90	54.5	"
103.5 m. pt.	62.9	"
90	68.6	"
70	73.4	"
50	77.3	"
40 Eutec.	79.1	" + $AlBr_3$
60	82.2	$AlBr_3$
80	87.1	"
90	92.2	"
95	95.1	"
96	100	"

In *p* Chloronitrobenzene.

t°.	Gms. AlBr₃ per 100 Gms. Sat. Sol.	Solid Phase.
83 m. pt.	0	*p* $C_6H_4ClNO_2$
80	9	"
70	24.8	"
60 Eutec.	36.6	" + $AlBr_3.p\,C_6H_4ClNO_2$
80	45.6	$AlBr_3.p\,C_6H_4ClNO_2$
100	54.9	"
115 m. pt.	62.9	"
100	66.8	"
60	72.4	"
20 Eutec.	78	" + $AlBr_3$
60	85.3	$AlBr_3$
80	89.3	"
93	95.4	"
96	100	"

Br

In *o* Bromonitrobenzene.

t°.	Gms. AlBr₃ per 100 Gms. Sat. Sol.	Solid Phase.
38 m. pt.	0	*o*.$C_6H_4BrNO_2$
30	19.7	"
21 Eutec.	30	" + $AlBr_3.o\,C_6H_4BrNO_2$
40	37.6	$AlBr_3.o\,C_6H_4BrNO_2$
60	45.3	"
80	53	"
88.5 m. pt.	56.9	"
80	59.7	"
60	64.1	"
40	68.6	"
24 Eutec.	72	" + $AlBr_3$
40	75.5	$AlBr_3$
60	79.8	"
80	86.3	"
93	94.5	"
96	100	"

In *m* Bromonitrobenzene.

t°.	Gms. AlBr₃ per 100 Gms. Sat. Sol.	Solid Phase.
54 m. pt.	0	*m* $C_6H_4BrNO_2$
50	11.6	"
45.5 Eutec.	19.5	" + $AlBr_3.m\,C_6H_4BrNO_2$
60	25.5	$AlBr_3.m\,C_6H_4BrNO_2$
80	34.5	"
110	49.5	"
122 m. pt.	56.9	"
110	61.6	"
80	69.2	"
60	74.1	"
42 Eutec.	78.7	" + $AlBr_3$
60	80.3	$AlBr_3$
80	84.9	"
93	93.6	"
96	100	"

SOLUBILITY OF ALUMINUM BROMIDE IN SEVERAL ORGANIC SOLVENTS (*Con.*).

(Determinations by Synthetic Method.)

In *p* Bromonitrobenzene.

t°.	Gms. $AlBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
124.5 m. pt.	0	$p.C_6H_4BrNO_2$
119	10	"
110	25.2	"
98 Eutec.	35.3	" + $AlBr_3.p\ C_6H_4BrNO_2$
110	39.7	$AlBr_3.p\ C_6H_4BrNO_2$
130	48.7	"
144 m. pt.	56.9	"
120	65.5	"
90	70.5	"
60	74.1	"
45 Eutec.	76	" + $AlBr_3$
60	79.6	$AlBr_3$
80	86.6	"
93	95.4	"
96	100	"

In *p* Nitrotoluene.

t°.	Gms. $AlBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
53.5 m. pt.	0	$p\ C_6H_4CH_3NO_2$
50	10	"
40	31.3	"
29 Eutec.	46.1	" + $AlBr_3.p\ C_6H_4CH_3NO_2$
50	52.9	$AlBr_3.p\ C_6H_4CH_3NO_2$
80	63	"
88 m. pt.	66	"
80	68.5	"
50	74.3	"
27 Eutec.	78.9	" + $AlBr_3$
50	83.3	$AlBr_3$
70	87.7	"
85	92.2	"
93	96.7	"
96	100	"

In *m* Nitrotoluene.

t°.	Gms $AlBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
16 m. pt.	0	$m\ C_6H_4CH_3NO_2$
12	14.5	"
8	21.8	"
1 Eutec.	32	" + $AlBr_3.m\ C_6H_4CH_3NO_2$
20	38.5	$AlBr_3.m\ C_6H_4CH_3NO_2$
40	46.6	"
80	59.7	"
90	63.3	"
96 m. pt.	66	"
90	68.8	"
60	73.8	"
27 Eutec.	78.9	" + $AlBr_3$
40	82	$AlBr_3$
70	89	"
90	95.3	"
96	100	"

In *o* Nitrotoluene.

t°.	Gms. $AlBr_3$ per 100 Gms. Sat. Sol.	Solid Phase
− 8.5 m. pt.	0	$o\ C_6H_4CH_3NO_2$
−11 Eutec.	8.7	" + $AlBr_3.2o C_6H_4CH_3NO_2$
10	12.8	$AlBr_3.2o C_6H_4CH_3NO_2$
30	24.8	"
40	38	"
42.5 Eutec.	47.7	" + $AlBr_3.2o C_6H_4CH_3NO_2$
60	54.3	$AlBr_3.o\ C_6H_4CH_3NO_2$
75	59.5	"
90 m. pt.	66	"
70	72	"
40	76.1	"
19 Eutec.	79.1	" + $AlBr_3$
40	82.5	$AlBr_3$
70	87.5	"
90	93.8	"
96	100	"

ALUMINUM BROMIDE $AlBr_3$

SOLUBILITY OF ALUMINUM BROMIDE IN CARBON DISULFIDE.

(Kaveler and Monroe, 1928.)

t°	Gms. $AlBr_3$ per 100 gms. sat. sol.	Mols. $AlBr_3$ per 100 Mols. $AlBr_3 + CS_2$	t°	Gms. $AlBr_3$ per 100 gms. sat. sol.	Mols. $AlBr_3$ per 100 mols. $AlBr_3 + CS_2$
0.1	41.7	17.0	60.0	86.4	64.4
8.4	49.1	21.6	70.0	90.5	73.1
15.0	55.1	25.8	71.0	91.1	74.2
20.0	58.8	28.5	76.0	93.5	79.1
25.0	62.7	32.3	81.0	94.5	83.3
30.0	66.7	36.2	85.0	96.2	87.8
50.1	80.9	54.5	91.7 (m.pt.)	100.0	100.0

SOLUBILITY OF ALUMINUM BROMIDE IN PYRIDINE.

(Muller, 1932(a).)

t°	Gms. $AlBr_3$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $AlBr_3$ per 100 gms. sat. sol.	Solid Phase
-11	1.86	$AlBr_3$:7.5 C_5H_5N	10	5.65	$AlBr_3$:$3C_5H_5N$
- 7	3.00	"	13.5	5.1	"
0	5.36	"	20	3.86	"
2	5.72	" + $AlBr_3$:$5.5C_5H_5N$	30	1.93	"
3	4.88	$AlBr_3$:$5.5C_5H_5N$	35	1.00	"
4	2.05	" + $AlBr_3 6C_5H_5N$	40	0.38	" + $AlBr_3$: ?C_5H_5N
5	3.52	$AlBr_3$:$6C_5H_5N$	60	0.41	$AlBr_3$:?C_5H_5N
6	4.32	"	80	0.55	"
7	6.09	" + $AlBr_3$:$3C_5H_5N$	100	1.03	"

The fusion-points of mixtures of $AlBr_3$ and C_5H_5N were determined by Plotnikow and Iwanow, 1931. The diagram of the results is made up of branches corresponding to the compounds $AlBr_3.C_5H_5N$ (m.pt.45°), $Al_2Br_6.C_5H_5N$ (m.pt.83°), $2Al_2Br_6.3C_5H_5N$ and $Al_2Br_6.2C_5H_5N$ (m.pt.98°).

SOLUBILITY OF ALUMINUM BROMIDE IN BENZONITRILE.

(Müller, 1932(a).)

t°	Gms. $AlBr_3$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $AlBr_3$ per 100 gms. sat. sol.	Solid Phase
-8	22.97	$AlBr_3 6C_6H_5CN$	25	27.47	$AlBr_3$:$4C_6H_5CN$
-5	23.50	"	30	29.05	"
-2	24.21	" $AlBr_3$:$4.5C_6H_5CN$	40	29.62	$AlBr_3$:$2C_6H_5CN$
0	23.95	AlBr :$4.5C_6H_5CN$	50	30.17	"
5	22.85	"	60	30.25	"
10	22.35	"	70	30.53	$AlBr_3$:C_6H_5CN
15	21.09	" + $AlBr_3$:$4C_6H_5CN$	80	31.35	"
18	23.25	$AlBr_3$:$4C_6H_5CN$	90	31.85	"
22	25.12	"	100	32.56	"

ALUMINUM BROMIDE

Fusion-points have been determined for the following mixtures:

$AlBr_3$ + AgBr (3)
" + $AlCl_3$ (2)(5)
" + $AsBr_3$ (2)(3)
" + $BaBr_2$ (3)
" + $BiBr_3$ (2)(3)
" + Br (3)(5)
" + CBr_4 (2)(3)
" + $CaBr_2$ (3)
$AlBr_3$ + HgBr (3)
" + $HgBr_2$ (2)(3)
" + KBr (3)
" + LiBr (3)
" + $MgBr_2$ (3)
" + $MnBr_2$ (3)(5)
" + NH_4Br (3)
" + NH_3 (4)
$AlBr_3$ + NaBr (3)
" + PBr_3 (1)(3)(5)
" + $PbBr_2$ (3)
" + $SbBr_3$ (2)(3)
" + $SnBr_2$ (3)
" + $SnBr_4$ (3)(5)
" + TlBr (3)
" + $ZnBr_2$ (3)

(1) = Isbekow, 1913; (2) = Isbekow, 1925; (3) = Kendall, Crittenden and Miller, 1923; (4) = Klemm and Redeker, 1931; (5) = Pusin and Makuc, 1938.

ALUMINUM Nitrosophenyl **HYDROXYLAMINE** $Al[C_6H_5.N(NO)O]_3$

The solubility in water of the precipitated aluminum salt of nitroso phenylhydroxylamine, obtained by adding a solution of "cupferron" ($C_6H_5.N(NO)O.NH_4$) to a solution of a soluble aluminum salt, was determined at 18° by a colorimetric method. The result corresponded to a solubility of $3.4.10^{-5}$ gm. atom Al per liter, equivalent to 0.0009 gm. $Al[C_6H_5.N(NO)O]_3$. (Martin and Pinkus, 1927). CH

ALUMINUM HELIANTHATE $(C_{14}H_{14}N_3SO_3)_3Al.6H_2O$.

100 cc. H_2O dissolve 0.0092 gms. $(C_{14}H_{14}N_3SO_3)_3Al.6H_2O$ at 20°-25°.
(Stark and Dehn, 1918.)

ALUMINUM OLEATE $Al(C_{18}H_{33}O_2)_3$

100 gms. methyl alcohol dissolve 2.49 gms. $Al(C_{18}H_{33}O_2)_3$ at 15° and 4.47 gms. at 66° (the b. pt.)

100 gms. acetone dissolve 0.39 gm. $Al(C_{18}H_{33}O_2)_3$ at 15°. (Henstock, 1934.)

100 gms. benzene dissolve 0.58 gm. Al $(C_{18}H_{33}O_2)_3$ at 15°. (Henstock, 1934.)

ALUMINUM STEARATE $Al(C_{18}H_{35}O_2)_3$

100 gms. methyl alcohol dissolve 0.2 gm. $Al(C_{18}H_{35}O_2)_3$ at 66° (the b.pt.)

100 gms. acetone dissolve 0.88 gm. $Al(C_{18}H_{35}O_2)_3$ at 15°. (Henstock, 1934.)

100 gms. benzene dissolve 0.18 gm. $Al(C_{18}H_{35}O_2)_3$ at 15°. (Henstock, 1934.)

ALUMINUM CHLORIDE $AlCl_3.6H_2O$ Cl

SOLUBILITY OF ALUMINUM CHLORIDE IN WATER.

The results of Malaquori, 1927, 1928, Palitzsch, 1929, and Tanaka, 1930, when plotted on cross section paper are not in good agreement, but an average curve may be drawn through them and from this the following approximate values have been read.

t°	Gms. $AlCl_3$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $AlCl_3$ per 100 gms. sat. sol.	Solid Phase
-55 (Eutec)	25.3	Ice + $AlCl_3.6H_2O$	25	31.6	$AlCl_3.6H_2O$
-40	26.8	$AlCl_3.6H_2O$	30	31.8	"
-20	29.1	"	40	32.1	"
0	30.5	"	60	32.5	"
10	31.0	"	80	32.7	"
20	31.4	"	100	32.9	"

Fusion-point data for mixtures of $AlBr_3$ + KCl and $AlBr_3$ + NaCl are are given by Starokadomskaia, 1930.

SOLUBILITY OF ALUMINUM CHLORIDE IN AQUEOUS SOLUTIONS OF FERRIC CHLORIDE AND VICE VERSA.

(Malquori, 1928(a); at 25° Malquori, 1927(b)).

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms. sat. sol.		Solid Phase
	$FeCl_3$	$AlCl_3$			$FeCl_3$	$AlCl_3$	
0	0.0	31.03	$AlCl_3.6H_2O$	25	31,67	7.19	$AlCl_3.6H_2O$
"	6.37	26.12	"	"	37.88	6.67	"
"	15.93	17.28	"	"	38.25	5.21	" $+FeCl_3.6H_2O$
"	26.30	12.21	" $+FeCl_3.6H_2O$	"	39.18	5.35	$FeCl_3.6H_2O$
"	27.40	11.55	$FeCl_3.6H_2O$	"	39.42	5.15	"
"	31.92	7.81	"	"	43.13	4.00	"
"	38.12	3.31	"	"	45.25	3.06	"
"	42.66	0.0	"	"	49.76	0.00	"
25	0.0	34.08(?)	$AlCl_3.6H_2O$	40	0.0	31.63	$AlCl_3.6H_2O$
"	8.29	26.02	"	"	17.32	22.70	"
"	10.34	22.88	"	"	35.78	17.85	"
"	15.13	19.55	"	"	45.07	14.64	"
"	18.98	16.72	"	60	0.0	31.73	"
"	24.78	12.50	"	"	26.31	21.75	"
"	27.14	9.63	"	"	38.91	17.92	"

Data for the systems, $AlCl_3 + FeCl_3 + HCl + H_2O$ at 25° and $AlCl_3 + FeCl_3 + KCl + H_2O$ at 25° are given by Malquori, 1929.

Cl

SOLUBILITY OF ALUMINUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 25°.

(Malquori, 1927(a).)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
HCl	$AlCl_3$		HCl	$AlCl_3$	
0.0	34.081(?)	$AlCl_3.6H_2O$	19.43	10.11	$AlCl_3.6H_2O$
4.15	29.75	" "	23.19	7.95	"
5.09	27.98	"	30.17	2.49	"
11.21	18.10	"	40.98	0.98	"
14.07	15.25	"			

SOLUBILITY OF ALUMINUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT 25° AND VICE VERSA.

(Malquori, 1927.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
KCl	$AlCl_3$		KCl	$AlCl_3$	
0.0	34.08(?)	$AlCl_3.6H_2O$	10.51	12.28	KCl
2.15	33.18	" +KCl	13.98	7.93	"
3.91	30.15	KCl	17.93	4.07	"
7.80	24.09	"	26.31	0.0	"
9.03	19.81	"			

Data for the system $AlCl_3 + KCl + KCl + H_2O$ at 0° and 80° are given Malquori, 1928(b). Data for this system at 25° are given by Malquori, 1927(b).

Data for the systems, $AlCl_3 + KCl + H_2O$ at 0° and 10°; $AlCl_3 + Al(NO_3)_3 + H_2O$ at 0°, and 10°; $KCl + KNO_3 + H_2O$ at 0° and 10° and for $(K,Al) + (NO_3,Cl) + H_2O$ at 10° are given by Tanaka, 1930.

SOLUBILITY OF ALUMINUM CHLORIDE IN AQUEOUS SOLUTIONS OF URETHAN AND VICE VERSA AT 25°.

Palitzsch, 1928, 1929.

Gm. mols. per 1000 gms. H_2O		Solid Phase	Gm. mols. per 1000 gms. H_2O		Solid Phase
$AlCl_3$	$NH_2COOC_2H_5$		$AlCl_3$	$NH_2COOC_2H_5$	
3.38	0.0	$AlCl_3.6H_2O$	2.02	1.778	$NH_2COOC_2H_5$
3.38	1.466	"	1.04	6.544	
3.39	1.554	" + $NH_2COOC_2H_5$	0.0	53.09	"
2.96	1.480	$NH_2COOC_2H_5$			

ALUMINUM CHLORIDE

One liter sat. solution of $AlCl_3$ in CCl_4 contains 0.74 gm. at 4°, 0.22 gm. at 14°, 0.15 gm. at 20° and 0.06 gm. at 34°.

One liter sat. solution of $AlCl_3$ in $CHCl_3$ contains 0.65 gm. at -15°, 1.0 gm. at 0° and 0.72 gm. at 25°. (Lloyd, 1918.) Cl

The solubility of aluminum chloride in anhydrous hydrazine is stated by Welsh and Broderson (1915) to be 1.0 gm. in 100 cc. at room temperature.

SOLUBILITY OF ALUMINUM CHLORIDE IN BENZENE AND IN TOLUENE

(Menschutkin, 1909(a).)

t°	Solvent	Gms. $AlCl_3$ per 100 gms. sat. sol.	t°	Solvent	Gms. $AlCl_3$ per 100 gms. sat. sol.
17	C_6H_6	0.20	17	$C_6H_5CH_3$	0.38
80	"	1.22	73	"	1.33

SOLUBILITY OF ALUMINUM CHLORIDE IN SEVERAL ORGANIC SOLVENTS.

(Menschutkin, 1909.)

(Determinations by Synthetic Method.)

In Nitrobenzene.

t°.	Gms. $AlCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
5.5 m. pt.	0	$C_6H_5NO_2$
2 Eutec.	10.3	" $+AlCl_3\,2C_6H_5NO_2$
15	18	$AlCl_3.2C_6H_5NO_2$
25.5 Eutec.	30.5	" $+AlCl_3\,C_6H_5NO_2$
45	34.2	$AlCl_3\,C_6H_5NO_2$
65	39.5	"
85	48	"
90 m. pt.	52	"
82	55.6	"
72	58	"
52 Eutec.	61.6	" $+AlCl_3$
90	64	$AlCl_3$
130	67.7	"
160	72.4	"
180	80.1	"
194	100	"

In *o* Chloronitrobenzene.

t°.	Gms. $AlCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
32.5 m. pt.	0	*o* $C_6H_4ClNO_2$
27	10.2	"
21	16.1	"
15 Eutec.	20.3	" $+AlCl_3$.*o* $C_6H_4ClNO_2$
35	25.5	$AlCl_3$.*o* $C_6H_4ClNO_2$
55	31.5	"
75	38.7	"
89 m. pt.	45.9	"
80	51	"
69 Eutec.	54.4	" $+AlCl_3$
110	57.5	$AlCl_3$
150	65.4	"
175	74.6	"
194	100	"

In *m* Chloronitrobenzene.

t°.	Gms. $AlCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
44.5 m. pt.	0	*m* $C_6H_4ClNO_2$
44	10.7	"
36 Eutec.	16.6	" $+AlCl_3$ *m* $C_6H_4ClNO_2$
50	21	$AlCl_3$ *m* $C_6H_4ClNO_2$
70	28.3	"
90	36.8	"
104 m. pt.	45.9	"
90	52.4	"
81 Eutec.	55.6	" $+AlCl_3$
120	60	$AlCl_3$
140	64.1	"
160	70.2	"

In *p* Chloronitrobenzene.

t°.	Gms. $AlCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
83.5 m. pt.	0	*p* $C_6H_4ClNO_2$
78	7.1	"
73	12.8	"
68 Eutec.	17.1	" $+AlCl_3$.*p* $C_6H_4ClNO_2$
80	22.2	$AlCl_3$.*p* $C_6H_4ClNO_2$
100	31.4	"
120	41.8	"
126 m. pt.	45.9	"
110	53.2	"
94 Eutec.	58.1	"$+ AlCl_3$
125	60.5	$AlCl_3$
155	66.9	"
180	77.7	"
190	88.2	"
194	100	"

SOLUBILITY IN SEVERAL ORGANIC SOLVENTS (*Con.*).

(Determinations by Synthetic Method.)

In *o* Bromonitrobenzene.

t°.	Gms. $AlCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
38.5	0	*o* $C_6H_4BrNO_2$
32	7.5	"
26	13.1	"
20 Eutec.	17.5	" $+AlCl_3.$*o* $C_6H_4BrNO_2$
40	21.7	$AlCl_3$ *o* $C_6H_4BrNO_2$
60	26.4	"
80	31.7	"
97 m. pt.	38	"
100	39.8	"
90	44.6	"
80 Eutec.	46.5	" $+AlCl_3$
110	50.1	$AlCl_3$
130	54.1	"
150	60.2	"
170	70	"
180	77.4	"

In *m* Bromonitrobenzene.

t°.	Gms. $AlCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
54.7	0	*m* $C_6H_4BrNO_2$
51	6.5	"
47 Eutec.	11.9	" $+AlCl_3.$*m* $C_6H_4BrNO_2$
60	16	$AlCl_3.$*m* $C_6H_4BrNO_2$
80	22.9	"
100	30.7	"
110	35.9	"
116 m. pt.	39.8	"
113	42.3	"
107	44.5	"
97 Eutec.	47.4	" $+AlCl_3$
120	51.5	$AlCl_3$
140	56.5	"
160	64.5	"
180	77.4	"
190	88.8	"
197	100	"

In *p* Bromonitrobenzene.

t°.	Gms. $AlCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
124.5 m. pt.	0	*p* $C_6H_4BrNO_2$
117	7.4	"
111	12.8	"
105	17.7	"
99 Eutec.	22.2	" $+AlCl_3$ *p* $C_6H_4BrNO_2$
120	28.4	$AlCl_3$ *p* $C_6H_4BrNO_2$
140	36.4	"
145 m. pt.	39.8	"
140	44.5	"
120	51.2	"
113 Eutec.	52.8	" $+AlCl_3$
130	55.9	$AlCl_3$
150	61.3	"
180	77.4	"
190	88.8	"
194	100.0	"

In *o* Nitrotoluene.

t°.	Gms. $AlCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−8.5 m. pt.	0	*o* $C_6H_4CH_3NO_2$
−9.3 Eutec.	1	" $+AlCl_3$ 2*o* $C_6H_4CH_3NO_2$
0	1 5	$AlCl_3.$2*o* $C_6H_4CH_3NO_2$
20	4	"
40	11	"
55 Eutec.	31	" $+AlCl_3$ *o* $C_6H_4CH_3NO_2$
85	41.8	$AlCl_3.$*o* $C_6H_4CH_3NO_2$
95.5 m. pt.	49.3	"
70	56.8	"
45 Eutec.	61.5	" $+AlCl_3$
95	64.5	$AlCl_3$
145	73.7	"
180	86.2	"
185	89.5	"
194	100	"

SOLUBILITY IN SEVERAL ORGANIC SOLVENTS (*Con.*).

(Determinations by Synthetic Method.)

In *m* Nitrotoluene.

t°.	Gms. $AlCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
16 m. pt.	0	*m* $C_6H_4CH_3NO_2$
13 Eutec.	7.8	" + $AlCl_3.2$*m* $C_6H_4CH_3NO_2$
27	13.4	$AlCl_3.2$*m* $C_6H_4CH_3NO_2$
35 Eutec.	24.5	" + $AlCl_3$.*m* $C_6H_4CH_3NO_2$
65	34	$AlCl_3$.*m* $C_6H_4CH_3NO_2$
90	44.2	"
95	46.7	"
99.5 m. pt.	49.3	"
70	56.8	"
45 Eutec.	61.5	" + $AlCl_3$
95	64.5	$AlCl_3$
120	68.2	"
130	70.2	"

In *p* Nitrotoluene.

t°.	Gms. $AlCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
52.5 m. pt.	0	*p* $C_6H_4CH_3NO_2$
47	9.2	"
42	15	"
37 Eutec.	19	" + $AlCl_3$.*p* $C_6H_4CH_3NO_2$
55	29.1	$AlCl_3$.*p* $C_6H_4CH_3NO_2$
80	34.8	"
95	41.3	"
109 m. pt.	49.3	"
100	53.4	"
60	61.7	"
45 Eutec.	64	" + $AlCl_3$
105	69.5	$AlCl_3$
165	80	"
190	94.3	"
194	100.0	"

C1

In Benzophenone.

t°.	Gms. $AlCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
48 m. pt.	0	$(C_6H_5)_2CO$
44	8.5	"
30.5 Eutec.	15.4	" + $AlCl_3(C_6H_5)_2CO$
60	19.3	$AlCl_3.(C_6H_5)_2CO$
90	26.5	"
120	37	"
130 m. pt.	42.3	"
110	48.8	"
80	53.5	"
60 Eutec.	56.1	" + $AlCl_3$
100	58	$AlCl_3$
140	63	"
160	68.6	"
180	78.5	"
190	89.1	"
192	93	"
194	100	"

In Benzoyl Chloride.

t°.	Gms. $AlCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−0.5 m. pt.	0	C_6H_5COCl
−4	7.9	"
−7.5 Eutec.	12.7	" + $AlCl_3.C_6H_5COCl$
0	14.1	$AlCl_3.C_6H_5COCl$
20	18.8	"
40	25	"
60	33	"
80	42.2	"
93 m. pt.	48.7	"
80	52.9	"
60	57.2	"
40	61	"

Fusion-point data are given by Kendall, Crittenden and Miller, 1923, for mixtures of $AlCl_3$ and each of the following compounds: AgCl, $BaCl_2$, CuCl, HgCl, $HgCl_2$, KCl, LiCl, $MgCl_2$, $MnCl_2$, NH_4Cl, NaCl, $SbCl_2$, $SnCl_2$, $SnCl_4$ and TlCl.

ALUMINUM Per CHLORATE $Al(ClO_4)_3.9H_2O$

C10

SOLUBILITY OF ALUMINUM PERCHLORATE IN WATER.

(Dobrosedow and Erdmann, 1926.)

t°	Gms. $Al(ClO_4)_3$ per 100 gms. sat. sol.	Solid Phase
0	54.87	$Al(ClO_4)_3.9H_2O$
14.3	56.68	"
91.5	64.62	"

SOLUBILITY OF ALUMINUM PERCHLORATE IN AQUEOUS SOLUTIONS OF AMMONIUM PERCHLORATE AND OF SODIUM PERCHLORATE AT 30° AND VICE VERSA.

(Craven and Bryce, 1934.)

Results for Ammonium Perchlorate

Gms. per 100 gms. H_2O		Solid Phase
NH_4ClO_4	$Al(ClO_4)_3$	
0.0	110.1	$Al(ClO_4)_3$.aq.
0.91	107.7	" + NH_4ClO_4
2.36	55.69	NH_4ClO_4
8.59	26.19	"
13.15	17.47	"
18.66	9.77	"
23.10	5.25	"
25.03	3123	"
28.00	0.00	"

Results for Sodium Perchlorate

Gms. per 100 gms. H_2O		Solid Phase
$NaClO_4$	$Al(ClO_4)_3$	
0.0	110.1	$Al(ClO_4)_3$.aq.
30.02	83.87	"
43.84	76.26	" + $NaClO_4.H_2O$
50.64	72.46	$NaClO_4.H_2O$
100.7	45.59	"
116.6	37.30	"
135.4	27.76	"
215.0	0.0	"

ALUMINUM Hexa Antipyrine Per **CHLORATE** $[Al(COC_{10}H_{12}N_2)_6](ClO_4)_3$.

100 cc. sat. solution in water ($d_{25/4}$ = 1.349?) contain 1.09 gm. $Al(COC_{10}H_{12}N_2)_6(ClO_4)_3$ at 20°. (Wilke-Dörfurt and Schliephake, 1929.)

F

ALUMINUM FLUORIDE AlF_3.

100 cc. sat. solution in water contain 0.559 gm. AlF_3 at 25° and the PH of the solution is 5.2. (Carter, 1928.)

SOLUBILITY OF ALUMINUM FLUORIDE IN AQUEOUS SOLUTIONS OF HYDROFLUORIC ACID AT 25°.

(Tananaev, 1938.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
HF	AlF_3		HF	AlF_3		HF	AlF_3	
0.0	0.55	$AlF_3.H_2O$	27.64	19.68	1.3.6	39.01	16.08	1.3.3
0.77	0.39	"	28.90	14.84	"	41.00	14.03	"
2.00	1.56	"	30.66	12.52	"	42.45	12.96	"
4.96	2.74	"	31.07	13.42	"	46.88	10.43	"
10.44	5.37	"	31.90	13.21	"	51.80	7.15	"
17.77	9.58	"	34.07	13.63	"	54.03	6.18	"
21.08	16.63	"	36.13	13.44	"	57.57	5.04	"
22.94	19.00	"	37.08	14.18	"	60.83	4.00	"
26.30	19.68	1.3.6	37.81	17.07	"	62.73	3.53	"

1.3.6 = $AlF_3.3HF.6H_2O$; 1.3.3 = $AlF_3.3HF.3H_2O$

Fusion-point data have been determined for the following mixtures:

AlF_3 + CaF_2	(Fedotieff and Iljinski, 1923.)
" + CaF_2 + NaF	"
" + CsF	(Pushin and Baskov, 1913.)
" + KF	(" " , Fedotieff and Timofieff, 1932.)
" + LiF	(Fedotieff and Timofieff, 1932.)
" + NaF	(Pushin and Baskov, 1913, Fedotieff and Iljinski, 1923.)

ALUMINUM Ammonium **FLUORIDE** $Al(NH_4)_3F_6$.

100 gms. sat. sol. in water contain 1.03 gm. $Al(NH_4)_3F_6$ at about 20°. (Carter, 1930.)

ALUMINUM Sodium **FLUORIDE** (Cryolite) $AlNa_3F_6$

SOLUBILITY OF ALUMINUM SODIUM FLUORIDE IN AQUEOUS SALT SOLUTIONS AT 25°.

(Frere, 1936.)

Results for:

F

Aluminum Nitrate		Aluminum Chloride		Aluminum Sulfate	
Mols. per 1000 mols. H_2O		Mols. per 1000 mols. H_2O		Mols. per 1000 mols. H_2O	
$2[Al(NO_3)_3]$	$AlNa_3F_6$	Al_2Cl_6	$AlNa_3F_6$	$Al_2(SO_4)_3$	$AlNa_3F_6$
0.0	0.34	0.50	0.66	0.40	0.56
0.49	0.65	1.02	1.14	0.74	0.87
0.96	1.11	3.23	2.94	1.56	1.59
3.05	2.91	5.12	4.12	3.33	2.84
5.09	4.37	7.22	5.39	5.08	4.02
10.03	7.72	9.25	6.57	7.59	5.54
12.12	9.01	12.03	7.92	10.50	7.13
14.37	10.62	15.27	9.53	13.72	8.63
19.76	14.36	20.28	11.41	17.04	10.60

Ferric Nitrate		Ferric Chloride		Ferric Sulfate	
Mols. per 1000 mols. H_2O		Mols. per 1000 mols. H_2O		Mols. per 1000 mols. H_2O	
$2[Fe(NO_3)_3]$	$AlNa_3F_6$	$2(FeCl_3)$	$AlNa_3F_6$	$Fe_2(SO_4)_3$	$AlNa_3F_6$
0.99	0.81	1.00	0.73	1.02	0.58
3.09	1.87	2.94	1.55	3.04	1.13
4.90	2.50	4.90	1.99	5.13	1.57
6.98	3.17	7.44	2.20	7.04	1.81
9.80	3.93	10.19	2.27	9.95	2.23
14.90	5.03	14.94	2.23	14.82	2.88
19.82	6.02	19.70	2.05	19.16	3.22
24.88	6.86	25.28	1.88	24.55	3.70

The solid phase in each case was unchanged cryolite.

ALUMINUM Hexa Antipyrine Boro**FLUORIDE** $[Al(COC_{10}H_{12}N_2)_6](BF_4)_3$

100 gms. sat. aqueous solution contain 1.3 gm $[Al(COC_{10}H_{12}N_2)_6](BF_4)_3$ at 20° (Wilke-Dörfurt and Mureck, 1929.)

ALUMINUM IODIDE AlI_3.

100 gms. Pyridine dissolve 0.82 gms. AlI_3 at 25°. (Müller, R., 1924.)

100 gms. liquid sulfur dioxide dissolve 0.23 gm. AlI_3 at 0°. (Jander and Ruppolt, 1937.)

Fusion-point determinations of mixtures of AlI_3 and each of the following compounds: KI, HgI_2, SbI_3, AsI_4 and I_2 are given by Nijnik, 1937.

ALUMINUM NITRATE $Al(NO_3)_3.9H_2O$

SOLUBILITY OF ALUMINUM NITRATE IN WATER.

(Malquori, 1927(c).)

t°	Gms. $Al(NO_3)_3$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. Al(NO) per 100 gms. sat. sol.	Solid Phase
- 5	12.5	Ice	50	49.0(46.0)	$Al(NO_3)_3.9H_2O$
-10	19.0	"	60	51.5(48.5)	"
-15	23.5	"	70	54.0(52.0)	"
-20	27.0	"	80	57.0(55.0)	"
-25	29.5	"	90tr.pt.	60.5	"$+Al(NO_3)_3.8H_2O$
-27(Eutec.)	30.45	$+Al(NO_3)_3.9H_2O$	95	60.7	$Al(NO_3)_3.8H_2O$
-20	32.5	$Al(NO_3)_3.9H_2O$	100	61.5	"
-10	35.0	"	105	62.0	"
0	37.5	"	107tr.pt.	62.5	"$+Al(NO_3)_3.6H_2O$
+10	40.0(36.0)	"	110	62.3	$Al(NO_3)_3.6H_2O$
20	42.5(38.5)	"	115	62.3	"
25	43.5(39.5)	"	120	62.5	"
30	45.0(40.5)	"	125	63.2	"
40	47.0(43.0)	"	129	63.8	"

The figures in parentheses in the above table, were taken from an average curve drawn through the results of: Inamura, 1919; Milligan, 1922; Tanaka, 1930; Saslawski and Ettinger, 1935, and Saslawsky, Ettinger and Eserowa, 1935.

SOLUBILITY OF ALUMINUM NITRATE IN AQUEOUS SOLUTIONS OF FERRIC NITRATE AND VICE VERSA.

(Malquori, 1927(e), 1929(a).)

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms. sat. sol.		Solid Phase
	$Fe(NO_3)_3$	$(Al(NO_3)_3$			$Fe(NO_3)_3$	$Al(NO_3)_3$	
0	0.0	37.81	$Al(NO_3)_3.9H_2O$	25	30.09	12.15	$Fe(NO_3)_3.9H_2O$
"	7.31	30.25	"	"	36.01	7.12	"
"	17.57	17.22	"	"	42.13	2.97	"
"	23.66	12.33	"	"	44.09	1.15	"
"	25.09	11.02	"$+Fe(NO_3)_3.9H_2O$	"	46.57	0.0	"
"	34.25	2.10	$Fe(NO_3)_3.9H_2O$	40	0.0	46.25	$Al(NO_3)_3.9H_2O$
"	40.15	0.0	"	"	5.22	39.83	"
25	0.0	39.25	$Al(NO_3)_3.9H_2O$	"	15.13	31.22	"
"	8.77	24.28	"	"	23.06	23.30	"
"	10.03	22.85	"	"	32.69	17.12	"$+Fe(NO_3)_3.9H_2O$
"	17.39	19.95	"	"	37.66	12.16	$Fe(NO_3)_3.9H_2O$
"	23.87	16.09	"	"	39.79	8.39	"
"	29.28	15.21	"$+Fe(NO_3)_3.9H_2O$	"	51.18	0.0	"

Data for the system $Al(NO_3)_3 + Fe(NO_3)_3 + KNO_3 + H_2O$ at 25° are given by Malquori, 1927(b).

SOLUBILITY OF ALUMINUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 25°.

(Inamura, 1919.)

An excess of carefully purified $Al_2(NO_3)_6.18H_2O$ was suspended in aqueous nitric acid solutions and rotated in a thermostat for one or two days. The saturated solution and undissolved solid were separated by filtration through asbestos and both analyzed. For the concentrated nitric acid solutions dehydrated aluminium nitrate was used. The results when plotted yield a curve with two branches instead of three as interpreted by the author. The results for regular intervals of concentration of nitric acid are as follows :

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
HNO_3.	$Al_2(NO_3)_6$		HNO_3.	$Al_2(NO_3)_6$	
0.0	39.0	$Al_2(NO_3)_6.18H_2O$	65.1	1.1	$Al_2(NO_3)_6.18H_2O$
10.0	30.5	»	68.5	1.0	»
20.0	22.6	»	72.5	1.2	» + $Al_2(NO_3)_6.16H_2O$
30.0	15.5	»	75.0	0.6	$Al_2(NO_3)_6.16H_2O$
40.0	9.0	»	80.0	0.2	»
50.0	3.9	»	85.0	0.1	»
60.0	1.6	»	90.0	0.35	»

SOLUBILITY OF ALUMINUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT DIFFERENT TEMPERATURES.

(Milligan, 1922)

Rapid stirring of an excess of the crystals with the acid for a first period of 30 minutes followed by a second period of a « few minutes » was employed. The results, when plotted yield curves from which the following figures for regular intervals of concentration of nitric acid were read. The figures in parentheses are the approximate densities of the saturated solutions at 20°.

Gms. HNO_3 per 100 gms sat. sol.	Gms. $Al(NO_3)_3$ per 100 gms. sat. solution at :			
	0°.15.	20°.	40°.	60°.
0	36.0 (1.324)	40.0 (1.383)	44.0 (1.430)	47.5 (1.461)
10	27.0 (1.314)	31.0 (1.368)	36.0 (1.402)	40.5 (1.457)
20	19.5 (1.311)	23.0 (1.354)	29.0 (1.386)	34.5 (1.457)
30	13.5 (1.315)	16.0 (1.345)	21.0 (1.377)	29.0 (1.460)
40	6.0 (1.320)	9.0 (1.340)	15.0 (1.370)	24.0 (1.468)
50	1.5 (1.336)	4.0 (1.345)	9.5 (1.375)	20.0 (1.480)
60	0.2 (1.363)	1.5 (1.364)	5.5 (1.392)	–
70	0.25 (1.432)	0.75 (1.405)	3.0 (1.430)	

SOLUBILITY OF ALUMINUM NITRATE IN AQUOUS SOLUTIONS OF SODIUM NITRATE AND VICE VERSA.

(Saslawsky, Ettinger and Eserowa, 1936; Saslawsky and Ettinger, 1935 1937)

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms. sat. sol.		Solid Phase
	$NaNO_3$	$Al(NO_3)_3$			$NaNO_3$	$Al(NO_3)_3$	
0	0.0	37.56	$Al(NO_3)_3.9H_2O$	20	11.66	32.29	$NaNO_3$
"	3.61	33.11	"	"	22.22	19.15	"
"	9.26	31.51	" + $NaNO_3$	"	29.34	12.47	"
"	9.97	28.23	$NaNO_3$	"	29.65	12.19	"
"	13.47	22.91	"	"	40.27	0.0	"
"	18.06	16.16	"	40	0.0	42.65	$Al(NO_3)_3.9H_2O$
"	27.44	9.67	"	"	10.38	38.71	" + $NaNO_3$
"	42.77	0.0	"	"	51.20	0.0	$NaNO_3$
20	0.0	38.56	$Al(NO_3)_3.9H_2O$	60	0.0	50.95	$Al(NO_3)_3.9H_2O$
"	5.35	37.30	"	"	9.05	44.38	" + $NaNO_3$
"	10.31	35.68	" + $NaNO_3$	"	55.50	0.0	$NaNO_3$

Data for the system $Al(NO_3)_3 + KNO_3 + NaNO_3 + H_2O$ at 0°, 20°, 40° and 60° are given by Saslawski and Ettinger, 1935.

SOLUBILITY OF ALUMINUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID.

(At 0°, 40° and 60° Malquori, 1928c; at 0°* and 20°* Saslawsky, Ettinger and Eserowa.)

t°	Gms. per 100 gms. sat. sol.		Solid Phase
	HNO_3	$Al(NO_3)_3$	
0	0	37.81	$Al(NO_3)_3 \cdot 9H_2O$
"	13.28	21.18	"
"	45.88	2.65	"
"	54.74	0.12	"
"	73.12	0.63	" + $Al(NO_3)_3 \cdot 8H_2O$
* "	73.83	0.19	" "
"	82.31	0.17	$Al(NO_3)_3 6H_2O$ +"
* "	82.61	0.17	" "
*20	81.05	0.30	" "
*20	72.75	0.80	$Al(NO_3)_3 \cdot 6H_2O$+"
40	0.0	46.25	"
"	16.41	28.63	"
"	33.41	14.52	"
"	70.27	2.35	" + $Al(NO_3)_2 \cdot 8H_2O$
"	80.25	0.45	$Al(NO_3)_3 \cdot 6H_2O$ + "
60	0.0	50.95	$Al(NO_3)_3 \cdot 9H_2O$
"	9.76	37.58	"
"	27.45	25.64	"
"	51.22	14.95	"
"	66.12	5.95	" + $Al(NO_3)_3 \cdot 8H_2O$
"	78.62	1.18	$Al(NO_3)_3 \cdot 6H_2O$ + "

NO

Data for the system $Al(NO_3)_3 + HNO_3 + KNO_3 + H_2O$ at 0°, 25°, 40° and 60° are given by Malquori, 1928(c).

Data for the System $Al(NO_3)_3 + HNO_3 + NaNO_3 + H_2O$ at 0° and at 20° are given by Saslowsky, Ettinger & Eserowa, 1937.

SOLUBILITY OF ALUMINUM NITRATE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE AT 25° AND VICE VERSA.

(Malquori, 1927(d)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
KNO_3	$Al(NO_3)_3$		KNO_3	$Al(NO_3)_3$	
0.0	39.25	$Al(NO_3)_3 \cdot 9H_2O$	20.73	25.19	KNO_3
4.83	37.93	"	22.12	20.05	"
9.41	36.15	"	25.91	11.43	"
13.94	35.23	" + KNO_3	26.89	8.75	"
18.97	29.81	KNO_3	27.31	0.0	"

SOLUBILITY OF MIXTURES OF ALUMINUM NITRATE AND POTASSIUM NITRATE IN WATER.

(Saslawsky and Ettinger, 1933)

t°	d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
		KNO_3	$Al(NO_3)_3$	
0	1.406	6.47	36.0	$Al(NO_3)_3 \cdot 9H_2O + KNO_3$
20	1.412	9.80	34.8	" " "
40	—	14.21	36.5	" "
60	—	19.53	38.5	" "

ALUMINUM HYDROXIDE $Al(OH)_3$.

SOLUBILITY IN WATER AT 18°. (Remy and Kuhlmann, 1924; Remy, 1925.)

The determinations were made by (1), the ordinary electrolytic conductivity method taking into consideration the carbonate content of the water and assuming that the aluminium was present as completely dissociated hydroxide and (2) by a conducto-titrometric method.

By method (1) there was found 0.00104 gms. or 0.010 millimols. Al_2O_3 per liter.
» (2) » 0.00094 » 0.009

By an electrometric titration method Busch, 1927, found 0.96 x 10^{-5} gm. mols. = 0.00098 gm. Al_2O_3 per liter of water at 29°.

SOLUBILITY OF MOIST FRESHLY PRECIPITATED ALUMINIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF ALUMINIUM SULPHATE.

(Kremann and Hüttinger, 1908.)

Results at 20°.

Gms. per 100 Gms. H_2O.		Solid Phase.
$Al_2(SO_4)_3$.	$Al(OH)_3$.	
2.37	0.15	$Al_2O_3.SO_3.9H_2O$
5	0.30	"
7	0.65	"
9.1	1.30	Transition Point
10	1.23	$Al_2O_3 2SO_3.12H_2O$
15	1.04	"
20	1.40	"
25	2.40	"
30	3.70	"
31.6	4.20	Transition Point
33	2.75	$Al_2O_3.3SO_3.16H_2O$
34.73	0.92	"

Results at 40°.

Gms. per 100 Gms. H_2O.		Solid Phase.
$Al_2(SO_4)_3$.	$Al(OH)_3$.	
5.22	1.33	$Al_2O_3.SO_3.9H_2O$
...	...*	Transition Point
8.85	1.82	$Al_2O_3.2SO_3 12H_2O$
10	1.65	"
15	1.40	"
20	2.15	"
25	3.80	"
28.5	5.80	Transition Point
30	4.35	$Al_2O_3.3SO_3.16H_2O$
35	1.60	"
49	0.60	"

Results at 60°.†

Gms. per 100 Gms H_2O		Solid Phase.
$Al_2(SO_4)_3$.	$Al(OH)_3$.	
3.24	0.75	$Al_2O_3.SO_3.9H_2O$
8.83	2.53	$Al_2O_3.2SO_3.12H_2O$
12.67	1.85	"
24.07	3.14	"
31.55	4.89	"
42.38	6.02	$Al_2O_3.3SO_3.16H_2O$
49.85	1.42	"

---

* The figures given are not sufficient to determine this transition point accurately.

† The author's figures for 60° are reproduced without change as they are not sufficient to determine transition points.

EQUILIBRIUM IN THE SYSTEM ALUMINIUM OXIDE, BARIUM OXIDE AND WATER AT 20°.

(Malquori, 1926.)

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol		Solid Phase.
BaO.	Al_2O_3.		BaO.	Al_2O_3	
0.0100	0.0020	Al_2O_3 XH_2O	1.873	0.456	$Al_2O_3.BaO.6H_2O$
0.5187	0.0373	»	2.134	0.630	» $+Al_2O_3.2BaO.5H_2O$
0.9016	0.1179	»	2.211	0.641	$Al_2O_3.2BaO.5H_2O$
1.205	0.2105	» $+Al_2O_3.BaO.6H_2O$	3.511	0.671	» $+Ba(OH)_2.8H_2O$
1.330	0.279	$Al_2O_3.BaO.6H_2O$	3.450	0.430	$Ba(OH_2).8H_2O$
1.654	0.345	»	3.390	0.002	»
1.732	0.378	»	3.320	0.001	»

Equilibrium in the system Al_2O_3 + CaO + $CaCl_2$ + H_2O. In connection with studies designed to throw light upon the binding power of Portland cement, Naken and Mosebach, 1936 agitated for long periods of time, mixtures of weighed amounts of 3 $CaO.Al_2O_3$ + $CaCl_2$ and of 3 $CaO.SiO_2$ + $CaCl_2$ with 1000 gram portions of water at 30°. The saturated solutions and residual solid phases were analyzed. These results and microscopic analyses showed that the solid phases tended to approach the composition 3 $CaO.Al_2O_3.CaCl_2.10H_2O$.

SOLUBILITY OF ALUMINUM HYDROXIDE IN AQUEOUS SOLUTIONS OF AMMONIUM HYDROXIDE AT 20°.

(Archibald and Habasian, 1917.)

The freshly prepared $Al(OH)_3$ suspended in aqueous NH_4OH solutions was rotated in sealed tubes at constant temperature untill attainment of equilibrium. The solutions were filtered and 10 cc. portions evaporated and residues weighed in platinum crucibles.

Normality of NH_4OH solution.	Gms. $Al(OH)_3$ dissolved per 100 cc. sat sol.	Normality of NH_4OH solution.	Gms. $Al(OH)_3$ dissolved per 100 cc. sat. sol.
0.05	0.0070	0.200	0.038
0.10	0.0080	0.500	0.045
0.125	0.025	1.000	0.024

SOLUBILITY OF ALUMINUM HYDROXIDE IN AQUEOUS SOLUTIONS OF AMMONIUM HYDROXIDE CONTAINING AMMONIUM NITRATE AND POTASSIUM NITRATE.

(Archibald and Habasian, 1917.)

t.	Normality of NH_4OH.	Wt. % added NH_4NO_3.	Gms. $Al(OH)_3$ per 100 cc. sat. sol.	t°.	Normality of NH_4OH.	Wt. % added KNO_3.	Gms. $Al(OH)_3$ per 100 cc. sat. sol.
20...	1.0	5.0	0.0190	20....	1.0	5.0	0.0760
20...	1.0	10.0	0.0085	20....	1.0	10.0	0.1310
20...	1.0	30.0	0.0036	30....	1.0	5.0	0.1120
20...	0.5	5.0	0.0145	30....	1.0	10.0	0.1320
20...	0.5	10.0	0.0011	20....	0.5	5.0	0.0450
30...	1.0	5.0	0.0143	20....	0.5	10.0	0.0485
30...	1.0	10.0	0.0066	30....	0.5	5.0	0.0713
30...	0.5	5.0	0.0081	20....	0.5	10.0	0.1033
30...	0.5	10.0	0.0010				

OH

SOLUBILITY OF ALUMINUM HYDROXIDE IN AQUEOUS SOLUTIONS OF POTASSIUM HYDROXIDE

(Fricke and Jucaitis, 1930.)

Weighed amounts of specially prepared aluminum hydroxide and measured volumes of potassium hydroxide solution of known concentration were shaken together in Jena flasks at constant temperature for periods up to six weeks. The clear supernatant solutions obtained by sedimentation or filtration through hardened filters were analyzed. The dissolved aluminum hydroxide was precipitated by diluting and passing in carbon oxide, and then weighed. The alkali was titrated. The composition of the solid phase was determined by direct analysis and by the "rest" method of Schreinemakers. The solid phases were also examined microscopically and röntgenographically.

Results at 30°			Results at 60°		
Mixtures shaken 3 weeks			Mixtures shaken one week		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
K_2O	Al_2O_3		K_2O	Al_2O_3	
7.77	0.95	$Al_2(OH)_6$	7.92	1.90	$Al_2(OH)_6$
21.00	2.62	"	21.60	10.24	"
28.80	12.71	"	25.64	15.92	"
29.10	16.70	"	27.81	19.42	"
29.63	16.60	K Aluminate	28.27	21.55	"
37.21	4.08	"	38.33	7.08	K Aluminate

SOLUBILITY OF ALUMINUM HYDROXIDE IN AQUEOUS SODIUM HYDROXIDE SOLUTIONS. (Haber and van Oordt, 1904.)

The mixtures were agitated for 24 hours. So-called acetic acid soluble *tonerde* (E. Merck) was used for the experiments. Temp. 20°-23°.

Normality of Aq. NaOH.	Gms. Al_2O_3 per Liter.
0.49	9.27
0.99	13.90
2.00	14.40

SOLUBILITY OF ALUMINUM HYDROXIDE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE. (Herz, 1911; Slade, 1911 and 1912.)

The experiments show that the ratio of Na to Al in the solution varies considerably depending upon whether the used Al hydroxide was precipitated hot or cold, also upon the length of time it was dried and upon the nature of the drying agent. Herz found a nearly constant ratio of 3 Na to 1 Al in solution. Slade gives ratios of approximately 2.5 . 1 in normal NaOH at 25° for cold precipitated hydroxide dried over H_2SO_4 and 9.0 : 1 for hot precipitated Al hydroxide dried over P_2O_5. Drying in thin layers also increased this ratio but to a somewhat less extent. Slade reports the solubility of $Al(OH)_3$ in a 0.6414 normal NaOH solution to be 1.34 gm. per 100 cc. at room temperature.

SOLUBILITY OF ALUMINUM HYDROXIDE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE
(Fricke and Juctigis, 1930.)

The same procedure was employed as described in the table for the solubility of aluminum hydroxide in aqueous solutions of potassium hydroxide. The authors discuss the results of Gondriaan, 1922, (see under Sodium Aluminates), and point out that his values for preparation β are in fair agreement with the present results, but the much lower figures obtained for preparations and y, as well as the two maximum points in his solubility curve, could not be confirmed.

Results at 30°

Mixtures shaken 6 weeks

Gms. per 100 gms. sat. sol.		Solid Phase
Na_2O	Al_2O_3	
3.95	0.70	$Al_2(OH)_6$
9.68	1.82	"
15.23	4.31	"
17.98	6.63	"
21.10	15.99	"
21.95	25.59	"
24.78	6.45	$Na_2O.Al_2O_3.HO$
26.53	3.50	"
30.95	1.93	"
35.90	1.16	"
38.50	0.44	"

Results at 60°

Mixtures shaken 3 weeks

Gms. per 100 gms. sat. sol.		Solid Phase
Na_2O	Al_2O_3	
3.87	1.41	$Al_2(OH)_6$
16.52	11.00	"
19.94	24.45	"$+Na_2O.Al_2O_3H_2O$
21.21	23.34	$Nu_2O.Al_2O_3.H_2O$
22.35	13.79	"
37.23	1.46	"
39.86	1.53	"
43.91	0.78	"

ALUMINUM OXIDE Al_2O_3

Fusion-point data for mixtures of Aluminum Oxide and a large number of other metal oxides salicates etc., are to be found in the literature, but since they represent special cases of solubility and are determinations made at very elevated temperatures, they have not been included in the present compilation.

ALUMINUM SULFATE $Al_2(SO_4)_3.18H_2O$.

SOLUBILITY IN WATER.

(Poggiale, 1843; Kremann and Hüttinger, 1908.)

t°.	Gms. $Al_2(SO_4)_3$ per 100 Gms Sat. Sol.	Solid Phase.	t°.	Gms. $Al_2(SO_4)_3$ per 100 Gms. Sat. Sol.	Solid Phase.
− 1.02	8.09	Ice	20	26.7	$Al_2(SO_4)_3$ 18H_2O
− 1.43	10.7	"	30	28.8	"
− 2.04	14.3	"	40	31.4	"
− 2.65	17.5	"	50	34.3	"
− 2.85	19.2	"	60	37.2	"
− 4 Eutec.	23.1	Ice + $Al_2(SO_4)_3$ 18H_2O	70	39.8	"
0	23.8	$Al_2(SO_4)_3$.18H_2O	80	42.2	"
+ 7.73	24.8	"	90	44.7	"
10	25.1	"	100	47.1	"

More recent results in accord with the above table are:

SO

t°	Gms. $Al_2(SO_4)_3$ per 100 gms. sat. sol.	Authority
0	23.92	(Ts'ai and Yen, 1936.)
5	24.6	(Mousseron and Gravier, 1932.)
18	26.1	" "
25	27.39	(Hill and Kaplan, 1938.)
42	32.3	(Mousseron and Gravier, 1932.)

The following higher values were obtained by Dobbins and co-workers.

t°	Gms. $Al_2(SO_4)_3$ per 100 gms. sat. sol.	Authority
0	27.02	(Sanders and Dobbins, 1931.)
0	29.97	(Dobbins and Addleston, 1935.)
25	29.29	(Dobbins and Byrd, 1931.)
30	31.99	(Dobbins and Addleston, 1935.)
42	34.24	" "

SOLUBILITY OF ALUMINUM SULFATE IN AQUEOUS SOLUTIONS OF SILVER SULFATE AT 30° AND VICE VERSA. (Caven and Mitchell, 1925 *a*.)

Mols. per 1000 gms H_2O			Mols. per 1000 gms H_2O.		
Ag_2SO_4.	$Al_2(SO_4)_3$.	Solid Phase	Ag_2SO_4.	$Al_2(SO_4)_3$.	Solid Phase.
0.00	1.187	$Al_2(SO_4)_3$ 18H_2O	0.0306	0.03026	Ag_2SO_4
0.0314	1.276	» + Ag_2SO_4	0.0304	0.1449	»
0.0310	0.9210	Ag_2SO_4	0.0292	0.0777	»
0.0308	0.8153	»	0.0285	0.000	»
0.0306	0.5114	»			

A1

Solubility of Aluminum Sulfate in Aqueous Solutions of Copper Sulfate at 25° and at 30° and Vice Versa.

Results at 25°.

(Occlesshaw, 1925.)

Gms. per 100 gms. sat. sol.		
$CuSO_4$.	$Al_2(SO_4)_3$.	Solid Phase.
0.0	27.80	$Al_2(SO_4)_3.18H_2O$
2.50	26.60	»
3.83	25.64	»
5.18	24.86	» + $CuSO_4.5H_2O$
5.32	24.65	$CuSO_4.5H_2O$
6.11	23.18	»
8.18	18.83	»
11.33	13.05	»
14.69	7.50	»
16.59	3.79	»
18.49	0.00	»

Results at 30°

(Caven and Mitchell, 1928.)

Gms. per 100 gms. sat. sol.		
$CuSO_4$.	$Al_2(SO_4)_3$.	Solid Phase.
0.00	28.86	$Al_2(SO_4)_3.18H_2O$
3.39	26.83	»
5.74	25.22	»
6.30	24.64	$CuSO_4.5H_2O$
7.67	22.00	»
9.79	17.65	»
12.13	13.80	»
16.70	5.97	»
18.65	2.75	»
20.33	0.00	»

Solubility of Aluminum Sulfate in Aqueous Solutions of Ferrous Sulfate at 25° and Vice Versa. (Occlesshaw, 1925.)

Gms. per 100 gms. sat. sol.		
$FeSO_4$.	$Al_2(SO_4)_3$.	Solid Phase.
2.11	26.75	$Al_2(SO_4)_3.18H_2O$
3.85	25.64	»
4.13	25.41	» + $Al_2(SO_4)_3.FeSO_4.24H_2O$
4.19	25.21	$Al_2(SO_4)_3.FeSO_4.24H_2O$
5.57	23.90	»
6.60	23.20	»
7.12	22.64	»
8.06	21.62	»
9.36	20.80	$Al_2(SO_4)_3.FeSO_4.24H_2O$
10.17	20.16	» + $FeSO_4.7H_2O$
10.60	19.37	$FeSO_4.7H_2O$
15.05	12.29	»
15.57	11.51	»
18.68	6.98	»
19.14	6.06	»
22.98	0.00	»

Solubility of Aluminum Sulfate in Aqueous Solutions of Ferric Sulfate at 25° and Vice Versa. (Wirth and Bakke, 1914.)

Gms per 100 Gms Sat. Sol		
$Al_2(SO_4)_3$.	$Fe_2(SO_4)_3$	Solid Phase.
27.82	0	$Al_2(SO_4)_3.18H_2O$
26.01	6.064	"
24.21	9.819	"
21.64	13.02	"
15.22	23.28	"
10.46	31.90	" + $Fe_2(SO_4)_3.9H_2O$
10.03	32.42	$Fe_2(SO_4)_3.9H_2O$
8.819	34.02	"
6.626	35.82	"
5.200	38.83	"
2.342	42.44	"
...	44.97	"

Solubility of Aluminum Sulfate in Aqueous Solutions of Sulfuric Acid at 25°. (Wirth, 1912.)

Gms per 100 Gms Sat Sol.		
$Al_2(SO_4)_3$.	H_2SO_4.	Solid Phase.
27.82	0	$Al_2(SO_4)_3.18H_2O$
29.21	5.13	"
26.2	10	"
19.5	20	"
11.6	30	"
4.8	40	$Al_2(SO_4)_3.18H_2O$
1.5	50	"
1	60	"
2.3	70	"
4	75	"

A curve was plotted from the published results and the above figures read from the curve.

ALUMINUM SULFATE $Al_2(SO_4)_3.18H_2O$

SOLUBILITY OF ALUMINUM SULFATE IN AQUEOUS 10 PERCENT SULFURIC ACID.

(Dobbins and Thomas, 1937.)

t°	Gms. $Al_2(SO_4)_3$ per 100 gms. sat. sol.	Solid Phase
30	14.52	$Al_2(SO_4)_3.18H_2O$
42	16.45	$Al_2(SO_4)_3$
50	18.77	"

SOLUBILITY OF ALUMINIUM SULFATE IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE AT 25° AND VICE VERSA. (Britton, 1922.)

The original determinations are given in terms of grams of water required to dissolve 100 grams of solute and percentage of K_2SO_4 in s lute. These values have been recalculated to unit weight of saturated solution with results as follows.

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol		
K_2SO_4.	$Al_2(SO_4)_3$.	Solid Phase.	K_2SO_4.	$Al_2(SO_4)_3$.	Solid Phase.
0.00	27.70	$Al_2(SO_4)_3.18H_2O$	2.05	4.74	$K_2Al_2(SO_4)_4.24H_2O$
0.98	23.02	»	2.27	4.47	»
1.93	30.27	» + $K_2Al_2(SO_4)_4.24H_2O$	2.99	3.58	»
1.94	27.86	$K_2Al_2(SO_4)_4.24H_2O$	3.61	2.99	»
1.46	15.98	»	5.73	2.03	»
1.45	11.28	»	7.25	1.85	»
1.50	10.22	»	10.60	1.45	»
1.72	8.43	»	11.47	1.35	» + K_2SO_4
1.78	7.07	»	10.69	0.76	K_2SO_4
1.87	6.13	»	10.75	0.00	»

SO

SOLUBILITY OF ALUMINUM SULFATE IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE AT 0° AND VICE VERSA.

(Ts'ai and Yen, 1936.)

The original results, expressed in terms of grams of water required to dissolve 100 grams of the two salts, and percentage of K_2SO_4 in the dissolved salts were recalculated, as in the previous table, to grams of salts per 100 grams of saturated solution.

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
K_2SO_4	$Al_2(SO_4)_3$		K_2SO_4	$Al_2(SO_4)_3$	
0.0	23.92	$Al_2(SO_4)_3.18H_2O$	0.721	2.32	$Al_2K_2(SO_4)_4.24H_2O$
0.078	24.07	" + $Al_2K_2(SO_4)_4.24H_2O$	0.945	1.82	"
0.096	22.73	$Al_2K_2(SO_4)_4.24H_2O$	1.313	1.46	"
0.096	21.64	"	1.574	1.28	"
0.107	19.89	"	2.014	1.08	"
0.151	18.10	"	2.545	0.90	"
0.164	16.28	"	3.040	0.75	"
0.180	13.80	"	3.640	0.59	"
0.145	11.31	"	4.178	0.46	"
0.132	8.47	"	4.733	0.34	"
0.158	6.99	"	5.499	0.28	"
0.193	5.40	"	6.372	0.20	"
0.290	4.48	"	6.961	0.14	" + K_2SO_4
0.414	3.66	"	6.936	0.07	K_2SO_4
0.605	2.84	"	6.89	0.0	"

SOLUBILITY OF ALUMINUM POTASSIUM SULFATE (POTASSIUM ALUM) IN WATER.

(Flöttmann, 1928.)

t°	d^{25}_4 of sat. sol.	Gms. $AlK(SO_4)_2$ per 100 gms. sat. sol.	Solid Phase
15	1.0458	4.82	$AlK(SO_4)_2.12H_2O$
20	1.0527	5.68	"
25	1.0605	6.62	"

SOLUBILITY OF MIXTURES OF POTASSIUM ALUM AND ALUMINUM SULFATE AND OF POTASSIUM ALUM AND POTASSIUM SULFATE IN WATER.

(Marino — Gazz chim ital 35, II, 351, '05)

SO

t°.	Gms per 1000 Gms H_2O		Gm Mols per 1000 Mols H_2O.		Solid Phase.
	$Al_2(SO_4)_3.18H_2O$.	K_2SO_4.	$Al_2(SO_4)_3.18H_2O$.	K_2SO_4.	
0	243.73	23.45	6.1	2.3	$K_2Al_2(SO_4)_4.24H_2O + Al_2(SO_4)_3$
20	824.25	30.85	15.1	3.1	"
35	911.02	35.29	24.1	3.6	"
50	1243.21	59.55	33.5	6.1	"
65	1598.00	119.43	43.1	12.6	"
77	1872.11	183.80	50.5	18.9	"
0	5.06	75.83	0.1	7.8	$K_2Al_2(SO_4)_4.24H_2O + K_2SO_4$
0.5	8.66	75.18	0.2	7.7	"
5	16.07	85.78	0.4	8.8	"
10	18.52	96.50	0.5	9.9	"
15	20.56	109.30	0.55	11.2	"
30	39.60	147.8	1.0	15.2	"
40	73.88	163.1	1.9	16.8	"
50	126.0	195.4	3.4	20.1	"
60	249.7	238.8	6.7	24.6	"
70	529.0	323.7	14.2	32.6	"
80	1044.0	517.27	28.1	53.4	"

SOLUBILITY OF MIXTURES OF POTASSIUM ALUM AND OF THALLIUM ALUM IN WATER AT 25°.

(Fock — Z. Kryst. Min. 28, 397, '97.)

$K_2Al_2(SO_4)_4.24H_2O$; $Tl_2Al_2(SO_4)_4.24H_2O$.

Composition of Solution.					Sp. Gr. of Solutions.	Solid Phase Mol % of Potassium Alum.
$KAl(SO_4)_2$ per Liter		$TlAl(SO_4)_2$ per Liter.		Mol % $KAl(SO_4)_2$.		
Grams	Mg Mols.	Grams.	Mg. Mols.			
69.90	270.5	0.00	0.00	100	1.0591	100.0
74.56	288.2	0.48	1.13	99.61	1.0601	99.32
67.90	262.8	1.72	4.07	98.48	1.0598	96.84
65.30	252.7	4.52	10.67	95.95	1.0603	90.84
64.95	251.4	9.60	22.67	91.73	1.0605	82.94
53.23	205.9	18.44	43.56	82.54	1.0609	68.24
45.32	175.4	24.60	58.10	75.12	1.0609	58.23
38.02	147.2	32.48	76.75	65.73	1.0611	46.72
34.54	133.6	35.59	84.10	61.36	1.0611	44.23
28.35	109.7	42.99	101.60	51.93	1.0623	32.07
10.94	42.4	66.12	156.2	21.34	1.0654	7.94
0.00	0.0	75.46	178.3	0.00	1.0674	0.00

Data for the influence of pressure on the solubility of potassium alum in water at 0° are given by Stackelberg, 1896.

SOLUBILITY OF AMMONIUM ALUM AND OF POTASSIUM ALUM IN WATER.

(Mulder; Poggiale — Ann. chim. phys. [3] 8, 467, '43; Locke — Am. Ch. J 26, 174, '01; Marino — Gazz. chim. ital. 35, II, 351, '05; Berkeley — Trans. Roy. Soc. 203 A, 214, '04.)

t°.	Ammonium Alum.			Potassium Alum.		
	Gms. $(NH_4)_2Al_2(SO_4)_4$ per 100 g. H_2O.	Gms. $(NH_4)_2Al_2(SO_4)_4 24H_2O$ per 100 g. H_2O.	G.M. $(NH_4)_2Al_2(SO_4)_4$ per 100 g. H_2O.	Gms. $K_2Al_2(SO_4)_4$ per 100 g. H_2O.	Gms. $K_2Al_2(SO_4)_4 24H_2O$ per 100 g. H_2O.	G.M. $K_2Al_2(SO_4)_4$ per 100 g. H_2O.
0	2.10	3.90	0.0044	3.0	5.65	0.0058
5	3.50	6.91	0.0074	3.5	6.62	0.0068
10	4.99	9.52	0.0105	4.0	7.60	0.0077
15	6.25	12.66	0.0132	5.0	9.59	0.0097
20	7.74	15.13	0.0163	5.9	11.40	0.0114
25	9.19	19.19	0.0194	7.23	14.14	0.0140
30	10.94	22.01	0.0231	8.39	16.58	0.0162
40	14.88	30.92	0.0314	11.70	23.83	0.0227
50	20.10	44.10	0.0424	17.00	36.40	0.0329
60	26.70	66.65	0.0569	24.75	57.35	0.0479
70	...	...	...	40.0	110.5	0.0774
80	...	...	...	71.0	321.3	0.1374
90	...	...	...	109.0	2275.0	0.2110
92.5	...	...	...	119.0	∞.	0.2313
95	109.7	∞	0.2312	...	...	...

SO

NOTE. — The potassium alum figures in the preceding table were taken from a curve plotted from the closely agreeing determinations of Mulder, Locke, Berkeley, and Marino. For the higher temperatures (above 60°), however, the results of Marino are lower than those of the other investigators, and are omitted from the average curve.

Locke called attention in his paper to the fact that Poggiale's results upon ammonium and potassium alum had evidently become interchanged through some mistake. This explanation is entirely substantiated, not only by Locke's determinations, but also by those of Mulder and Berkeley. The ammonium alum figures given above were therefore read from Poggiale's potassium alum curve, with which Locke's determination of the solubility of ammonium alum at 25° is in entire harmony.

SOLUBILITY OF AMMONIUM ALUM IN PRESENCE OF AMMONIUM SULFATE AND IN PRESENCE OF ALUMINIUM SULFATE IN WATER.

(Rüdorff — Ber. 18, 1160, '85)

Mixture Used.	100 Gms. Saturated Solution Contain:	
	Grams $(NH_4)_2SO_4$	+ Grams $Al_2(SO_4)_3$.
Saturated Ammonium Alum at 18.5°	1.42	3.69
20 cc. above sol. + 6 gms. cryst. $Al_2(SO_4)_3$ . . .	0.45	16.09
20 cc. above sol. + 4 gms. cryst. $(NH_4)_2SO_4$. . .	20.81	0.29

EQUILIBRIUM BETWEEN ALUMINUM SULFATE, LITHIUM SULFATE, AND WATER AT 30°. (Schreinemaker and De Waal, 1906.)

Composition in Weight per cent: Of Solution. % Li_2SO_4.	% $Al_2(SO_4)_3$.	Of Residue. % Li_2SO_4.	% $Al_2(SO_4)_3$.	Solid Phase.
25.1	0	...	...	$Li_2SO_4.H_2O$
21.93	5.34	...	...	"
16.10	14.89	63.70	4.02	"
13.63	20.76	14.72	31.17	$Li_2SO_4.H_2O + Al_2(SO_4)_3.18H_2O$
13.24	21.71	61.24	7.22	$Li_2SO_4.4H_2O$
11.73	22.08	6.92	33.54	$Al_2(SO_4)_3.18H_2O$
6.75	24.34	3.77	37.06	"
3.44	26.12	...	...	"
0.0	28.0	...	...	"

SOLUBILITY OF ALUMINUM SULFATE IN AQUEOUS SOLUTIONS OF LITHIUM SULFATE AT 0° AND VICE VERSA.

(Sanders and Dobbins, 1931.)

SO

Gms. per 100 gms. sat. sol. Li_2SO_4	$Al_2(SO_4)_3$	Solid Phase	Gms. per 100 gms. sat. sol. Li_2SO_4	$Al_2(SO_4)_3$	Solid Phase
0.0	27.02	$Al_2(SO_4)_3.18H_2O$	15.90	16.10	$Li_2SO_4.H_2O$
0.99	26.30	"	17.05	13.35	"
4.51	23.30	"	18.52	11.43	"
8.63	20.15	"	19.59	9.09	"
10.10	19.31	"	20.09	7.49	"
10.61	19.31	"	20.67	6.39	"
11.40	18.14	"	21.96	4.73	"
12.80	17.80	"	23.39	2.31	"
14.65	16.60	"	25.43	0.0	"

At other temperatures the composition of the solution simultaneously saturated with both salts is as follows:

t°	Gms. per 100 gms. sat. sol. Li_2SO_4	$Al_2(SO_4)_3$	Solid Phase
25	13.55	19.75	$Al_2(SO_4)_3.18H_2O + Li_2SO_4.H_2O$
50	11.93	24.74	" "

SOLUBILITY OF ALUMINUM SULFATE IN AQUEOUS SOLUTIONS OF MANGANESE SULFATE AT 30° AND VICE VERSA. (Caven and Mitchell, 1925.)

Gms. per 100 gms. sat. sol. $MnSO_4$	$Al_2(SO_4)_3$	Solid Phase	Gms. per 100 gms. sat. sol. $MnSO_4$	$Al_2(SO_4)_3$	Solid Phase.
0.00	28.86	$Al_2(SO_4)_3.18H_2O$	19.91	15.01	$Al_2(SO_4)_3.MnSO_4.22H_2O$
7.41	24.42	»	27.39	10.40	»
11.09	21.93	»	31.43	8.43	»
12.14	21.13	»	32.97	7.21	» + $MnSO_4.5H_2O$
15.23	19.59	» + $Al_2(SO_4)_3.MnSO_4.22H_2O$	37.94	2.47	$MnSO_4.5H_2O$
15.96	18.11	$Al_2(SO_4)_3.MnSO_4.22H_2O$	40.03	0.00	»

SOLUBILITY OF ALUMINUM SULFATE IN AQUEOUS SOLUTIONS OF NICKEL SULFATE AT 30° AND VICE VERSA. (Caven and Mitchell, 1925 *a*.)

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
$NiSO_4$.	$Al_2(SO_4)_3$		$NiSO_4$.	$Al_2(SO_4)_3$.	
0.00	28.86	$Al_2(SO_4)_3.18H_2O$	17.53	15.29	$NiSO_4.7H_2O$
4.74	25.87	»	22.56	8.70	»
10.87	21.95	»	23.58	7.34	»
12.91	21.30	» + $NiSO_4.7H_2O$	26.03	5.29	»
13.29	20.79	$NiSO_4.7H_2O$	30.77	0.00	»

EQUILIBRIUM IN THE SYSTEM ALUMINUM SULFATE, AMMONIUM SULFATE AND WATER AT 25°.

(Hill and Kaplan, 1938.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$(NH_4)_2SO_4$	$Al_2(SO_4)_3$		$(NH_4)_2SO_4$	$Al_2(SO_4)_3$	
0.0	27.39	$Al_2(SO_4)_3.18H_2O$	2.014	3.875	$AlNH_4(SO_4)_2.12H_2O$
0.02	27.29	" + $AlNH_4(SO_4)_2.12H_2O$	8.753	1.190	"
0.125	21.18	$AlNH_4(SO_4)_2.12H_2O$	14.72	0.845	"
0.352	14.81	"	21.13	0.726	"
0.550	14.45	"	32.69	0.463	"
0.973	7.497	"	42.78	0.332	" + $(NH_4)_2SO_4$
1.439	4.630	"	43.32	0.00	$(NH_4)_2SO_4$

The solubility of the ammonium alum at 25°, approaching equilibrium from above and from below, was found to be 6.19 gms. $AlNH_4(SO_4)_2$ per 100 gms. sat. sol.

SO

These authors also give data for equilibrium at 25° in the systems:

(1) $AlNH_4(SO_4)_2 + AlK(SO_4)_2 + H_2O$
(2) $AlNH_4(SO_4)_2 + AlNa(SO_4)_2 + H_2O$
and (3) $AlNH_4(SO_4)_2 + FeNH_4(SO_4)_2 + H_2O$

(1) gives a continuous series of solid solutions, in which the distribution ratio of the two salts between the liquid phase and the solid phase is a constant.

(2) forms no solid solutions at 25°.

(3) forms a continuous series of solid solutions, with the ferric alum present in the aqueous phase in larger ratio throughout.

EQUILIBRIUM IN THE SYSTEM ALUMINUM SULFATE, SODIUM SULFATE AND WATER AT DIFFERENT TEMPERATURES.

(Dobbins and Addleston, 1935; Dobbins and Byrd, 1931.)

Results at 0°

Gms. per 100 gms. sat. sol.		Solid Phase
Na_2SO_4	$Al_2(SO_4)_3$	
0.0	27.97	$Al_2(SO_4)_3.18H_2O$
1.31	26.42	"
2.12	25.55	" + $Na_2SO_4.10H_2O$
2.88	24.33	$Na_2SO_4.10H_2O$
3.85	22.25	"
4.38	14.99	"
5.02	9.33	"
5.80	5.20	"
6.45	0.0	"

Results at 25°

Gms. per 100 gms. sat. sol.		Solid Phase
Na_2SO_4	$Al_2(SO_4)_3$	
0.0	29.29	$Al_2(SO_4)_3.18H_2O$
2.27	27.64	"
3.92	26.68	"
6.29	23.07	$AlNa(SO_4)_2.12H_2O$
10.74	18.66	"
13.70	16.24	"
16.30	14.63	"
18.89	12.80	" + $Na_2SO_4.10H_2O$
19.06	9.18	$Na_2SO_4.10H_2O$
19.85	6.83	
21.55	0.0	

Results at 30°

0.0	31.99	$Al_2(SO_4)_3 \cdot 18H_2O$
1.55	31.21	"
2.30	30.87	" + $AlNa(SO_4)_2 \cdot 12H_2O$
3.18	29.56	$AlNa(SO_4)_2 \cdot 12H_2O$
9.20	22.68	"
15.95	17.73	"
26.67	11.73	" + $Na_2SO_4 \cdot 10H_2O$
27.07	8.77	$Na_2SO_4 \cdot 10H_2O$
27.75	5.14	"
29.61	0.00	"

Results at 42°

0.0	34.24	$Al_2(SO_4)_3 \cdot 18H_2O$
1.89	32.21	" + $AlNa(SO_4)_2 \cdot 12H_2O$
5.49	26.94	$AlNa(SO_4)_2 \cdot 12H_2O$
10.31	21.35	"
18.74	15.19	"
25.70	12.43	" + Na_2SO_4
27.13	10.11	Na_2SO_4
29.10	6.83	"
32.94	0.0	"

The results of the above authors for the solubility of $Al_2(SO_4)_3 \cdot 18H_2O$ in water are higher than reported by other investigators, hence it is possible that the above results are subject to slight revision downward.

Data for the system at 5°, 18° and 42° are given by Mousseron and Gravier, 1932, but their results are expressed in terms which do not permit of recalculation to the weight percentage basis.

Data for the above system at 30°, 42° and 50°, but using as the liquid phase, 10 percent aqueous sulfuric acid instead of water, are given by Dobbins and Thomas, 1937.

SO

ALUMINUM sodium **SULFATE** (Sodium Alum)

SOLUBILITY OF SODIUM ALUM IN WATER.
(Smith, 1909.)

t°.	Gms. $Na_2Al_2(SO_4)_4$ per 100 Gms. Sat. Sol.	Gms. $Na_2Al_2(SO_4)_4$ per 100 Gms. Water.	t°.	Gms. $Na_2Al_2(SO_4)_4 \cdot 24H_2O$ per 100 Gms Sat. Sol.	Gms. $Na_2Al_2(SO_4)_4 \cdot 24H_2O$ per 100 Gms Water.
10	26.9	36.7	10	50.8	103.1
15	27.9	38.7	15	52.7	111.3
20	29	40.9	20	54.8	121.4
25	30.1	43.1	25	56.9	131.8
30	31.4	45.8	30	59.4	146.3

Above 30°, sodium alum is decomposed in contact with its saturated solution. The exact temperature of transition has not been determined.

Single determinations differing from the above are given by Tilden (1884) and by Auge (1890).

More recent determinations by Mousseron and Gravier, 1932, differing from the above, are as follows:

t°	d_{15} of sat. sol.	Gms. $AlNa(SO_4)_2$ per 100 gms. sat. sol.	t°	d_{15} of sat. sol.	Gms. $AlNa(SO_4)_2$ per 100 gms. sat. sol.
0	1.264	27.24 (106.4)	25	1.313	28.96 (121.4)
5	1.279	28.18 (114.2)	30	—	29.45 (126.5)
10	1.295	28.23 (114.8)	35	1.336	30.03 (131.8)
15	1.303	28.28 (115.2)	38	1.351	30.21 (133.7)
20	—	28.43 (116.5)	45	1.317	28.98 (121.7)

The figures in parentheses are **grams** $AlNa(SO_4)_2 \cdot 12H_2O$ per 100 gms. H_2O.

SOLUBILITY OF CAESIUM ALUM, RUBIDIUM ALUM, AND OF THALLIUM ALUM IN WATER.

(Setterburg — Liebig's Annalen, 211, 104, '82; Locke — Am. Ch. J. 26. 183, '01; Berkeley — Trans. Roy. Soc. 203 A, 215, '04.)

t°.	Caesium Alum. Gms. per 100 Gms. H_2O.		Rubidium Alum. Gms. per 100 Gms. H_2O.		Thallium Alum. Gms. per 100 Gms. H_2O.	
	$Al_2Cs_2(SO_4)_4$.	$Al_2Cs_2(SO_4)_4 .24H_2O$.	$Al_2Rb_2(SO_4)_4$.	$Al_2Rb_2(SO_4)_4 .24H_2O$.	$Al_2Tl_2(SO_4)_4$.	$Al_2Tl_2(SO_4)_4 .24H_2O$.
0	0.21	0.34	0.72	1.21	3.15	4.84
5	0.25	0.40	0.86	1.48	3.80	5.86
10	0.30	0.49	1.05	1.81	4.60	7.12
20	0.40	0.65	1.50	2.59	6.40	10.00
25	0.50	0.81	1.80	3.12	7.60	11.95
30	0.60	0.97	2.20	3.82	9.38	14.89
40	0.85	1.38	3.25	5.69	14.40	23.57
50	1.30	2.11	4.80	8.50	22.50	38.41
60	2.00	3.27	7.40	13.36	35.36	65.19
70	3.20	5.27	12.40	23.25	...	...
80	5.40	9.01	21.60	43.25	...	...
90	10.50	18.11	...	...	...	...
100	22.70	42.54	...	...	...	...

NOTE. — Curves were plotted from the closely agreeing determinations recorded by the above named investigators and the table constructed from the curves.

Recent determinations of the solubility of caesium alum in water, by Hart and Huselton (1914), agree well with the data in the above table.

100 gms. glycol dissolve 16.82 gms. $Al_2(SO_4)_3$. (de Coninck, 1905.)

ALUMINIUM SULFIDE Al_2S_3.

Fusion-point data for mixtures of $Al_2S_3 + Ag_2S$ are given by Cambi (1912).

ARSENIC As

Fusion point data are given for the following mixtures:

As + I (Jaeger and Doornbosch, 1912; Quercigh, 1912.)
As + S (Jonker, 1909.)
As + Sb (Mansuri, 1928.)

ARSENIC Tri BROMIDE $AsBr_3$

Fusion point data are given for the following mixtures:

$AsBr_3$	+ $AsCl_3$	(1)	$AsBr_3$	+ Urethan	(4)
"	+ AsI_3	(1)	"	+ Ethyl Urethan	(4)
"	+ Br	(2)	"	+ Anilin hydrochloride	(4)
"	+ $BiBr_3$	(2)	"	+ Phenol	(4)
"	+ PBr_3	(2)(8)	"	+ Resorcinol	(4)
"	+ PBr_5	(2)	"	+ Naphthalene	(5)(7)
"	+ S_2Br_2	(2)	"	+ β Naphthol	(4)
"	+ $SbBr_2$	(2)(3)(4)			
"	+ $SnBr_4$	(2)			

(1) Raeder, 1933; (2) Pusin and Makne, 1938; (3)
(4) Pusin and Löwy, 1926;
(7) Pusin and Kriger, 1914; (8) Jaeger and Doornbosch, 1912.

ARSENIC TriCHLORIDE $AsCl_3$.

When 1.0 gm. of arsenic as the trichloride is dissolved in 100 cc. of aq. HCl and the solution shaken with 100 cc. of ether the following percentages of the metal enter the ethereal layer; with 20% HCl, 68%; 15% HCl, 37%; 10% HCl, 7%; 5% HCl, 0.7% and with 1% HCl, 0.2% of the arsenic. (Mylius, 1911.)

Fusion point data are given for the following mixtures:

Cl

$AsCl_3$ + AsI_3 (Raeder, 1933.)
" + Cl (Biltz and Meineeke, 1923.)
" + Diphenylamine (Pusin and Hrustanovic, 1938.)
" + o Toluidine " "
" + m " " "
" + p " " "
" + 10 10 chlor.9.10.
dihydro phenarsazin (Adamsit) "

ARSENIC TriIODIDE AsI_3.

100 gms. H_2O dissolve about 6 gms. AsI_3 at 25°. (U. S. P.)
100 gms. carbon disulfide dissolved about 5.2 gms. AsI_3. (Squires.)
100 gms. methylene iodide, CH_2I_2, dissolve 17.4 gms. AsI_3 at 12°, *d* of sat solution = 3.449. (Retgers, 1893.)

A very careful study by Madson and Krauskopf, 1931, of the preparation of pure AsI_3, its exact melting point (138.6°), stability and solubility in organic solvents, showed that in each solvent the compound gradually decomposed and saturation could not be obtained even after 4 weeks. In glacial acetic acid at 30° there was found 0.1 gm. AsI_3 per 100 gms. of solution after 24 hours stirring and 0.17 gm. after 115 hours. The rate of solution with time was greater after 115 hours than after 24 hours stirring. An effort was made to find a solvent in which gradual decomposition did not occur but the only difference was a variable rate of decomposition with each solvent.

ARSENIC TriIODIDE

Fusion point data are given for the following mixtures:

AsI_3 + I (Quercigh, 1912.)
" + PI_3 (Jaeger and Doornbosch, 1912.)
" + SbI_3 " "
" + SnI_4 (Vasilev, 1917.)
" + Iodoform (Hertel, 1932.)
" + " + Sulfur (" ")

ARSENIC TRIOXIDE As_2O_3.

SOLUBILITY OF THE:

Crystallized Modification.
In Water.

t°.	Gms. As_2O_3 per 100 cc. Sat. Solution.
2	1.201
15	1.657
25	2.038
39.8	2.930
b. pt.	6. +

(Bruner and St. Tolloczko — Z. anorg. Chem. 37, 456, '03; Chodounsky — Listy. Chem. 13, 114, '88.)

Amorphous Modification.
In Water.

t°.	Gms. As_2O_3 per 100 cc. H_2O.
ord. temp.	3.7
b. pt.	11.86

In Alcohol, Ether and CS_2. at 15°

	G. As_2O_3 per 100 g. Solvent.
Alcohol	0.446
Ether	0.454
CS_2	0.001

(Winkler — J. pr. Chem. [2] 31, 347, '85.)

SOLUBILITY OF ARSENIC TRIOXIDE IN WATER.
(Anderson and Story, 1923.)

The mixtures were constantly agitated in a thermostat, and saturation was approached from above. Periods of 10 days to 2 weeks were required for the attainment of equilibrium. The As_2O_3 was determined by titration with standard iodine solution.

t°.	Gms. As_2O_3 per 100 gms. H_2O.	t°.	Gms. As_2O_3 per 100 gms. H_2O.	t°.	Gms. As_2O_3 per 100 gms. H_2O.	t°.	Gms. As_2O_3 per 100 gms. H_2O.
0.....	1.21	25.....	2,05	48.2...	3.43	75.....	5.62
15.....	1.66	39.8.	2.93	62.... .	4.45	98.5...	8.18

O

100 gms. sat. sol. in water contain 1.99 gm. As_2O_3 at 25°. (Schnellbach and Rosin, 1929.)

100 gms. 95% formic acid dissolve 0.02 gm. As_2O_3 at 19.8°. (Aschan, 1913.)

100 gms. sat. solution in Malonic acid diethylester, $(C_2H_5)_2C.(COOC_2H_5)_2$, contain 0.058 gm. As_2O_3 at 15o and 0.061 gms. at 100 . (Zappi and Manini, 1929.)

100 gms. sat. sol. in glycerol contain 15.9 gms. As_2O_3 at 25°, but saturation attained extremely slow. (Schnellbach and Rosin, 1929.)

Data upon the influence of diols upon the solubility of As_2O_3 in glacial acetic acid are given by Englund, 1930.

SOLUBILITY OF ARSENIC TRIOXIDE IN AQUEOUS SOLUTIONS OF CALCIUM GLUCONATE AT 20° AND VICE VERSA.

(De Carli, 1932.)

Gms. per 100 gms. sat. sol. $(C_5H_6(OH)_5COO)_2Ca$	Gms. per 100 gms. sat. sol. As_2O_3	Solid Phase	Gms. per 100 gms. sat. sol. $(C_5H_6(OH)_5COO)_2Ca$	Gms. per 100 gms. sat. sol. As_2O_3	Solid Phase
0.0	1.78	As_2O_3	7.58	3.45	$(C_6H_{11}O_7)_2Ca$
1.56	2.17	"	6.57	2.56	"
2.35	2.25	"	4.92	1.69	"
3.22	2.55	"	4.21	0.96	"
4.47	3.05	"	3.45	0.13	"
9.29	4.97	"+$(C_6H_{11}O_7)_2Ca$	3.29	0.0	"

SOLUBILITY OF ARSENIC TRIOXIDE IN AQUEOUS SOLUTIONS OF ACIDS.

(Giron and Mangili, 1936.)

t°	Mols. Acid per liter	Gms. As_2O_3 per 100 gms. sat. solution in aq. sol. of: H_3AsO_4	H_3PO_4	H_2SO_4	HCl	$HClO_4$
25	1.0	1.62	1.62	1.55	1.83	1.71
"	5.0	1.10	0.94	0.54	—	0.43
"	7.5	1.23	0.63	0.25	5.02	0.18
60	1.0	3.50	3.50	3.26	3.64	3.47
"	5.0	2.63	2.09	1.19	—	1.0
"	7.5	2.10	1.57	0.78	15.43	0.42
98-99	1.0	8.45	8.46	7.27	—	6.69
"	5.0	5.08	4.51	2.62	—	1.88
"	7.5	4.36	3.02	1.48	25.92	0.84

SOLUBILITY OF ARSENIC TRIOXIDE IN AQUEOUS SOLUTIONS OF ARSENATES AND PHOSPHATES.

(Giron and Monticelli, 1938.)

In aqueous solutions of:

t°	Mono potassium Phosphate Gms. per 100 gms. sat. sol. KH_2PO_4	 As_2O_3	Mono potassium Arsenate Gms. per 100 gms. sat. sol. KH_2AsO_4	 As_2O_3	Mono sodium Phosphate Gms. per 100 gms. sat. sol. NaH_2PO_4	 As_2O_3	Mono sodium Arsenate Gms. per 100 gms. sat. sol. NaH_2AsO_4	 As_2O_3
25	12.706	2.283	17.704	2.339	11.366	2.043	16.175	2.154
25	—	—	—	—	44.635	1.454	56.256	1.548
60	12.600	4.594	17.199	4.727	11.041	4.153	15.961	4.361
60	—	—	—	—	43.795	2.931	55.700	3.027
100	12.583	8.990	16.767	9.360	10.751	8.321	15.602	8.630
100	—	—	—	—	43.451	6.051	—	—

SOLUBILITY OF ARSENIC TRIOXIDE IN WATER AND IN AQUEOUS SOLUTION OF HYDROCHLORIC ACID AT 15° (Interpolated from the original).

(Wood, 1908.)

Mols. HCl per Liter.	Gms. As_2O_3 per 100 cc. Solution.	Mols. HCl per Liter.	Gms. As_2O_3 per 100 cc. Solution.
0	1.495	6	3.8
0.46	1.5	7	7.5
2	1.2	8	12.5
4	1.3	9	17.7

SOLUBILITY OF ARSENIC TRIOXIDE IN AQUEOUS SALT SOLUTIONS.

(Schreinemakers and deBaat, 1917.)

In Aq. Ammonium Bromide at 30°.

Gms. per 100 Gms. Sat. Sol.		Solid Phase.
As_2O_3.	NH_4Br.	
2.26	0	As_2O_3
2.25	0.339	" +$As_2O_3.NH_4Br$
0.679	4.37	$As_2O_3.NH_4Br$
0.518	7.18	"
0.386	13.31	"
0.303	20.14	"
0.237	31.69	"
0.154	41.34	"
0.190	45.06	" +NH_4Br
0	44.8	NH_4Br

In Aq. Sodium Bromide at 30°.

Gms. per 100 Gms. Sat. Sol.		Solid Phase.
As_2O_3.	NH_4Br.	
2.19	5.57	As_2O_3
2.09	10.89	"
1.88	20.79	"
1.63	30.39	"
1.50	35.75	"
1.20	39.24	$(As_2O_3)_2NaBr$
0.953	43.64	"
0.852	45.99	"
0.719	50.25	" +$NaBr.2H_2O$
0	±49.5	$NaBr.2H_2O$

In Aq. Barium Bromide at 30°.

Gms. per 100 Gms. Sat. Sol.		Solid Phase.
As_2O_3.	$BaBr_2$.	
2.09	9.41	As_2O_3
2.03	16.88	"
1.97	24.03	"
1.87	24.41	"
1.58	23.49	$(As_2O_3)_2BaBr_2$
0.757	29.09	"
0.678	33.08	"
0.464	38.19	"
0.322	43.02	"
0.277	50.03	" +$BaBr_2.2H_2O$
0	50.62	$BaBr_2.2H_2O$

In Aq. Barium Chloride at 30°.

Gms. per 100 Gms. Sat. Sol.		Solid Phase.
As_2O_3.	$BaCl_2$.	
2.24	3.84	As_2O_3
2.20	8.72	"
2.19	8.86	"
2.15	10.34	"
1.69	9.55	$(As_2O_3)_2.BaCl_2$
1.12	13.62	"
0.905	16.93	"
0.737	20.06	"
0.608	23.87	"
0.506	26.54	" +$BaCl_2.2H_2O$
0	27.6	$BaCl_2.2H_2O$.

In Aq. Calcium Bromide at 20°.

Gms. per 100 Gms. Sat. Sol.		Solid Phase.
As_2O_3.	$CaBr_2$.	
1.58	9.65	As_2O_3
1.28	20.13	"
0.912	34.90	"
0.789	41	"
0.698	47.67	"
0.513	52.06	"
0.687	58.22	" +$CaBr_2.6H_2O$
0	58.20	$CaBr_2.6H_2O$

In Aq. Calcium Chloride at 19.5°-20°.

Gms. per 100 Gms. Sat. Sol.		Solid Phase.
As_2O_3.	$CaCl_2$.	
1.78	0	As_2O_3
1.39	12.66	"
1.01	23.09	"
0.865	27.68	"
0.757	31.85	"
0.697	36.01	"
0.675	41.92	" +$CaCl_2.6H_2O$
0	42.7	$CaCl_2.6H_2O$

SOLUBILITY OF ARSENIC TRIOXIDE IN AQUEOUS SALT SOLUTIONS. (*Continued.*)

In Aq. Lithium Bromide at 30°.

Gms. per 100 Gms. Sat. Sol.		Solid Phase.
As_2O_3.	LiBr.	
2.26	0	As_2O_3
1.69	11.68	"
1.20	23.23	"
0.734	35.54	"
0.534	37	" $+(As_2O_3)_2.LiBr$
0.332	42.62	$(As_2O_3)_2.LiBr$
0.281	43.87	"
0.198	46.75	"
0	59.62	$LiBr.H_2O$

In Aq. Lithium Chloride at 30°.

Gms. per 100 Gms. Sat. Sol.		Solid Phase.
As_2O_3.	LiCl.	
1.69	7.57	As_2O_3
1.15	15.30	"
0.77	22.67	"
0.54	29.04	"
0.43	35.37	"
0.39	41.13	"
0.385	43.01	"
0.41	45.12	" $+LiCl.H_2O$
0	46.1	$LiCl.H_2O$

In Aq. Potassium Bromide at 30°.

Gms. per 100 Gms. Sat. Sol.		Solid Phase.
As_2O_3.	KBr.	
2.25	0.336	As_2O_3+D
0.818	2.51	*D*
0.460	12.78	"
0.327	22.59	"
0.290	27.40	"
0.275	36.98	"
0.207	39.04	"
0.166	42.07	" $+KBr$
0	±41.3	KBr

D varies from $(As_2O_3)_2KBr$ to $(As_2O_3)_7(KBr)_4$.

In Aq. Potassium Iodide at 30°.

Gms. per 100 Gms. Sat. Sol.		Solid Phase.
As_2O_3.	KI.	
2.26	0	As_2O_3
0.772	1.19	$(As_2O_3)_2.KI$
0.296	9.56	"
0.183	22.89	"
0.150	34.31	"
0.119	40.79	"
0.081	47.07	"
0.115	53.51	"
0.134	60.54	" $+KI$
0	61.5	KI

In Aq. Strontium Bromide at 30°.

Gms. per 100 Gms. Sat. Sol.		Solid Phase.
As_2O_3.	$SrBr_2$.	
1.69	11.69	As_2O_3
1.74	22.09	"
1.48	31.98	"
1.25	41.91	"
1.07	46.87	"
0.991	48.91	" $+SrBr_2.6H_2O$
0	49.11	$SrBr_2.6H_2O$

In Aq. Strontium Chloride at 30°.

Gms. per 100 Gms. Sat. Sol.		Solid Phase.
As_2O_3.	$SrCl_2$.	
2.14	6.27	As_2O_3
1.92	13.67	"
1.67	21.29	"
1.46	27.46	"
1.28	34.03	"
1.23	36.16	" $+SrCl_2\,6H_2O$
0	37.5	$SrCl_2\,6H_2O$

SOLUBILITY OF ARSENIC TRIOXIDE IN AQUEOUS SOLUTIONS OF AMMONIA AT 30° (INTERPOLATED FROM ORIGINAL RESULTS).

(Schiememakers and deBaat, 1915.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.
NH_3.	As_2O_3.	
0	2.3	As_2O_3
1	8.3	"
2	14.9	"
2.8	20.5	$As_2O_3+NH_4AsO_2$
3	13	NH_4AsO_4
3.5	9.1	"
4	7.6	NH_4AsO_4
5	6.2	"
7	4.6	"
10	3.1	"
13	2.4	"
14.3	2.2	"

ARSENIC PENTOXIDE As_2O_5.

SOLUBILITY IN WATER.

(Menzies and Potter, 1912.)

t°.	Gms. As_2O_5 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. As_2O_5 per 100 Gms. Sat. Sol.	Solid Phase.
− 5	10.6	Ice	−10	36.2	$As_2O_5.4H_2O$
−10	15.6	"	0	37.3	"
−20	21.3	"	+10	38.3	"
−30	25.1	"	20	39.7	"
−40	27.8	"	29.5	41.4	"+$3As_2O_5.5H_2O$
−50	29.9	"	40	41.6	$3As_2O_5.5H_2O$
−59 Eutec.	31.7	Ice+$As_2O_5.4H_2O$	60	42.2	"
−50	32.6	$As_2O_5.4H_2O$	80	42.9	"
−40	33.5	"	100	43.4	"
−30	34.4	"	120	43.7	"
−20	35.4	"	140	44.5	"

100 gms. 95% HCOOH dissolve 7.6 gms. As_2O_5 at 19°. (Aschan, 1913.)

EQUILIBRIUM IN THE SYSTEM ARSENIC PENTOXIDE, FERRIC OXIDE AND WATER AT 25°.

O

(Hartshorne, 1927.)

The mixture used for the equilibrium studies was prepared by adding hydrochloric acid to arsenic acid and ferric hydroxide and repeatedly evaporating to dryness to remove the hydrochloric acid. The concentrated mixture had a greenish tint. Portions of it were suitably diluted with water and stirred in the solubility apparatus until attainment of equilibrium. Samples were removed for analysis and either water or syrupy arsenic acid solution added to the residue for obtaining the next equilibrium mixture. Since equilibrium was attained very slowly it is possible that it was not reached in all cases.

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
Fe_2O_3	As_2O_5		Fe_2O_3	As_2O_5	
trace	2.6	1:1:x	0.037	18.82	1:1:x + 1:2:8
"	3.5	"	0.059	21.77	"
"	4.4	"	0.076	23.13	"
"	5.4	"	0.1	8.0	1:2:8
"	5.8	"	"	8.4	"
"	6.4	"	"	12.3	"
0.001	7.96	"	"	13.2	"
0.004	10.11	"	"	14.3	"
0.010	12.49	"	"	14.9	"
0.036	16.19	"	"	15.5	"

1:1:x = $Fe_2O_3.As_2O_5.XH_2O$ - where x is not far removed from 6 - There is also present varying amounts of absorbed arsenic acid - Amorphous.
1:2:8 = $Fe_2O_3.2As_2O_5.8H_2O$, crystalline needles.

ARSENIC ACID $H_3AsO_4 \cdot \frac{1}{2}H_2O$

EQUILIBRIUM IN THE SYSTEM ARSENIC ACID, MANGANOARSENATE AND WATER AT 25°.

(Grube, Heller and Hermann, 1936.)

To arsenic acid solutions of different concentrations purified manganese carbonate was added in slight excess. With active stirring a crystalline solid phase separated after some time. The supernatant solution was analyzed repeatedly until after constant stirring no further change in composition occurred.

Normality of H_3AsO_4 solution used	Gms. per 100 gms. sat. sol.		Solid Phase
	$Mn_3(AsO_4)_2$	H_3AsO_4	
0.99	1.10	2.15	$Mn_3(AsO_4)_2 \cdot H_2O$
1.76	2.26	4.88	"
2.15	3.07	6.00	"
2.70	5.68	10.56	"
3.0	7.32	13.16	"
4.14	5.84	14.07	$MnHAsO_4 \cdot 4H_2O$
5.10	3.60	15.32	"
7.35	6.98	22.27	"
9.25	7.79	30.12	"
10.05	8.14	32.52	"
14.0	10.44	39.36	$MnHAsO_4 \cdot 4H_2O$ $H_4[Mn(AsO_4)_2] \cdot 3H_2O$
14.85	12.16	41.40	"
17.50	11.49	45.41	"
20.05	10.92	48.58	"
25.50	10.11	55.31	"
26.41	8.62	61.16	"
30.00	5.65	71.00	"
32.55	2.58	76.22	$H_4[Mn(AsO_4)_2]$
35.10	0.00	81.02	"

EQUILIBRIUM IN THE SYSTEM ARSENIC ACID, SODIUM ARSENATE AND WATER AT 0°.

(Rosenheim and Thon, 1927.)

Highly purified NaOH and As_2O_5 were used for preparing the solutions. Considerable difficulty was experienced in filtering the syrupy arsenic acid solutions which always contained finely divided, almost colloidal particles in suspension. This was accomplished with the aid of porcelain filter discs and suction.

Up to 40 hours was allowed for securing equilibrium.

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
Na_2O	As_2O_5		Na_2O	As_2O_5	
0.0	66.06	$H_3AsO_4 \cdot \frac{1}{2}H_2O$	9.34	38.01	$NaH_2AsO_4 \cdot H_2O$
2.18	63.17	"	10.25	38.03	"
3.11	60.14	"	10.98	38.33	"
3.31	58.34	"	12.95	39.34	"
3.77	57.26	"	13.15	39.03	" $+Na_2HAsO_4 \cdot 12H_2O$
3.72	56.19	"	13.04	35.89	$Na_2HAsO_4 \cdot 12H_2O$
5.36	54.15	$NaH_2AsO_4 \cdot H_2O$	10.35	30.87	"
7.01	52.14	"	6.29	19.15	"
7.91	47.11	"	4.18	11.92	"
8.51	44.48	"	2.62	5.80	"
9.01	40.28	"	1.82	3.37	"

Results are also given for the solubility of $NaH_2AsO_4 \cdot H_2O$ and $Na_2HAsO_4 \cdot 12H_2O$ in water at temperatures up to 34°.

ARSENIC ACID $H_3AsO_4.{}^1/_2H_2O$

Solubility in Aqueous Solutions of Salts at 22°.

(Dhar. 1926.)

An excess of Arsenic acid was shaken with the aqueous solutions for 30 hrs.

Aqueous solution of :	Gm. equiv. of salt per liter.	Excess* of Arsenic acid in gm. équiv. per liter.	Dissociation constant.
Sodium Benzoate C_6H_4COONa......	0.0283	0.0017	$0.6.10^{-6}$
» » »	0.0565	0.0038	$0.3.10^{-6}$
» » »	0.1130	0.0062	$0.7.10^{-6}$
Sodium Acetate CH_3COONa.........	0.0475	0.0050	$0.5.10^{-6}$
» » »	0.0950	0,0073	$0.1.10^{-6}$
» » »	0.1900	0.0015	$0.3.10^{-6}$
Sodium Butyrate C_3H_7COONa......	0.0375	0.0009	$0.3.10^{-6}$
» » »	0.0750	0.0030	$0.1.10^{-6}$
» » »	0.1500	0.0102	$0.3.10^{-6}$

* This probably refers to the excess of arsenic acid above that dissolved by water alone. Although the author mentions that determinations of the solubility in water were made, the results are not given.

MetaARSENIC ACID $HAsO_3$

Distribution at 25° between:

(Auerbach, 1903)

H_2O and Amyl Alcohol.

Gms AsO_3H per 1000 cc. Aq. Layer.	Gms AsO_3H per 1000 cc. Alcoholic Layer.
4.82	0.90
9.63	1.75
18.44	3.50

Sat. Aq. H_3BO_3 Solution and Amyl Alcohol.

O

Gms. AsO_3H per 1000 cc. Aq. Layer.	Gms. AsO_3H per 1000 cc. Alcoholic Layer.
9.28	1.75
18.74	3.47

ARSENIOUS ACID H_3AsO_3.

Solubility of Arsenious Acid in Aqueous Solutions of Potassium Fluoride at 30°.

(Bhagwat and Dhar, 1929.)

Mols. KF per liter	0.0	0.08215	0.1643	0.3287
Mols. " "	0.0284	0.2936	0.3026	0.3096

Solubility of Arsenious Acid in Glycerol at 20°.

(Holm, 1921, 1922.)

Solvent.	Gms. Arsenious acid per 100 gms. Glycerol. Sat. approached from below.	Gms. Arsenious acid per 100 gms. Glycerol. Sat. approached from above.
Glycerol of $d = 1.2326$..............	19.5	25.7
» » $d = 1.2645$..............	35.4	43.5

Although 20 weeks were allowed for the attainment of equilibrium, agreement between the results obtained by approaching saturation from below and from above was not reached.

ARSENIC TriSULFIDE As_2S_3

S

1000cc. water dissolve 0.0008 gm. As_2S_3 at 0°. (Holtje, 1929.)
" " " 0.00052 gm. " " 18°. (Weigel, 1907.)

Fusion point data are given for mixtures of:

$As_2S_3 + Ag_2S$ (Jaeger and Van Klooster, 1912.)
$As_2S_3 + Tl_2S$ (Cauneri-Fernandez, 1925.)
$AsS(C_6H_5)_3 +$ Triphenyl phosphine oxide (Pascal, 1923.)
" + " " sulfide " "
$AsO(C_6H_5)_3 +$ " " " " "
" + " " oxide " "

ARSENIC Penta **SULFIDE** As_2S_5

1000cc. water dissolve 0.00136 gm. As_2S_5 at 0°. (Höltje, 1929.) This author also gives results for the solubility of As_2S_3 and Ag_2S_5 in water containing H_2S.

Au **GOLD** Au

SOLUBILITY OF GOLD IN MERCURY.

(Sunier and Gramke, 1929; Sunier and White, 1930; Sunier, A.A. and Weiner, 1931; Andersor, 1932; Mees, 1936.)

For determinations up to 300° the pyrex glass container for the Hg-Au mixtures consisted of two chambers separated by a capillary and glass wool filter. The mixture after saturation in one of these chambers could be filtered into the other without removing the apparatus from the constant temperature bath. The apparatus was charged with the Hg-Au mixtures of such composition that an insoluble residue of only about 0.5 gm. of Au would remain. It was evacuated, sealed and gently rocked in the water bath for determinations at the lower temperatures, in an oil bath for the intermediate temperatures and in an air bath for the higher temperatures. Equilibrium was approached from above and from below and a period of three hours rocking at the chosen temperature of the determination was allowed. The saturated solution was analyzed by evaporating the Hg from a weighed sample in a current of H (later, air was used at 200°) and then heating the residue of Au to 500-550° for 12-16 hours.

For the determinations between 280° and 400° the synthetic method was used. Since it was necessary to ascertain the temperature at which the last trace of Au just disappeared, there was used a pyrex glass tube provided with two chambers connected at their opposite ends respectively by a capillary tube and a wider tube. When this was properly turned the saturated solution flowed through the capillary and left behind the undissolved Au which could then be seen and the point determined at which the last particle just disappeared.

The results of Parravano, 1918 and of Britton and McBain, 1926, which are respectively about 75% and 5% higher than the present results, are discussed. The determinations of Braley and Schneider, 1921 differ so widely from the others that it seems probable that these authors made some serious error. The much older results of Kasaneff are remarkable for their probable accuracy.

t°	Gm. Atoms Au per 100 gm. atoms Au + Hg	t°	Gm. Atoms Au per 100 gm. atoms Au + Hg	t°	Gm. Atoms Au per 100 gm. atoms Au + Hg	t°	Gm. Atoms Au per 100 gm. atoms Au + Hg
0	0.0813	80	0.459	220	3.65	307tr.pt.	18.5
10	0.1038	100	0.684	230	4.17	310	23.0
20	0.1306	120	0.996	240	4.80	320	27.0
30	0.1629	140	1.385	250	5.58	330	29.6
40	0.2014	160	1.871	260	6.55	340	32.0
50	0.2489	180	2.380	270	7.83	350	34.0
60	0.3076	190	2.68	280	9.50	360	35.8
70	0.3767	200	2.92	290	11.80	370	37.5
80	0.4614	210	3.24	300	15.42	380	39.0
						388	40.0

Analyses of the solid phase in contact with the solutions above the tr. pt. at 307° indicated that it contained approximately 78 atom percent Au.

GOLD Au.

SOLUBILITY OF GOLD IN POTASSIUM CYANIDE SOLUTIONS. (Maclaurin, 1893.)

Gold disks were placed in Nessler tubes with aqueous KCN solutions.

Per cent KCN.	Gms. Au Dissolved in 24 Hours in Nessler Tubes: Full.	½ Full.	Oxygen. Passed in.	Oxygen + Agitation.
0.1	0.00195	0.00331	...	...
1	0.00162	0.00418	0.00845	0.0187
5	0.0032	0.0046	0.01355	0.0472
20	0.0012	0.00305	0.0115	0.0314
50	0.00043	0.00026	0.00505	0.0108

The following data for more dilute KCN solutions are given by Christy (1901). Gold strips 2 × ¼ inch were rotated for 24 hrs. in aq. KCN solutions and the loss in weight determined.

Per cent KCN.	Mgs. Au Dissolved	Per cent KCN.	Mgs. Au Dissolved.	Per cent KCN.	Mgs. Au Dissolved.
0	0.010	0.002	0.44	0.016	74.96
0.0005	0.043–0.07	0.00325	1.77	0.0325	150.54
0.001	0.10–0.23	0.004	4.29	0.065	168.12
0.0016	0.16	0.008	48.43		

Data are also given for 48 hour periods and for solutions containing O_2.

One liter of conc. HNO_3 dissolved 0.66 gm. Au on boiling for two hours. (Dewey, '10)

Data for the rate and limit of solubility of Au in conc. HCl solutions of iron alum and of cupric chloride are given by McCaughey, 1909.

SOLUBILITY OF GOLD IN AQUEOUS SOLUTIONS OF POTASSIUM CYANIDE.

(White, 1919.)

Rectangular pieces of gold, $1^1/_2$ × 1 cm., were suspended by cotton thread in jars containing 500 cc. of solution. The milligrams of gold dissolved per sq. cm. in 24 hours or less was determined by loss in weight. Air was bubbled through the solutions in some cases. It was concluded that the speed of the reaction depends entirely upon the rate of diffusion of the cyanide and the necessary oxygen, of which in practise the latter is the more important. The final effect of the reaction is represented by the well known equation $2\,Au + 4\,KCN + O + H_2O = 2\,K\,Au.(CN)_2 + 2\,KOH$. Therefore, 0.010 gm. of oxygen per liter is equivalent to 0.0163 per cent of KCN, 0.007 gm. is equivalent to 0.0114 per cent KCN and 0.006 gm. per liter, to 0.0098 per cent KCN. With water having an average content of 0.006 gm. oxygen per liter the concentration of KCN should not exceed 0.01 per cent.

SOLUBILITY OF GOLD AMALGAM IN AQUEOUS SOLUTIONS OF POTASSIUM CYANIDE.

(White, 1923.)

Comparative experiments with two pieces of pure gold, one of which was coated with a very small amount of mercury, suspended in a cyanide solution containing 0.027 per cent KCN and 0.006 per cent Na OH and saturated with oxygen, showed that 1.3 mg. Au per sq. cm. of the pure gold was dissolved in 24 hours at 28°, but that only 0.5 mg. Au per sq. cm. of the amalgam coated gold was dissolved under the same conditions.

Data for the distribution of gold between bismuth and zinc, bismuth and aluminium, lead and zinc, lead and aluminium, and zinc and tellurium, are given by Tammann and Schaftmeister, 1924.

Solubility of Potassium Cyanide in Aqueous Solutions of Gold (Aurous) Cyanide at 25° and Vice Versa.

(Bassett and Corbet, 1924.)

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
K CN.	Au CN.		K CN.	Au CN.	
41.7	0.00	KCN	9.66	2.97	$KAu(CN)_2$
42.02	trace	»	7.02	8.34	»
41.98	0.17	» + $KAu(CN)_2$	5.19	11.02	»
38.98	0.35	$KAu(CN)_2$	4.78	15.47	» + AuCN
24.04	0.76	»	2.60	7.27	AuCN
23.79	0.27	»	2.32	7.32	»
13.70	2.55	»	2.37	6.12	»

Cl **GOLD CHLORIDE** (Auric) $AuCl_3$.

100 gms. H_2O dissolve 68 gms. $AuCl_3$.

When 1 gm. of gold as chloride is dissolved in aq. HCl of different strengths and the solutions shaken with 100 cc. portions of ether, the following percentages of the gold enter the ethereal layer. With 20% HCl, 95%; 10% HCl, 98%; 5% HCl, 98%; 1% HCl, 84% and 0.18% HCl, 40.3% of the gold.

Distribution results, indicating considerable variation in the constitution of the dissolved substance in the two layers, are also given. (Mylius, 1911.)

GOLD PHOSPHORUS TRI CHLORIDE (Aurous) $AuClPCl_3$.

100 gms. PCl_3 dissolve 1 gram at 15°, and about 12.5 grams at 120°.
(Lindet — Compt. rend. 101, 1492, '85)

GOLD ALKALI DOUBLE CHLORIDES.

Solubility of Sodium Gold Chloride, Lithium Gold Chloride, Potassium Gold Chloride, Rubidium Gold Chloride, and Caesium Gold Chloride in Water.

(Rosenbladt — Ber. 19, 2537, '86)

t°.	Grams Anhydrous Salt per 100 Grams Solution.				
	$NaAuCl_4$.	$LiAuCl_4$.	$KAuCl_4$.	$RbAuCl_4$.	$CsAuCl_4$.
10	58.2	53.1	27.7	4.6	0.5
20	60.2	57.7	38.2	9.0	0.8
30	64.0	62.5	48.7	13.4	1.7
40	69.4	67.3	59.2	17.7	3.2
50	77.5	72.0	70.0	22.2	5.4
60	90.0	76.4	80.2	26.6	8.2
70	...	81.0	...	31.0	12.0
80	..	85.7	...	35.3	16.3
90	...	...	...	39.7	21.7
100	...	...	...	44.2	27.5

100 gms. glycerol (d_{15} = 1.256) dissolve 0.21 gm. $AuK(CN)_2.5H_2O$ at 15–16°.
(Ossendowski, 1907)

OH **GOLD HYDROXIDE** (Auric) $Au(OH)_3$.

The solubility of auric hydroxide in water, as calculated from satisfactorily agreeing values for the solubility product, assuming complete dissociation, is 2.4×10^{-12} mols. Au $(OH)_3$ per liter. (Jirsa and Jendek, 1924.)

THE SOLUBILITY OF GOLD HYDROXIDE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE AT 25°.

(Johnston and Leland, 1928.)

Gm. Mols. per 1000 gms. H_2O		Solid Phase	Gm. Mols. per 1000 gms. H_2O		Solid Phase
NaOH	Au x 10^{-4}		NaOH	Au x 10^{-4}	
0.0	0.031	$Au(OH)_3$	0.522	7.26	Na_2HAuO_3
0.0752	0.87	"	0.667	4.69	"
0.1005	1.00	"	0.748	3.50	"
0.1507	2.00	"	0.840	2.62	"
0.1998	2.91	"	1.049	1.50	"
0.2097	5.64	"	1.682	1.70	"
0.3900	9.73	"	3.095	2.35	"
0.4138	10.54	"	3.983	2.69	"
0.4215	9.79	Na_2HAuO_3	6.05	3.84	"
0.4941	7.73	"	8.37	5.23	"

OH

The authors also give results for the solubility of gold hydroxide in aqueous 0.2 normal sodium hydroxide containing increasing amounts of potassium sulfate.

SOLUBILITY OF AURIC HYDROXIDE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 11°.

(Jirsa and Buryanek, 1923; Jirsa and Jelinek, 1924.)

Gold hydroxide, Au $(OH)_3$, prepared by anodic oxidation of gold was agitated in a thermostat at 11° with aqueous H_2SO_4 solutions for different lengths of time. The curves show an increase with time. The freshly made hydroxide dissolves more rapidly than older hydroxide. It is not certain that equilibrium was reached. In the later experiments an attempt was made to approach equilibrium from above, that is, to go from concentrated solutions, by hydrolysis, to dilute solutions. It appears that a tendency exists to form super saturated solutions in the beginning, but in about 48 hours a concentration is reached which agrees fairly well with that found previously by constant agitation for 60 days. The results for diluted 35 normal H_2SO_4 solutions rotated 60 days with the original solid phase and with new, were:

NO

Normality of H_2SO_4.	11.72.	12.60.	19.33.
Gms. Au per 100 cc. solution....	0.0922	0.1324	1.4128

GOLD Ammonium **NITRATE** $Au(NH_3)_4(NO_3)_3$.

Solvent.	t°.	Gms. $Au(NH_3)_4(NO_3)_3$ per 100 gms. sat. sol.	Authority.
Water...............	25	2.88	(Weitz, 1914.)
Aq. 0.1 *n* KNO_3......	»	2.156	»

BORON Tri CHLORIDE BCl_3

FUSION POINTS OF MIXTURES OF BORON TRICHLORIDE AND CHLORINE AND OF BORON TRICHLORIDE AND HYDROCHLORIC ACID.

(Graff, 1933; Hackspill, 1933.)

Results for BCl_3 + Cl

t°	Gms. BCl_3 per 100 gms. of mixture
-103.0	0.0
-135.4 (Eutec)	65.5
-108.7	100.0

Results for BCl_3 + HCl

t°	Gms. BCl_3 per 100 gms. of mixture
-115.0	0.0
-134.0 (Eutec)	44.0
-108.7	100.0

BORON TRI-FLUORIDE BF_3.

1 cc. H_2O absorbs 1.057 cc. BF_3 at 0° and 762 mm.; 1 cc. conc. H_2SO_4 (Sp. Gr. 1.85) absorbs 50 cc. BF_3.

F

The freezing-point curve of the system boron trifluoride-hydrogen sulfide was found by Germann and Booth, 1926, to contain two eutectics, a maximum corresponding to $BF_3.H_2S$ with f. pt. — 137° and a transition point of a compound $BF_3.7H_2S$ at — 99°. « Judging from the flatness of the curve at the maximum, the compound $BF_3.H_2S$ is considerably dissociated, so that there should be little difficulty separating H_2S as an impurity from BF_3 by fractional distillation ».

BORON OXIDE, BORIC ANHYDRIDE B_2O_3

EQUILIBRIUM IN THE SYSTEM BORON OXIDE, POTASSIUM OXIDE DETERMINED BY THERMIC ANALYSIS.

(Rollet, 1935.)

Considerable difficulty was experience on account of the slowness of crystallization and tendency of the mixtures to form glass.

O

t°	Gms. K_2O per 100 gms. mixture	Solid Phase	t°	Gms. K_2O per 100 gms. mixture	Solid Phase
950(f.pt.)	57.5	$B_2O_3.K_2O$	825(tr.pt.)	33.5	$3B_2O_3.K_2O+4B_2O_3.K_2O$
787(Eutec.)	45.3	" + $2B_2O_3.K_2O$	857(f.pt.)	25.2	$4B_2O_3.K_2O$
815(f.pt.)	40.3	$2B_2O_3.K_2O$	780(tr.pt.)	21.3	" + $5B_2O_3.K_2O$
770(eutec.)	37.5	" + $3B_2O_3.K_2O$	780(f.pt.)	20.8	$5B_2O_3.K_2O$
decomposes before melting		$3B_2O_3.K_2O$			

Fusion point data are given for:

B_2O_3 + BaO	(Guertler, 1904.)	B_2O_3 + $NaBO_2$	(?) Ponomarev, 1917.)
B_2O_3 + CaO	" "	B_2O_3 + CdO	(Mazzetti and DeCarli, 1926.)
B_2O_3 + SrO	" "	B_2O_3 + PbO	" "
B_2O_3 + K_2O + KCl	(Stalhane, 1930.)	B_2O_3 + MnO	" "
B_2O_3 + K_2O + KBr	" "	B_2O_3 + Li_2O	" "

BORON OXIDE HYDRATE, BORIC ACID $B(OH)_3$

SOLUBILITY OF BORIC ACID IN WATER.

(Nasini and Ageno, 1909.)

OH

t°.	Gms. H_3BO_3 per 100 Gms. Sat. Sol.	t°.	Gms. H_3BO_3 per 100 Gms. Sat. Sol.	t°.	Gms. H_3BO_3 per 100 Gms. Sat. Sol.
−0.76 Eutec	2.46	30	6.30	80	19.11
0	2.6	40	8.02	90	23.30
+10	3.6	50	10.35	100	28.7
20	4.8	60	12.90	110	38.7
25	5.5	70	15.70	120	52.4

The results of Herz and Knoch (1904), and one determination by Auerbach (1903), given in terms of gms. per 100 cc. sat. solution, appear to be in good agreement with the above. The earlier data of Ditte (1877) are low.

More recent determinations by Kendall and Andrews, 1921; Linderstrom and Lang, 1924; Kolthoff, 1926; Menzel, 1927; Levi and Gilbert, 1927; (Sborgi and Amelotti, 1930; and Sborgi, 1932, are in satisfactory agreement with the above results. The determinations of Burgess and Hunter, 1929, are not in good agreement. The above results of Nasini and Ageno, at temperatures above 100° are considered to be too high by v. Stackelberg, Quantram and Dressel 1937. These authors and McCulloch, 1937, give the following results for equilibrium in the system $B_2O_3+H_2O$ at higher temperatures.

t°	Gms. B_2O_3 per 100 gms. sat. sol.	Solid Phase
103.2 (b.pt.sat.sol.)	17.5	H_3BO_3
170.0 (m.pt.)	56. *	"
168 (tr.pt.)	61. *	" + HBO_2
203 (m.pt.)	80. *	HBO_2
215-220	80.1	B_2O_3 (cryst.)
245-250	82.8	"
310-315	85.0	"
460-470 (m.pt.)	96.6	"

Estimated from the authors' diagram.

OH

McCulloch obtained crystalline B_2O_3 by fusing boric acid under atmospheric pressure at 225-250°. The liquid thus obtained becomes cloudy after several days and finally thickens, becomes pasty and at last reaches a state of stone like hardness. Its density is 2.42 instead of only 1.84 which is the density of boric oxide glass. The solubility determinations at temperatures above 215° were made by heating 25 gm. portions of crystalline B_2O_3 with small amounts of H_3BO_3 in sealed pyrex tubes at the given temperatures, until equilibrium was reached, draining the liquid from the solid by tilting the tube, solidifying the liquid by rapid cooling, and analyzing the solid thus obtained.

EQUILIBRIUM IN THE SYSTEM BORIC ACID, CALCIUM GLUCONATE AND WATER AT 20°.

(DeCarli, 1931.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$(C_6H_{11}O_7)_2Ca$	B_2O_3		$(C_6H_{11}O_7)_2Ca$	B_2O_3	
3.57	3.15	$B_2O_3.3H_2O$	33.85	3.03	$(C_6H_{11}O_7)_2Ca$
12.50	3.95	"	32.44	2.67	"
21.18	4.91	"	30.60	2.53	"
30.02	5.73	"	27.40	2.23	"
37.60	6.89	"	24.90	1.94	"
52.97	8.28	"	18.12	1.29	"
57.44	8.80	"	14.08	0.95	"
39.04	3.67	$(C_6H_{11}O_7)_2Ca$	11.10	0.78	"
36.04	3.13		7.51	0.49	"

SOLUBILITY OF BORIC ACID IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AND OF ALKALI CHLORIDES AT 25°. (Herz, 1910.)

(The original results are given in millimols per 10 cc. They have been calculated to gram quantities, plotted on cross-section paper and the following values read from the curves.)

Gms. HCl or Alkali Chloride per 100 cc. Sat. Sol.	Gms. H_3BO_3 Dissolved per 100 cc. Sat Sol. in Aq.:				
	HCl.	LiCl.	NaCl.	RbCl.	KCl.
0	5.59	5.59	5.59	5.59	5.59
2	4.92	5.20	5.40	5.60	5.67
4	4.36	4.85	5.30	5.62	5.75
6	3.88	4.45	5.20	5.67	5.85
8	3.50	4.07	5.15	5.72	5.90
10	3.15	3.75	5.10	5.77	6
15	...	3	5.07	5.90	6.25
20	...	...	...	6.10	6.50
30	...	...	...	6.55	...

BORIC ACID H_3BO_3.

SOLUBILITY IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 25°.

(Kendall and Andrews, 1921.)

Normality of aq. HCl.	Gms. mols. H_3BO_3 per liter sat. sol.	Normality of aq. HCl.	Gms. mols. H_3BO_3 per liter sat. sol.	Normality of aq. HCl.	Gms. mols. H_3BO_3 per liter sat. sol.
0.0	0.8950	1.147	0.7042	5.160	0.3715
0.0660	0.8810	1.802	0.6270	7.073	0.3446
0.1302	0.8580	2.617	0.5431	9.380	0.3501
0.2733	0.8380	3.126	0.4976	11.56	0.3687
0.6112	0.7761	4.336	0.4189		

SOLUBILITY OF BORIC ACID IN AQUEOUS SOLUTIONS OF HYDROCHLORIC, SULPHURIC, AND NITRIC ACIDS AT 26°.

(Herz — Z. anorg. Chem. 33, 355, 34, 205, '03.)

Normality of the H_2SO_4, HCl or HNO_3.	Normality of Dissolved $B(OH)_3$.	Gms. Strong Acid per 100 cc. Solution.	Gms. $B(OH)_3$ per 100 cc. Solution.		
			In HCl.	In H_2SO_4.	In HNO_3.
0	0.91	0	5.64	5.64	5.64
0.5	0.78	5	4.0	4.25	4.50
1.0	0.71	10	3.2	3.6	3.9
2.0	0.58	15	2.45	3.0	3.35
3.0	0.49	20	1.8	2.5	2.9
4.0	0.41	25	...	2.0	2.55
5.0	0.35	30	...	1.55	2.1
6.0	0.26	35	...	...	1.75

The determinations given in the original tables in terms of normal solutions when plotted together lay close to an average curve drawn through them. The figures in the tables here shown were read (and calculated) from the average curve.

SOLUBILITY OF BORIC ACID IN AQUEOUS SOLUTIONS OF ELECTROLYTES AT 25°.

(Bogdan — Ann. Scient. Univ. Jassy, 2, 47, '02–'03.)

Gms. Electrolyte per 100 Gms. H_2O.	Grams H_3BO_3 per 100 Gms. H_2O in Aq. Solutions of:					
	NaCl.	KCl.	$NaNO_3$.	KNO_3.	Na_2SO_4.	K_2SO_4.
0	5.75	5.75	5.75	5.75	5.75	5.75
10	5.75	5.80	5.78	5.81	5.88	5.92
20	5.74	5.86	5.81	5.88	6.00	6.10
40	5.72	5.98	5.87	6.04	6.33	6.50
60	5.72	6.12	5.95	6.20	6.70	6.92
80	5.71	6.29	6.02	6.37	7.10	7.40

SOLUBILITY OF BORIC ACID IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 25°.

(Kendall and Andrews, 1921.)

Normality of aq. HNO_3	Gm. mols H_3BO_3 per liter sat sol	Normality of aq. HNO_3	Gm. mols. H_3BO_3 per liter sat sol.	Normality of aq HNO_3	Gm. mols. H_3BO_3 per liter sat sol.
0.0779	0.8820	1.580	0.6685	4.698	0.4471
0.1951	0.8610	2.372	0.5943	8.410	0.2963
0.5337	0.8028	3.118	0.5444	10 95	0.2305
0.9890	0.7361	3.806	0.4977	15.18	0.1973

EQUILIBRIUM IN THE SYSTEM BORIC ACID, CHROMIUM TRIOXIDE AND WATER.

(Gilbert, 1925.)

Results at 25°.			Results at 45°.		
	Gms per 100 gms. sat. sol			Gms. per 100 gms. sat. sol.	
$d_{\frac{25}{4}}$ of sat. sol.	CrO_3	B_2O_3	$d_{\frac{45}{4}}$ of sat. sol.	CrO_3.	B_2O_3.
1.052	4.90	2.79	1.038	2.40	4.76
1.086	9.42	2.28	1.219	25.60	2.33
1.156	18 07	1.58	1.528	53.80	1.85
1.212	24.31	1.35	1.603	57.34	1.12
1.296	33.05	1.02	1.603	57.50	0.87
1.420	43.75	0.65	1.612	58.10	0.92
1.699	59.90	0.16	1.674	61.56	0.90
1.699	62.40	0.10			

SOLUBILITY OF BORIC ACID IN AQUEOUS SOLUTIONS OF VARIOUS SALTS AT 18°.

(Kolthoff, 1926.)

Composition of aqueous solvent.	Gm. mols. H_3BO_3 per liter	Composition of aqueous solvent.	Gm. mols. H_3BO_3 per liter.
Water	0.736	1.0 Molar Na acetate	1.09
1.3 Molar LiCl	0.56	0.5 » Na benzoate	0.96
0.5 » HCl	0.655	0.05 » K Na tartrate	0.835
1.0 » »	0.595	0.25 » »	1.23
1.0 » NaCl	0.724	0.50 » »	1.69
1.0 » KCl	0.790	0.25 » Na oxalate	0.92
0.5 » $CaCl_2$	0.628	0.1 » Na lactate	0.84
1.0 » KNO_3	0.817	0.5 » »	1.31
1.0 » KSCN	0.778	1.0 » »	1.92
1.0 » KBr	0.768	0.1 » Na citrate	0.93
1.0 » KI	0.745	0.25 » »	1.17
0.5 » Na_2SO_4	0.880	0.50 » »	1.52
0.33 » K ferricyanide	0.760	0.20 » Na salicylate	0.985
0.25 » K ferrocyanide	0.850	0.50 » »	1.350

SOLUBILITY OF BORIC ACID IN AQUEOUS SOLUTIONS OF VARIOUS SALTS AT 22°.

(Dhar, 1926.)

An excess of boric acid was shaken with the aqueous salt solutions. The flasks stood in a thermostat at 22°. It is not clear whether constant or intermittent shaking was employed. The results are given in terms of excess of boric acid dissolved in the salt solution, but the figure for the amount dissolved in water alone is not given.

Used salt solution	Gm equiv. of salt per liter.	Excess H_3BO_3 dissolved, expressed in gm. equiv. per liter	Dissociation constant.
Sodium benzoate C_6H_5COONa	0.0283	0.0020	0.3×10^{-5}
» »	0.0565	0.0032	0.3×10^{-5}
» »	0.1130	0.0052	0.2×10^{-5}
Sodium salicylate $C_6H_4.OH.COONa$ (o)	0.0544	0.0005	1.1×10^{-4}
» »	0.1087	0.0007	1.0×10^{-4}
» »	0.2173	0.0013	0.6×10^{-4}
Sodium acetate CH_3COONa	0.0475	0.0025	0.4×10^{-5}
» »	0.0950	0.0035	0.4×10^{-5}
» »	0.1900	0.0015	0.6×10^{-6}
Sodium butyrate C_3H_7COONa	0.0375	0.0018	0.4×10^{-5}
» »	0.0750	0.0040	0.2×10^{-5}
» »	0.1500	0.0102	0.7×10^{-6}

Solubility of Boric Acid in Aqueous Solutions of Salts at Several Temperatures. (Linderstrom-Lang, 1924.)

Composition of aq. solvent.		Gm. mols. H_3BO_3 dissolved per liter at		
Salt used.	Gm. equiv. per liter.	12°.	17°.85.	23°.85.
None..	$=H_2O$	0.6061	0.7219	0.8633
LiCl...	0.669	0.5276	0.6379	0.7622
» ...	1.338	0.4663	0.5642	0.6714
» ...	2.676	0.3683	0.4492	0.5396
» ...	4.113	0.2927	0.3126	0.4380
NaCl..	0 4	0.6033	–	0.8514
» ..	0.8	0.6000	0.7116	0.8426
» ..	1.6	0.5953	0.7008	0.8223
» ..	2.4	–	0.6889	–
» ..	3.2	0.5794	0.6769	0.7944
KCl...	0.7	0.6403	0.7558	0.8960
» ...	1.4	0.6714	0.7884	0.9306
» ...	2.1	0.7028	0.8199	0.9609
» ...	2.8	0.7379	0.8538	0.9959
HCl ..	0.6	–	0.6435	–
» ...	1.2	–	0.5778	–
» ...	1.5	–	0.5463	–
$BaCl_2$..	0.8	–	0.6769	–
» ..	1.2	–	0.6594	–
» ..	1.6	–	0.6451	–

Composition of aq. solvent.		Gms. mols. H_3BO_3 dissolved per liter at 17°.85.
Salt used.	Gm. equiv. per liter.	
KI	0.6	0.7219
»	1.2	0.7239
»	1.8	0.7223
»	2.4	0.7175
$MgCl_2$.	0.495	0.6562
» .	0.989	0.5973
» .	1.979	0.4997
» .	3.958	0.3500
$CaCl_2$..	0 598	0.6530
» ..	1.195	0.5937
» ..	2.390	0.4890
» ..	4.780	0.3417
RbCl..	0.0	0.7313 (at 18°)
» ..	0.6	0.7689 »
» ..	1.2	0.8083 »
» ..	2.4	0.8880 »
CsCl..	0.732	0.7725 »
» ..	1.455	0.8203 »
» ..	2.177	0.8713 »

OH

Solubility of Boric Acid in Aqueous Solutions of:

(Bhagwat and Dhar, 1929.)

Chromic Acid at 30°

Gm. Mols. per liter	
CrO_3	$B(OH)_3$
0.009457	1.035
0.01017	1.035
0.04728	1.133
0.0947	1.213
0.1017	1.238

Potassium Fluoride at 30°

Gm. Mols. per liter	
KF	$B(OH)_3$
0.0	1.029
0.08217	1.205
0.1643	1.330
0.3287	1.566

Solubility of Boric Acid in Aqueous Solutions Hydrogen Peroxide at 18°.

(Menzel, 1927.)

Gm. Mols. per liter	
H_2O_2	$B(OH)_3$
0.0	0.741
0.057	0.734
0.115	0.730
0.178	0.728
0.273	0.724

Gm. Mols. per liter	
H_2O_2	$B(OH)_3$
0.583	0.717
0.815	0.709
1.35	0.703
1.80	0.693
2.33	0.684

A warm solution containing sufficient $B(OH)_3$ to yield a solid phase when cooled to 18° was stirred several hours after the addition of strong H_2O_2. After attainment of equilibrium 2.0cc. portions of the supernatant solution were withdrawn for analysis. A further amount of H_2O_2 was added and the operation repeated. Very great accuracy is not claimed for the results.

SIMULTANEOUS SOLUBILITY OF BORIC ACID AND SALTS OF POTASSIUM AND SODIUM IN WATER AT SEVERAL TEMPERATURES.

(Teeple, 1929.)

t°	Per 100 Gms. H_2O		Solid Phase
35	8.2 gms. H_3BO_4	+ 36.8 gms. NaCl	H_3BO_3 + NaCl
"	13.1 " "	+ 53.0 " Na_2SO_4	" + Na_2SO_4
"	9.6 " "	+ 11.9 " " +33.2 gms. NaCl	" + Na_2SO_4 + NaCl
75	22.2 " "	+ 38.5 " NaCl	" + NaCl
"	31.4 " "	+ 51.7 " Na_2SO_4	" + Na_2SO_4
"	25.0 " "	+ 12.4 " " +35.5 gms. NaCl	" + " + NaCl
35	11.6 " "	+ 41.0 " KCl "	" + KCl
"	12.5 " "	+ 21.2 " K_2SO_4	" + K_2SO_4
"	12.1 " "	+ 2.8 " " +39.9 gms. KCl	" + " + KCl
"	7.1 " "	+ 2.4 " $K_2B_{10}O_{16}$	" + KB_8
"	11.0 " "	+ 0.3 " " + 40.7 gms. KCl	" + KB_8 + KCl
"	18.4 " "	+ 8.4 " $Na_2B_4O_7$	" + NaB_{10}
"	9.4 " "	+ 1.2 " " + 36.3 gms. NaCl	" + " + NaCl
20.5	7.6 " "	+ 25.3 " Na_2SO_4	" + Na_{10}
"	9.8 " "	+ 25.8 " " + 1.9 gm. $Na_2B_4O_7$	" + " + NaB_{10}
23.5	8.9 " "	+ 31.2 " "	" + "
"	12.6 " "	+ 6.2 " $Na_2B_4O_7$	" + NaB_{10}
"	10.9 " "	+ 1.9 " " + 31.3 gms. Na_2SO_4	" + " + Na_{10}
28.5	10.6 " "	+ 47.3 " Na_2SO_4	" + Na_{10}
"	14.9 " "	+ 7.0 " $Na_2B_4O_7$	" + NaB_{10}
"	12.1 " "	+ 1.7 " " + 47.8 gms. Na_2SO_4	" + " + Na_{10}
35	14.9 " "	+ 2.3 " " + 52.1 gms. Na_2SO_4	" + " + Na_2SO_4

$KB_8 = K_2B_{10}O_{16}\cdot 8H_2O$; $NaB_{10} = Na_2B_{10}O_{16}\cdot 10H_2O$; $Na_{10} = Na_2SO_4\cdot 10H_2O$

OH

SOLUBILITY OF BORIC ACID IN AQUEOUS SOLUTIONS OF PHOSPHORIC ACID AT 25°.

(Levi and Gilbert, 1927.)

$d\frac{25}{4}$ of sat. sol.	Gms. per 100 gms. sat. sol. P_2O_5	Gms. per 100 gms. sat. sol. B_2O_3	Solid Phase	$d\frac{25}{4}$ of sat. sol.	Gms. per 100 gms. sat. sol. P_2O_5	Gms. per 100 gms. sat. sol. B_2O_3	Solid Phase
1.042	3.63	2.55	H_3BO_3	1.504 (tr.pt.)	48.05	1.27	H_3BO_3+BPO_4
1.048	4.34	2.53	"	1.516	48.51	1.20	BPO_4
1.190	21.51	1.12	"	—	48.89	1.11	"
1.215	23.66	1.05	"	—	51.52	0.23	"
1.281	31.01	0.62	"	—	53.37	trace	"
1.391	40.39	0.45	"	1.645	58.68	"	"
1.434	43.70	0.68	"	1.722	63.43	"	"

The method of Kolthoff, 1922 for the very difficult determination of mixtures of boric and phosphoric acids was not found to give sufficiently accurate results. Although the use of sodium citrate and Kolthoff's PH value for the total acid end point was retained, a new procedure was adapted for the titration of the boric acid.

SOLUBILITY OF BORIC ACID IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25° AND AT 45°.

(Levi and Gilbert, 1927.)

The solubility determinations were complicated by the ease with which highly supersaturated solutions were obtained, even at room temperature, in the high concentrations of sulfuric acid. In some cases the solutions stood for several weeks before any solid phase began to separate. The saturated solutions were analyzed by titrating with sodium hydroxide in the presence of p nitrophenol as indicator, and, after appearance of first yellow color, corresponding to the H_2SO_4, a solution of mannite and a few drops of phenolphthaleine were added and titration continued for boric acid.

The authors consider that the lower results of Herz, 1903, for this system are due to his use of a less accurate method.

OH

Results at 25°

$d\frac{25}{4}$ of sat. sol.	Gms. per 100 gms. sat. sol. SO_3	Gms. per 100 gms. sat. sol. B_2O_3	Solid Phase
1.017	0.00	3.08	H_3BO_3
1.039	2.90	2.79	"
1.088	9.12	2.18	"
1.160	17.56	1.54	"
1.284	30.62	0.97	"
1.412	41.78	0.71	"
1.479	46.80	0.65	"
1.625	55.84	2.69	"
—	54.66	6.09	"
1.668	53.50	8.12	"
—	55.74	7.70	$B_2O_3.SO_3.4H_2O$
1.617	54.73	10.32	"
—	51.87	15.45	"
—	47.27	20.93	"
—	51.87	21.85	$3B_2O_3.SO_3.3H_2O$
—	57.32	18.34	"
—	63.36	15.23	"
1.882	73.66	10.39	"
—	87.72	4.82	"

Results at 45°

$d\frac{45}{4}$ of sat. sol.	Gms. per 100 gms. sat. sol. SO_3	Gms. per 100 gms. sat. sol. B_2O_3	Solid Phase
1.023	0.0	5.17	H_3BO_3
1.029	0.47	5.07	"
1.036	1.93	4.83	"
1.086	8.58	3.74	"
1.097	10.18	3.51	"
1.231	25.48	1.89	"
1.446	44.87	0.13	"
1.628	52.25	7.07	"
1.671	54.13	8.33	$B_2O_3.SO_3.4H_2O$
1.685	56.65	6.14	"
—	60.89	4.89	"
—	62.66	6.85	"
1.800	57.22	13.56	"
—	59.87	23.60	$3B_2O_3.SO_3.3H_2O$
—	57.70	19.25	"
—	60.43	17.99	"

SOLUBILITY OF BORIC ACID IN AQUEOUS SATURATED SOLUTIONS OF MONO POTASSIUM AND MONO SODIUM PHOSPHATES AND VICE VERSA.

(Levi and Aguzzi, 1938.)

Results for H_3BO_3 + KH_2PO_4

t°	Gms. per 100 gms. sat. sol. H_3BO_3	Gms. per 100 gms. sat. sol. KH_2PO_4	Solid Phase
0	2.6	0.0	H_3BO_3
29.9	6.4	0.0	"
47.5	11.0	0.0	"
0	3.5	16.5	" + KH_2PO_4
29.9	8.9	33.7	" "
47.5	26.2	53.4	" "
0	0.0	14.3	KH_2PO_4
29.9	0.0	28.6	"
47.5	0.0	40.8	"
47.5	13.4	29.2(KCl)	H_3BO_3 + KCl

Results for H_3BO_3 + NaH_2PO_4

Gms. per 100 gms. sat. sol. H_3BO_3	Gms. per 100 gms. sat. sol. NaH_2PO_4	Solid Phase
2.6	0.0	H_3BO_3
6.4	0.0	"
11.0	0.0	"
4.4	58.1	" + NaH_2PO_4
11.2	108.3	" "
37.2	187.6	" "
0.0	57.7	NaH_2PO_4
0.0	106.0	"
0.0	158.3	"

SOLUBILITY OF BORIC ACID IN AQUEOUS SATURATED SOLUTIONS OF MONO POTASSIUM AND MONO SODIUM ARSENATES AND VICE VERSA.

(Levi and Agussi, 1938.)

Results for H_3BO_3 + KH_2AsO_4

t°	Gms. per 100 gms. sat. sol. H_3BO_3	Gms. per 100 gms. sat. sol. KH_2AsO_4	Solid Phase
0	2.6	0.0	H_3BO_3
25	5.4	0.0	"
50	11.5	0.0	"
0	3.3	25.3	" + KH_2AsO_4
25	8.3	39.1	" "
50	27.5	65.6	" "
0	0	23.9	KH_2AsO_4
25	0	35.0	"
50	0	53.2	"

Results for H_3BO_3 + NaH_2AsO_4

t°	Gms. per 100 gms. sat. sol. H_3BO_3	Gms. per 100 gms. sat. sol. NaH_2AsO_4	Solid Phase
0	2.6	0.0	H_3BO_3
25	5.4	0.0	"
50	11.5	0.0	"
0	4.4	119.3	" + NaH_2AsO_4
25	11.2	250.0	" "
50	>45.0	>320.0	" "
0	0	117.4	NaH_2AsO_4
25	0	222.4	"
50	0	284.1	"

100 gms. Liquid Ammonia (NH_3) dissolve 1.92 gm. H_3BO_3 at 25°. (Hunt and Boncyk, 1933.)

SOLUBILITY OF BORIC ACID IN AQUEOUS SOLUTIONS OF UREA, ACETONE, AND OF PROPYL ALCOHOL AT 25° (Bogdan.)

Grams of $CO(NH_2)_2$, $(CH_3)_2CO$ or of C_3H_7OH per 100 Gms. H_2O.	Gms. H_3BO_3 per 100 g. H_2O in Aq. Solutions of: $CO(NH_2)_2$	$(CH_3)_2CO$.	C_3H_7OH.
0	5·75	5·75	5·75
10	5·84	5·84	5·80
20	5·93	5·93	5·85
40	6.13	6.12	5·94
60	6.31	6.29	6.03

EQUILIBRIUM IN THE SYSTEM BORIC ACID, CIS TETRAHYDRONAPHTHALENE 1.2 DIOL. AND WATER AT 25°. (Hermans, 1925.)

Gms. per 100 gms sat. sol. HBO_2.	Diol.	Solid Phase.
3.94	1.85	Boric acid
3.92	2.08	»
3.90	2.14	» + Diol
3.29	2.10	Diol
1.55	1.99	»

Data for the system boric acid, phenol and water are given by Timmermans (1907).

SOLUBILITY OF BORIC ACID IN AQUEOUS SOLUTIONS OF SEVERAL ALCOHOLS AT 25°.

(Mueller and Abegg, 1906.)

In Aq. Methyl Alcohol.

Solvent.		Gms. H_3BO_3 per 100 cc. Sat. Sol.
$d_{\frac{25}{4}}$.	Wt. % CH_3OH.	
0.9691	19	5.55
0.9340	41.5	6.27
0.9185	50	6.81
0.9019	58	7.20
0.8842	66	8.10
0.7960	100	17.99*

* $d_{\frac{25}{4}}$ = 0.8904.

In Aq. Ethyl Alcohol.

Solvent.		Gms. H_3BO_3 per 100 cc. Sat. Sol.
$d_{\frac{25}{4}}$.	Wt. % C_2H_5OH.	
0.9714	20.2	5.14
0.9350	42.3	4.96
0.8789	67.3	4.52
0.8576	76.2	4.34
0.8198	91.1	5.54
0.8089	95	6.85
0.7947	100	9.47†

In Aq. Propyl Alcohol.

Solvent.		$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. H_3BO_3 per 100 cc. Sat. Sol.
$d_{\frac{25}{4}}$.	Wt. % C_3H_7OH.		
0.9043	50.83	0.9193	3.99
0.8231	79.41	0.8570	2.83
0.8133	95.5	0.8466	3.58
0.8010	100	0.8297	5.96

† $d_{\frac{25}{4}}$ = 0.8553.

In Aq. *i* Butyl Alcohol

Solvent		$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. H_3BO_3 per 100 cc Sat. Sol.
$d_{\frac{25}{4}}$.	Mol % C_4H_9OH		
0.9923	0.70	1.0124	5.48
0.9853	2.15	1.0038	5.32
0.9855	2.18	1.0046	5.32
0.8173	71.4	0.8351	2
0.8133	77.1	0.8220	2.15
0.8081	85.6	0.8195	2.61
0.7984	100	0.8172	4.30

* = H_2O sat. with amyl alcohol.

In Aq. *i* Amyl Alcohol.

Solvent		$d_{\frac{25}{4}}$ of Sat. Sol.	Gms H_3BO_3 per 100 cc Sat. Sol.
$d_{\frac{25}{4}}$.	Mol. % $C_5H_{11}OH$.		
0.9943	0.448	1.0132	5.48
0.9936	0.520	1.0125	5.46
0.9931	0.525*	1.0123	5.46
0.8232	67.26†	0.8290	1.60
0.8183	75.54	0.8253	1.69
0.8142	83.40	0.8223	1.98
0.8068	100	0.8220	3.54

† = Amyl alcohol sat. with H_2O.

One liter H_2O saturated with amyl alcohol dissolves 55.5 gms. H_3BO_3 at 15°.

(Auerbach, 1903.)

SOLUBILITY OF BORIC ACID IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 15° AND AT 25°.

(Seidell, 1908.)

Results at 15°.

d_{15} of Sat. Sol.	Gms. C_2H_5OH per 100 Gms. Solvent.	Gms. H_3BO_3 per 100 Gms. Sat. Sol.
1.014	0	4.11
0.9986	8.9	3.90
0.9658	32	3.58
0.9268	51	3.48
0.8820	70.2	3.22
0.8389	91.3	5.06
0.8370	93.6	5.70
0.8356	99.8	9.18

Results at 25°.

d_{25} of Sat. Sol.	Gms C_2H_5OH per 100 Gms Solvent.	Gms per 100 Gms Sat. Sol.	
		H_3BO_3.	C_2H_5OH.
1.018	0	5.42	0
0.987	20	5.20	18.96
0.952	40	5.10	37.96
0.908	60	5	57
0.862	80	5.05	75.96
0.853	85	5.30	80.50
0.842	90	6.20	84.4
0.838	95	8	87.4
0.838	100	11.20	88.8

SOLUBILITY OF BORIC ACID IN AQUEOUS SOLUTIONS OF LACTIC ACID, OXALIC ACID, *d* and *i* TARTARIC ACIDS AT 25°.

In Aq. Lactic Acid.

(Mueller and Abegg, 1906.)

Solvent.		$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. H_3BO_3 per 100 cc. Sat. Sol.
$d_{\frac{25}{4}}$	Mol. % $C_3H_6O_3$.		
1.0252	2.321	1.0444	6.64
1.0722	6.819	1.0986	9.98
1.1405	18.77	1.1635	11.53
1.2023	36.33	1.2254	12.90

In Aq. Oxalic Acid.

(Herz, 1910.)

Gms per 100 cc. Sat. Sol.		Solid Phase.
$H_2C_2O_4$.	H_3BO_3.	
2.26	6.17	H_3BO_3
5.36	6.70	"
12.39	7.44	" + $H_2C_2O_4$
11.27	3.45	$H_2C_2O_4$
10.84	0.97	"
10.77	0.55	"
10.63	0	"

In Aq. *d* and *i* Tartaric Acid.

(Herz, 1911.)

Gms per 100 cc Sat. Sol.		
$C_4H_6O_6$.		H_3BO_3.
0		5.59
11.25	*d* Acid	6.20
22.5	"	6.63
45	"	7.48
9.45	*i* Acid	6.11
18.90	"	6.48
37	"	7.23

THE SYSTEM BORIC ACID, ACETIC ACID AND WATER AT 30°. (Dukelski, 1909.)

(The sat. solutions and residues were analyzed by titrating total acidity with 0.1 *n* NaOH and the acetic acid alone by an iodometric method.)

Gms. per 100 Gms. Sat. Sol. B_2O_3.	Gms. per 100 Gms. Sat. Sol. $(CH_3CO)_2O$.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. B_2O_3.	Gms. per 100 Gms. Sat. Sol. $(CH_3CO)_2O$.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. B_2O_3.	Gms. per 100 Gms. Sat. Sol. $(CH_3CO)_2O$.	Solid Phase.
3.55	...	$B(OH)_3$	1.01	73.96	$B(OH)_3$	4.98	82.13	$B_2O_3.2(CH_3CO)_2O$
3.18	7.78	"	0.54	80.67	"	5.13	84.60	"
2.98	16.44	"	0.45	84.55	"+(?)	5.41	85.68	"
2.34	28.96	"	0.39	84.65	"	4.82	88.74	$B_2O_3.3(CH_3CO)_2O$
1.98	41.06	"	0.41	84.48	"	4.71	89.98	"
1.47	52.63	"	0.46	84.44	"	4.06	92.68	"
1.12	67.76	"	0.50	84.51	"	3.10	95.76	"

SOLUBILITY OF BORIC ACID IN AQUEOUS SOLUTIONS OF:

Acetic Acid at 26°. (Herz, 1903*a*.)

Normality of Solutions. CH_3COOH.	Normality of Solutions. $B(OH)_3$.	Gms. per 100 cc. Solution. CH_3COOH.	Gms. per 100 cc. Solution. $B(OH)_3$.
0	0.91	0	5.64
1	0.82	5	4.7
2	0.65	10	4.2
4	0.42	20	3.0
6	0.25	30	2.0

Acetone at 20°. (Herz and Knoch, 1904.)

cc. Acetone per 100 cc. Solvent.	$B(OH)_3$ per 100 cc. Solution. Millimols.	$B(OH)_3$ per 100 cc. Solution. Grams.
0	79.15	4.91
20	81.71	5.07
30	83.35	5.17
40	82.72	5.13
50	81.62	5.06
60	76.40	4.74
70	67.62	4.19
80	55.05	3.41
100	8.06	0.50

OH

SOLUBILITY OF BORIC ACID IN:

Pure Glycerol (Sp.Gr. = 1.260 at 15.5°).

(Hooper — Pharm. J. Trans. [3] 13, 258, '82.)

t°.	Gms. $B_2O_3 \cdot 3H_2O$ per 100 cc. Glycerine	Gms. $B(OH)_3$ per 100 Gms. Glycerine.	Gms. $B(OH)_3$ per 100 Gms. Solution.
0	20	15.87	13.17
10	24	19.04	16.00
20	28	22.22	18.21
30	33	26.19	20.75
40	38	30.16	23.17
50	44	34.92	25.95
60	50	39.68	28.41
70	56	44.65	30.72
80	61	48.41	32.61
90	67	53.18	34.70
100	72	57.14	36.36

Aq. Solutions of Glycerol at 25°.

(Herz and Knoch — Z. anorg. Chem. 45, 268, '05.)

Wt. % Glycerine in Solvent.	Millimols $B(OH)_3$ per 100 cc. Sol.	Sp. Gr. at $\frac{25°}{4°}$.	Gms. $B(OH)_3$ per 100 cc. Solution.	Gms. $B(OH)_3$ per 100 Gms. Solution.
0	90.1	1.017	5.59	5.50
7.15	90.1	1.038	5.59	5.38
20.44	90.6	1.063	5.62	5.28
31.55	92.9	1.090	5.76	5.29
40.95	97.0	1.113	6.02	5.41
48.7	103.0	1.133	6.39	5.64
69.2	140.2	1.187	8.69	7.32
100.0	390.3	1.272	24.20	19.02

IN AQUEOUS SOLUTIONS OF GLYCEROL AT 25°.

(Mueller and Abegg, 1906.)

Solvent. $d_{\frac{25}{4}}$.	Solvent. Mol. % $C_3H_8O_3$.	Solvent. Wt. % $C_3H_8O_3$.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. H_3BO_3 per 100 cc. Sat. Sol.
1.1574	24.64	60.	1.1707	7.49
...	46.75	...	1.2260	13.22
1.2370	67.71	90	1.2526	18.35
1.2531	90 58	96.6	1.2710	23.44

AQUEOUS SOLUTIONS OF DULCITE AT 25°.

(Mueller and Abegg, 1906.)

Solvent. $d_{\frac{25}{4}}$.	Solvent. Mol. % $C_6H_8(OH)_6$.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. H_3BO_3 per 100 cc. Sat. Sol.
0.9995	0.065	1.0686	5.50
1.0018	0.130	1.0212	5.63
1.0060	0.260	1.0260	5.81

100 gms. glycerol (d_{15} = 1.256) dissolve 11 gms. H_3BO_3 at 15°-16°. (Ossendowski, 1907.)

100 gms. Glycerol of $d = 1.2326$ (= 86.5 %) dissolve 13.78 gms. H_3BO_3 at 20°.

" " $d = 1.2645$ (= 98.5 %) " 24.8 " " "

(Holm, 1921, 1921 *a*, 1922.)

SOLUBILITY OF BORIC ACID IN AQUEOUS SOLUTIONS OF d TARTARIC ACID AND VICE VERSA.

(Burgess and Hunter, 1929.)

t°	Gms. per 100 gms. sat. sol. $C_4H_6O_6$	Gms. per 100 gms. sat. sol. H_3BO_3	Solid Phase
0	0.0	1.9	H_3BO_3
"	33.1	6.8	"
"	55.8	10.0	"
"	62.3	11.1	"+$C_4H_6O_6$
"	58.6	6.4	$C_4H_6O_6$
"	53.5	0.0	"
25	0.0	5.1	H_3BO_3
"	2.8	5.3	"
"	9.5	5.8	"
"	14.9	6.2	"
"	24.6	7.3	"
"	31.3	8.8	"
"	39.4	9.6	"
"	49.1	10.5	"
"	65.1	13.0	"+$C_4H_6O_6$
"	63.7	10.7	$C_4H_6O_6$
"	63.3	9.9	"
25	61.6	7.8	$C_4H_6O_6$
"	60.4	4.2	"
"	59.6	0.0	"
50	0.0	9.5	H_3BO_3
"	4.4	9.5	"
"	14.3	9.6	"
"	15.2	9.8	"
"	19.6	10.0	"
"	25.1	10.0	"
"	28.6	10.2	"
"	37.8	10.7	"
"	51.2	12.8	"
"	60.1	14.8	"
"	65.0	15.8	"
"	67.3	16.5	"+$C_4H_6O_6$
"	66.9	12.4	$C_4H_6O_6$
"	66.7	9.3	"
"	66.2	5.8	"
"	66.1	0.0	"

OH

SOLUBILITY OF BORIC ACID IN AQUEOUS SOLUTIONS OF MANNITE AT 25° AND VICE VERSA.

(Ageno and Valla, 1912, 1913.)

Grams per 100 cc. Sat. Sol. H_3BO_3.	Grams per 100 cc. Sat. Sol. $C_6H_{14}O_6$.	Solid Phase.
5.50	0	H_3BO_3
5.90	1.82	"
6.29	5.46	"
6.44	7.28	"
6.64	9.11	"
6.83	10.93	"
7.08	12.75	"
7.27	14.57	"
7.71	18.99	"
8.70	25.65	H_3BO_3
9.43	32.43	" $+C_6H_{14}O_6$
7.71	27.97	$C_6H_{14}O_6$
5.75	25.65	"
4.92	24.65	"
3.46	23.03	"
2.87	22.98	"
1.64	20.80	"
0	19.58	"

Additional determinations at 30° also given.

Determinations at 25°, differing somewhat from the above, are given by Mueller and Abegg (1906).

EQUILIBRIUM IN THE SYSTEM BORIC ACID, MANNITOL AND WATER AT 25°.

(Hermans, 1925.)

Gms. per 100 gms. sat. sol. HBO_3.	Gms. per 100 gms. sat. sol. Mannitol.	Solid Phase.
4.25	5.43	H_3BO_3
4.68	11.5	»
5.07	17.2	»
5.28	20.0	»
5.52	22.5	»
5.70	25.1	» + Mannitol
5.68	24.4	Mannitol
5.40	25.4	»
5.13	24.7	»
2.27	20.8	»
0.0	17.7	»

100 gms. dichlorethylene dissolve 0.006 gm. H_3BO_3 at 15°. (Wester and Brunis, 1914.)

100 gms. trichlorethylene dissolve 0.016 gm. H_3BO_3 at 15°. " "

100 cc. anhydrous hydrazine dissolve 55 gms. H_3BO_3 at room temp. (Welsh and Broderson, 1915.)

DISTRIBUTION OF BORIC ACID BETWEEN WATER AND AMYL ALCOHOL AT 25°.

(Fox — Z. anorg. Chem. 35, 130, '03.)

Millimols $B(OH)_3$ in Aq. Layer.	Millimols $B(OH)_3$ in Alcoholic Layer.	Gms. $B(OH)_3$ in 100 cc. Aq. Layer.	Gms. $B(OH)_3$ in 100 cc. Alcoholic Layer.	Millimols $B(OH)_3$ in Aq. Layer.	Millimols $B(OH)_3$ in Alcoholic Layer.	Gms. $B(OH)_3$ in 100 cc. Aq. Layer.	Gms. $B(OH)_3$ in 100 cc. Alcoholic Layer.
265.8	76.6	1.648	0.475	87.9	33.2	0.545	0.206
196.5	59.5	1.219	0.369	75.2	22.7	0.466	0.141
159.6	47.5	0.990	0.294	64.6	19.76	0.400	0.123
126.0	37.1	0.781	0.230				

RESULTS AT 15°. (Mueller and Abegg, 1906.)

Millimols $B(OH)_3$ per Liter. Aq. Layer.	Millimols $B(OH)_3$ per Liter. Alcohol Layer.	Gms. $B(OH)_3$ per 100 cc. Aq. Layer.	Gms. $B(OH)_3$ per 100 cc. Alcohol Layer	Millimols $B(OH)_3$ per Liter. Aq. Layer.	Millimols $B(OH)_3$ per Liter. Alcohol Layer.	Gms. $B(OH)_3$ per 100 cc. Aq. Layer.	Gms. $B(OH)_3$ per 100 cc. Alcohol Layer.
894	264	5.44	1.64	427.4	127.6	2.65	0.79
607.2	176.4	3.76	1.09	372	110	2.31	0.68
589.3	177.4	3.65	1.10	289.1	84.9	1.79	0.53

Data agreeing with those of Fox at 25° are also given by Mueller and Abegg, 1906. One determination at 35° gave 0.907 gm. $B(OH)_3$ per 100 cc. aq. layer and 0.274 gm. per 100 cc. alcohol layer.

DISTRIBUTION OF BORIC ACID BETWEEN AQUEOUS SODIUM CHLORIDE SOLUTIONS AND AMYL ALCOHOL AT 25°.

(Mueller and Abegg, 1906)

Gms. per 100 cc.: Aq. Layer. NaCl.	Aq. Layer. H_3BO_3.	Alcohol Layer. H_2O.	Alcohol Layer. H_3BO_3.	d_{25} of Alcohol Layer.	Gms. per 100 cc.: Aq. Layer. NaCl.	Aq. Layer. H_3BO_3.	Alcohol Layer. H_2O.	Alcohol Layer. H_3BO_3.	d_{25} of Alcohol Layer.
0	5.46	7.39	1.65	0.8296	16.64	5.13	4.71	1.79	0.8247
5.53	5.37	6.40	1.65	0.8277	17.90	5.02	4.31	1.79	0.8241
8.72	5.27	5.90	1.67	0.8268	20.36	5.02	4.19	1.87	0.8240
10.91	5.23	5.46	1.69	0.8259	23.52	4.97	3.59	1.96	0.8233
13.84	5.16	5.15	1.77	0.8254	25.03	4.95	3.20	1.99	0.8229

DISTRIBUTION OF BORIC ACID BETWEEN WATER AND MIXTURES OF AMYL ALCOHOL AND CARBON DISULFIDE AT 25°.

(Herz and Kurzer, 1910.)

75 Vol. % $C_5H_{11}OH$+25 Vol. % CS_2. Gms. H_3BO_3 per 100 cc. Aqueous Layer.	75 Vol. % … $C_5H_{11}OH+CS_2$. Layer	50 Vol. % $C_5H_{11}OH$+50 Vol. % CS_2. Gms. H_3BO_3 per 100 cc. Aqueous Layer.	50 Vol. % … $C_5H_{11}OH+CS_2$. Layer.	25 Vol. % $C_5H_{11}OH$+95 Vol. % CS_2. Gms. H_3BO_3 per 100 cc. Aqueous Layer.	25 Vol. % … $C_5H_{11}OH+CS_2$. Layer.
0.387	0.095	0.469	0.095	0.433	0.053
0.743	0.171	0.839	0.161	0.910	0.108
1.143	0.266	1.207	0.226	1.343	0.164
1.590	0.365	1.791	0.344	1.940	0.238

BORIC ACID (Tetra) $H_2B_4O_7$.

100 grams water dissolve 2.69 grams $H_2B_4O_7$ at 15°, Sp. Gr. = 1.015.

(Gerlach, 1889.)

BARIUM ARSENATE $Ba_3(AsO_4)_2$.

100 gms. H_2O dissolve 0.055 gm $Ba_3(AsO_4)_2$; 100 gms. 5% NH_4Cl dissolve 0.195 gm., and 100 gms. 10% NH_4OH dissolve 0.003 gm. $Ba_3(AsO_4)_2$

(Field — J. Ch Soc. 11 6, 1859.)

BARIUM ARSENATES $BaHAsO_4.H_2O$, $BaH_4(AsO_4)_2.H_2O$.

EQUILIBRIUM IN THE SYSTEM BARIUM OXIDE, ARSENIC PENTOXIDE AND WATER AT 30°. (Hendricks, 1926.)

The bottles containing the mixtures were kept at constant temperature and the solutions analyzed at intervals of one week. The composition of the solid phase was determined by the method of Schreinemakers, and by observation under the microscope.

AsO

d_{30} of. sat. solution.	Gms. per 100 gms. sat. sol. BaO.	As_2O_5.	Mol. ratio in solution.	Solid Phase.
1.003	0.22	0.002	136.8	Probably solid solution
1.002	0.11	0.003	57.3	»
1.001	0.02–0.03	0.29–0.034	0.93–1.37	$BaHAsO_4.H_2O + Ba_3(AsO_4)_2$? H_2O
1.067	2.63	3.98	0.99	$BaHAsO_4.H_2O$
1.094	3.60	5.86	0.92	»
1.117	4.36	7.26	0.90	»
1.108	4.04	6.72	0.90	»
1.151	5.49	9.28	0.89	»
1.176	6.25	10.56	0.89	»
1.188	6.62	11.27	0.88	»
1.281	6.98	11.12	0.94	»
1.271	9.46	14.92	0.95	»
1.357	11.67	18.52	0.94	»
1.474	13.59	22.95	0.90	»
1.592	15.37	27.26	0.85	»
–	16.65	28.01	–	» + $BaH_4(AsO_4)_2.2H_2O$
1.694	15.65	31.17	0.75	$BaH_4(AsO_4)_2.2H_2O$
1.719	13.35	35.87	0.56	»
1.809	7.53	47.27	0.24	»
1.817	6.56	48.48	0.20	»
2.150	trace	68.40	–	»
2.280	»	72.04	–	» + $3As_2O_5.5H_2O$
1.869	»	59.44	–	$3As_2O_5.5H_2O$

The existence of the salt $BaH_4(AsO_4)_2.2H_2O$ reported by Hendricks, 1926, is questioned by Guerin, 1938, and in order to clear up uncertainties, this system has been further studied, especially in the basic region. Results for 17° and equilibrium obtained after very long p periods of agitation are given in the present paper only in the form of a diagram. In the basic region the tribarytic arseniate $As_2O_5.3BaO.?\ H_2O$ is stable in presence of solutions of baryta. The number of molecules of H_2O it contains could not be determined. Its solubility in water at 17° is about 0.18 gms. per liter. The dibarytic arseniate is not hydrolysable and its solubility in water at 17° is about 0.59 gms. per liter.*

Data for equilibrium in the system barium oxide, arsenic trioxide and water at 25° and at 50° are given by Story and Anderson, 1924.

BARIUM BORATES.

SOLUBILITY IN AQUEOUS BORIC ACID SOLUTIONS AT 30°.

(Sborgi, 1913.)

BO

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
B_2O_3.	BaO.		B_2O_3.	BaO.	
3.6	0.04	H_3BO_3+1.3.7	0.3	0.23	1.3.7
3.4	0.04	1.3.7	0.3	0.31	1.37+1.1.4
2.5	0.04	"	0.2	0.8	1.1.4
2.0	0.04	"	0.2	1.2	"
1.0	0.05	"	0.24	4.8	"
0.5	0.09	"	0.26	5.8	1.14+$Ba(OH)_2$
0.4	0.12	"	0.08	5.3	$Ba(OH)_2$

1.3.7 = $BaO.3B_2O_3.7H_2O$ (Triborate); 1.1.4 = $BaO.B_2O_3.4H_2O$ (Metaborate). The original results were plotted and above figures read from curve.

BARIUM BROMIDE $BaBr_2.2H_2O$.

SOLUBILITY IN WATER.

(Kremers — Pogg. Ann. 90, 47, '56; Etard — Ann. chim. phys. [7] 2, 540, '94.)

Br

t°.	Gms. BaBr₂ per 100 Grams.			t°.	Gms. BaBr₂ per 100 Grams.		
	Water. (Kremers.)	Solution (Kremers.)	Solution (Etard.)		Water. (Kremers.)	Solution. (Kremers.)	Solution. (Etard.)
−20	...	...	45.6	40	114	53.2	51.5
0	98	49.5	47.5	50	118	54.1	52.5
10	101	50.2	48.5	60	123	55.1	53.5
20	104	51.0	49.5	70	128	56.1	54.5
25	106	51.4	50.0	80	135	57.4	55.5
30	109	52.1	50.6	100	149	60.0	57.8
				140	...	...	59.4

Sp. Gr. of saturated solution at 19.5° = 1.710.

SOLUBILITY OF BARIUM BROMIDE IN WATER.

(Millikan, 1917.)

t°.	Gms. BaBr₂ per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. BaBr₂ per 100 gms. sat. sol.	Solid Phase.
− 3.9..	17.8	Ice	20...	51.0	$BaBr_2.2H_2O$ (Kremers)
14.1..	38.2	"	40...	53.5	" "
−21.1..	44.6	"	60...	55.2	" "
−22.6..	46.6	" + $BaBr_2.2H_2O$	80...	57.4	" "
0.0..	49.5	$BaBr_2.2H_2O$ (Kremers)	100...	59.8	" "

SOLUBILITY OF BARIUM BROMIDE IN AQUEOUS SOLUTIONS OF BARIUM HYDROXIDE AND VICE VERSA AT 25°.

(Millikan, 1917.)

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
BaO.	BaBr₂.		BaO	BaBr₂.	
0.0	51.10	$BaBr_2.2H_2O$	3.71	36.41	$BaBr_2.BaO.5H_2O + BaO.9H_2O$
0.78	50.67	"	3.46	27.91	$BaO.9H_2O$
0.79	50.65	" + $BaBr_2.BaO.5H_2O$	3.48	25.03	"
0.91	49.30	$BaBr_2.BaO.5H_2O$	3.41	18.42	"
2.15	41.71	"	3.53	13.45	"
2.42	40.47	"	4.05	0.0	"

SOLUBILITY OF MIXTURES OF BARIUM BROMIDE AND BARIUM IODIDE IN WATER AT DIFFERENT TEMPERATURES.

(Etard.)

t°.	Grams per 100 Gms. Solution.		t°.	Grams per 100 Gms. Solution.	
	$BaBr_2$.	BaI_2.		$BaBr_2$.	BaI_2.
−16	4.8	58.4	170	11.0	67.4
+60	5.5	66.0	210	14.9	67.7
135	9.2	67.2	Both salts present in solid phase.		

Data for the system Barium Bromide + Barium Oxide + H_2O at 25° are given by Milikau (1916).

Data for the lowering of the melting point of $BaBr_2$ by BaF_2 and by $BaCl_2$ are given by Ruff and Plato (1903).

SOLUBILITY OF BARIUM BROMIDE IN AQUEOUS SOLUTIONS OF HYDROBROMIC ACID AT 18°. (Chlopin, 1925.)

Gms. per 100 cc. sat. sol.		Gms. per 100 cc. sat. sol.	
HBr.	$BaBr_2$.	HBr.	$BaBr_2$.
0.0	86.67	14.858	33.93
8.915	52.29	21.026	13.36
11.742	45.73	25.231	8.91
13.421	40.79	33.521	2.37

Br

SOLUBILITY OF BARIUM BROMIDE IN AQUEOUS SOLUTIONS OF HYDROBROMIC ACID AT 0° AND AT 25°.

(Chlopin and Nikitin, 1927.)

Results at 0°						Results at 25°	
Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.	
HBr	$BaBr_2$	HBr	$BaBr_2$	HBr	$BaBr_2$	HBr	$BaBr_2$
0.0	48.05	4.07	40.88	18.35	17.81	0.0	50.16
0.965	46.25	4.63	39.71	20.89	14.21	1.15	48.30
1.16	45.96	10.41	30.17	24.20	9.97	2.08	46.80
1.83	44.82	11.00	29.32	25.68	8.24	3.98	43.53
2.28	43.97	14.64	23.42	32.66	2.15	6.86	38.77
2.80	43.05	15.80	21.68	44.01	0.049		

These authors also give results for equilibrium in the system Barium bromide, Radium bromide, Hydrobromic acid and Water at 0° and at 25°.

The following additional determinations of the solubility of barium bromide in aqueous solutions of hydrobromic acid at 25° are given by Scott and Durham, 1930.

Gms. per 100 gms. sat. solution	HBr	0.0	5.35	9.19	12.81
	$BaBr_2$	50.28	40.76	34.40	28.73

In liquid ammonia, Linhard and Stephan, 1933, 1934, found that 100 gms. of the saturated solutions contain 0.017 gm. (0.0006 gm. mols.) $BaBr_2$ at 0°.

Solubility of Barium Bromide in Methyl and Ethyl Alcohols.

(de Bruyn — Z. physik. Chem. 10, 783, 92; Richards — Z. anorg. Chem. 3, 455, '93; Rohland — *Ibid.* 15 412, '97.)

t°.	Parts $BaBr_2$ per 100 parts Aq. C_2H_5OH of: 100%.	97%.	87%.	Parts $BaBr_2.2H_2O$ per 100 parts of Aq. CH_3OH of: 100%.	93.5%.	50%.
15.0	..	0.48 ($BaBr_2.2H_2O$)	..	45.9	27.3	4.0
22.5	3	...	6	56.1	...	...

100 gms. sat. solution in methyl alcohol at the crit. temp. contain 0.4 gm $BaBr_2$. (Centnerszwer, 1910.)

Solubility of Barium Bromide in Pure Methyl Alcohol (d_{4}^{25} = 0.7866).

(Lloyd, Brown, Glynwyn, Bonnel and Jones, 1928.)

t^0	Gms. $BaBr_2$ per 100 gms. CH_3OH	t^0	Gms. $BaBr_2$ per 100 gms. CH_3OH
0	44.4	30	40.9
10	43.1	40	40.2
15	42.5	50	39.4
20	41.9	60	38.8

Solubility of Barium Bromide in Absolute Ethyl Alcohol.

(Bonnell and Jones, 1926.)

Br

Note. — The mixtures were shaken by hand at intervals during a long period of time. Equilibrium was approached from above in some cases. The solutions were analyzed repeatedly untill constant results were obtained. Temperatures constant to 0.02°.

t°.	Gms. Ba Br_2 per 100 gms. C_2H_5OH.	t°.	Gms. Ba Br_2 per 100 gms. C_2H_5OH.	t°.	Gms. Ba Br_2 per 100 gms. C_2H_5OH
0	5.88	20	4.130	50	1.837
10	5.067	30	3.322	60	1.479
15	4.590	40	2.433	70	1.253

100cc. of 95% C_2H_5OH containing 0.2 n HBr dissolve 22.0 gms. $BaBr_2$ at 25°. (Yagoda, 1930.)

Solubility of Barium Bromide in Acetone of the Highest Purity.

(Bell, Rowlands, Bamford, Thomas and Jones, 1930.)

t^0	Gms. $BaBr_2$ per 100 gms. CH_3COCH_3	Solid Phase	t^0	Gms. $BaBr_2$ per 100 gms. CH_3COCH_3	Solid Phase
0	0.0287	$BaBr_2$	30	0.0258	$BaBr_2$
10	0.0275	"	40	0.0254	"
20	0.0262	"	50	0.0246	"
25	0.0261	"			

100cc. of Iso Amyl Alcohol ($(CH_3)_2CH.(CH_2)_2OH$) of d_{25}= 0.805 dissolve 0.013 gm. $BaBr_2$ at 25°. (Yagoda, 1930.)

Freezing-point lowering data are given by Kellner, 1917 for mixtures of Ba Br_2 + Li Br, Ba Br_2 + KBr and Ba Br_2 + Na Br.

BARIUM Per**BROMIDE** $BaBr_4$.

Data for the formation of barium perbromide in aqueous solutions at 25° are given by Herz and Bulla (1911). See reference calcium perbromide.

BARIUM BROMATE $Ba(BrO_3)_2H_2O$.

BrO

SOLUBILITY IN WATER.

(Trautz and Anschütz, 1906; Rammelsberg, 1841.)

t°	Gms. $Ba(BrO_3)_2$ per 100 Gms Solution.	t°.	Gms. $Ba(BrO_3)_2$ per 100 Gms. Solution.	t°.	Gms. $Ba(BrO_3)_2$ per 100 Gms. Solution.
− 0.034	0.28	30	0.95	70	2.922
0	0.286	40	1.31	80	3.521
+10	0.439	50	1.72	90	4.26
20	0.652	60	2.271	98.7	5.256
25	0.788			99.65	5.39

SOLUBILITY OF BARIUM BROMATE IN AQUEOUS SOLUTIONS OF SALTS AT 25°.

(Harkins, 1911.)

Conc. of Salt in Gms. Equivalents per Liter.	Gms. $Ba(BrO_3)_2$ Dissolved per Liter in Aqueous Sol. of:			
	KNO_3.	$Ba(NO_3)_2$.	$KBrO_3$.	$Mg(NO_3)_2$.
0	7.93 (1.0038)	7.93	7.93	7.93
0.025	8.62 (1.0059)	7 22 (1.0059)	5.216 (1.0046)	...
0.050	9.91 (1.0080)	6.83 (1.0083)	3.415 (1.0062)	...
0.100	10.25 (1.0120)	6 415 (1 0132)	1.72 (1.0109)	8.196 (1.0114)
0.200	...	6.230 (1.0233)	...	...

Figures in parentheses show densities of the sat. sols. at $\frac{25°}{4°}$.

CH

BARIUM FORMATE $Ba(HCOO)_2$

SOLUBILITY OF BARIUM FORMATE IN WATER.

(Ashton, Houston and Saylor, 1933.)

t^0	Gms. $Ba(HCOO)_2$ per 100 gms. H_2O	Solid Phase	t^0	Gms. $Ba(HCOO)_2$ per 100 gms. H_2O	Solid Phase
0	26.2	$Ba(HCOO)_2$	60	38.6	$Ba(HCOO)_2$
10	28.0	"	70	41.3	"
20	29.9	"	80	44.2	"
30	31.9	"	90	47.6	"
40	34.0	"	100	51.3	"
50	36.3	"			

The above determinations were made with the greatest possible care and are considered to be more accurate than the previous results of Krasnicki, 1887 and of Stanley, 1904.

BARIUM METHIONATE $Ba\ CH_2(SO_3)_2 \cdot 2H_2O$

100 gms. H_2O dissolve 0.368 gm. $BaCH_2O_6S_2$ (rhombohedric plates) at 25°. 100 gms. H_2O dissolve 0.308 gm. $BaCH_2O_6S_2$ (rhombohedric needles) at 25°. (Backer, 1927; Backer and Terpstra, 1929.)

BARIUM Chlor **METHIONATE** $Ba\ CHCl(SO_3)_2$

100 gms. H_2O dissolve 34.04 gms. $Ba\ CHCl(SO_3)_2$ at 25°. (Backer, 1930.)

BARIUM FORMATE

SOLUBILITY OF BARIUM FORMATE IN AQUEOUS SOLUTIONS OF
FORMIC ACID AT 25°.

(Dunn and Philip, 1934.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
HCOOH	$Ba(HCOO)_2$		HCOOH	$Ba(HCOO)_2$	
0.0	23.51	$Ba(HCOO)_2$	23.38	26.09	$Ba(HCCO)_2.HCOOH$
5.39	24.25	"	28.49	24.71	"
10.57	25.03	"	38.07	23.11	"
15.41	25.72	"	47.5	22.56	"
21:80	26.70	"+$Ba(HCOO)_2.HCOOH$	58.4	23.45	"
22.43	26.87	$Ba(HCOO)_2.HCOOH$	65.8	25.72	"

The freezing-points of mixtures of Barium Formate and Formic acid are given by Kendall and Adler, 1921.

BARIUM MALONATE $BaC_3H_2O_4.2H_2O$.

CH

SOLUBILITY IN WATER.

(Miczynski — Monatsh. Chem. 7, 263, '86)

t°.	Gms. $BaC_3H_2O_4$ per 100 Gms.		t°.	Gms. $BaC_3H_2O_4$ per 100 Gms.	
	Water.	Solution.		Water.	Solution.
0	0.143	0.143	50	0.287	0.285
10	0.179	0.179	60	0.304	0.303
20	0.212	0.211	70	0.317	0.316
30	0.241	0.240	80	0.326	0.325
40	0.266	0.265			

Results slightly higher than the above, from 0°-50° are given by Cantoni and Diotalevi (1905).

BARIUM ACETATE $Ba(CH_3COO)_2$.

SOLUBILITY IN WATER.

(Walker and Fyffe, 1903; Krasnicki, 1887, gives incorrect results.)

t°.	Gms. $Ba(CH_3COO)_2$ per 100 Gms.		Solid Phase.	t°.	Gms. $Ba(CH_3COO)_2$ per 100 Gms.		Solid Phase.
	Water.	Solution.			Water.	Solution.	
0.3	58.8	37.0	$Ba(C_2H_3O_2)_2.3H_2O$	40.5	79.0	44.1	$Ba(C_2H_3O_2)_2$
7.9	61.6	38.1	"	41.5	78.7	44.0	"
17.5	69.2	40.9	"	44.5	77.9	43.8	"
21.6	72.8	42.1	"	51.8	76.5	43.4	"
24.1	78.1	43.9	"	63.0	74.6	42.7	"
26.2	76.4	43.3	$Ba(C_2H_3O_2)_2.H_2O$	73.0	73.5	42.4	"
30.6	75.1	42.9	"	84.0	74.0	42.5	"
35.0	75.8	43.1	"	99.2	74.8	42.8	"
39.6	77.9	43.8	"				

Transition temperatures 24.7° and 41°.

100 cc. 97% ethyl alcohol dissolve 0.0223 gm. barium acetate at room temp.

(Crowell, 1918)

Solubility of Barium Acetate in Aqueous Solutions of Barium Hydroxide at 25° and Vice Versa.

(Foote and Hickey, 1937.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$Ba(OH)_2$	$Ba(CH_3COO)_2$		$Ba(OH)_2$	$Ba(CH_3COO)_2$	
0.0	43.20	$Ba(CH_3COO)_2.H_2O$	2.85	29.32	$Ba(OH)_2.8H_2O$
1.35	42.40	"	3.22	16.91	"
2.58	41.75	" + $Ba(OH)_2.8H_2O$	4.489	0.0	"
2.64	37.97	$Ba(OH)_2.8H_2O$			

Solubility of Barium Acetate in Aqueous Solutions of Acetic Acid at 25°.

(Iwaki, 1914.)

Mols. per 100 Mols. Sat. Sol.		Solid Phase.	Mols. per 100 Mols. Sat. Sol.		Solid Phase.
CH_3COOH.	$(CH_3COO)_2Ba$.		CH_3COOH.	$(CH_3COO)_2Ba$.	
0	5.18	$(CH_3COO)_2Ba.3H_2O$	28.72	4.52	3.3.11
0.41	5.21	"	36.54	5.60	"
1.40	5.34	" +3.3.11	42.08	7.85	"
1.46	5.32	3.3.11	46.51	8.87	" +1.3
3.30	3.48	"	51.98	8.62	1.3
10.23	3.14	"	65.77	8.40	"
20.60	3.62	"	85.27	7.36	"

CH

3.3.11 = $3(CH_3COO)_2Ba.3CH_3COOH.11H_2O$, 1.3 = $(CH_3COO)_2Ba.3CH_3COOH$.

The composition of the above compound 3.3.11 was confirmed by Dunn and Philip, 1934.

Solubility of Barium Acetate in Pure Acetic Acid Determined by the Freezing Point Method.

(Davidson and McAllister, 1930.)

t°	Gm. Mols. $Ba(C_2H_3O_2)_2$ per 100 gm. mols. Mixture	Solid Phase	t°	Gm. Mols. $Ba(C_2H_3O_2)_2$ per 100 gm. mols. Mixture	Solid Phase
16.50	0.0	CH_3COOH	32.0	6.82	$Ba(C_2H_3O_2)_2.2CH_3COOH$
15.43	1.59	"	48.0	8.11	" (Stable modification)
15.0	2.32	"	54.0	8.62	"
14.63	3.04	"	64.0	9.84	"
19.0	2.67	$Ba(C_2H_3O_2)_2.3CH_3COOH$	74.1	11.70	"
22.5	3.16	"	84.0	14.06	"
31.8	4.48	"	90.3	15.58	"
36.0	5.18	"	13.8	8.11	"
41.1	6.21	"	19.9	9.70	" (Unstable modification)
47.3	7.53	"	27.1	11.37	"
49.0	8.62	"	32.0	12.38	"

100 gms. pure methyl alcohol dissolve 0.55 gm. $Ba(C_2H_3O_2)_2$ at 15° and 0.23 gm. at the b. pt. (66°). (Henstock, 1934.)

BARIUM Trimethyl **ACETATE** $Ba[(CH_3)_3.C.COO]_2.5H_2O$

100 gms. H_2O dissolve 34 gms. of the hydrated salt at 0°, 33 gms. at 20° and 32 gms. at 40°. (Landau, 1893.)

BARIUM Sulfo **ACETATE** $CH_2(SO_3)(CO_2)Ba.H_2O$

100 gms. H_2O dissolve 0.296 gm. $BaC_2H_2O_5S$ at 25°. (Backer, 1927.)

BARIUM Brom Sulfo **ACETATE** $CHBr(SO_3)(CO_2)\ Ba.1\frac{1}{2}H_2O$

100 gms. H_2O dissolve 3.14 gms. $CHBr(SO_3)(CO_2)Ba$ at 25°. (Backer, 1927.)

BARIUM Chlor Sulfo **ACETATE** $CHCl(SO_3)(CO_2)Ba.H_2O$

100 gms. H_2O dissolve 1.51 gm. $CHCl(SO_3)(CO_2)Ba$ at 25°. (Backer, 1927.)

BARIUM MALATE $BaC_4H_4O_5$.

SOLUBILITY IN WATER.

(Cantoni and Basadonna — Bull. soc. chim. [3] 35, 731, '06.)

t°.	Gms. $BaC_4H_4O_5$ per 100 cc. Sol.	t°.	Gms. $BaC_4H_4O_5$ per 100 cc. Sol.	t°.	Gms. $BaC_4H_4O_5$ per 100 cc. Sol.
20	0.883	35	0.895	60	1.011
25	0.901	40	0.896	70	1.041
30	0.903	50	0.942	80	1.044

SOLUBILITY IN WATER AND IN ALCOHOL.

(Partheil and Hübner — Archiv. Pharm. 241, 413, '03.)

100 grams water dissolve 1.24 gms. $BaC_4H_4O_5$ at 18°, and 1.3631 gms. at 25°.

100 grams 95% alcohol dissolve 0.0038 gms. $BaC_4H_4O_5$ at 18°, and 0.0039 gm. at 25°.

SOLUBILITY OF ACTIVE AND RACEMIC BARIUM MALATE IN WATER.

(Duboux and Cuttat, 1921.)

Results for the Actiye Salt.			Results for the Racemic Salt.		
t°.	Gms. $C_4H_4O_5Ba$ per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. $C_4H_4O_5Ba$ per 100 gms. sat. sol.	Solid Phase.
0.0...	1.020	$C_4H_4O_5Ba$	0.....	0.76	$C_8H_8O_{10}.Ba_2.H_2O$
12.5...	1.150	»	– ...	–	–
25.0...	1.240	»	25.0...	0.58	»
37.5...	1.310	»	37:5...	0.84	»

BARIUM TARTRATE $Ba(C_2H_2O_3)_2$.

SOLUBILITY IN WATER.

(Cantoni and Zachoder — Bull. soc. chim. [3] 33, 751, '05; see also Partheil and Hübner.)

t°	Gms. $Ba(C_2H_2O_3)_2$ per 100 cc. Solution.	t°.	Gms. $Ba(C_2H_2O_3)_2$ per 100 cc. Solution.	t°.	Gms. $Ba(C_2H_2O_3)_2$ per 100 cc Solution.
0	0.0205	30	0.0315	70	0.0480
10	0.0242	40	0.0352	80	0.0527
20	0.0279	50	0.0389	85	0.0541
25	0.0297	60	0.0440	..	...

BARIUM TARTRATE, active $C_4H_4O_6.Ba\,^1/_2H_2O$, racemic $C_8H_8O_{12}.Ba_2$.

SOLUBILITY OF EACH IN WATER. (Duboux and Cuttat, 1921.)

t°.	Gms. $C_4H_4O_6Ba$ per 100 gms. sat. sol.	Solid phase.	t°.	Gms. $C_8H_8O_{12}Ba_2$ per 100 gms. sat. sol.	Solid Phase.
0......	0.0200	$C_4H_4O_6Ba.^1/_2H_2O$	0......	0.0243	$C_8H_8O_{12}Ba_2$
12.5....	0.0247	"	12.5....	0.0284	"
25.0....	0.0294	"	25.0....	0.0325	"
37.5....	0.0341	"	37.5....	0.0366	"

SOLUBILITY OF BARIUM TARTRATE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE, SODIUM CHLORIDE AND AMMONIUM CHLORIDE.

(Cantoni and Jolkowski, 1907.)

At Different Temperatures. Varying Concentrations at 16°.

t°.	Gms $Ba(C_2H_2O_3)_2$ per 100 cc Sat Sol in			Gms. Chloride per 100 Gms Solvent	Gms $Ba(C_2H_2O_3)_2$ per 100 cc Sat Sol in:		
	7% KCl.	7% NaCl.	7% NH_4Cl.		KCl	NaCl.	NH_4Cl.
16	0.0823	0.0887	0.1050	0.5	0.0398	0.0410	0 0441
30	0.1017	0.1151	0.1370	1	0.0466	0.0514	0.0589
55	0.1230	0.1348	0.1590	3	0.0723	0.0826	0.0892
70	0.1500	0.1781	0.2030	10	0.1199	0.1260	0.1342
85	0.1828	0.2168	0.2360	15	0.1435	0.1440	0.1585
				20	0.1466	0.1573	0.1663

The authors refer to their determination of the amount of decomposition of the tartrate by the aqueous chloride solutions. Constant agitation and temperature were maintained.

SOLUBILITY OF BARIUM TARTRATE IN AQUEOUS ACETIC ACID SOLUTIONS AT 26°-27°.

(Herz and Muhs, 1903.)

Normality of Acetic Acid.	Gms residue* per 50 cc. Sol.	Gms per 100 cc Solution.		Normality of Acetic Acid.	Gms residue* per 50 cc. Sol.	Gms per 100 cc. Solution	
		CH_3COOH.	Ba tartrate.			CH_3COOH.	Ba tartrate.
0	0.0328	0.	0.0655	3.77	0.1866	22.62	0.3728
0 565	0.1151	3.39	0.2300	5 65	0.1865	33.90	0.3726
1 425	0 1559	8.55	0 3115	16.85	0.0218	101.10	0.0436
2 85	0 1739	17 11	0 3475	...	...	...	...

* Dried at 70°

100 grams 95% alcohol dissolve 0.032 gm. Ba tartrate at 18° and 0.0356 gm. at 25°. (Partheil and Hubner.)

BARIUM SUCCINATE AND BARIUM ISO SUCCINATE

$Ba.CH_2CH_2(COO)_2$. $Ba.CH_3CH_2(COO)_2$.

SOLUBILITY OF EACH IN WATER.

(Miczynski — Monatsh. Chem. 7, 263, 1886.)

t°.	Gms. Ba. Succinate per 100 Gms.		Gms. Ba. Iso Succinate per 100 Gms.	
	Water.	Solution.	Water.	Solution.
0	0.421	0.420	1.884	1.849
10	0.432	0.430	2.852	2.774
20	0.418	0.417	3.618	3.493
30	0.393	0.392	4.181	4.014
40	0.366	0.365	4.542	4.346
50	0.337	0.336	4.700	4.594
60	0.306	0.305	4.656	4.450
70	0.273	0.272	4.410	4.224
80	0.237	0.237	3.962	3.810

100 gms. H_2O dissolve 0.396 gms. Ba Succinate at 18° and 0.410 gms. at 25°.

100 gms. 95% alcohol dissolve 0.0015 gms. Ba Succinate at 18° and 0.0016 gms. at 25°. (Partheil and Hübner — Archiv. Pharm. 241, 413, '03.)

Cantoni and Diotalevi (1905), and Tarugi and Checchi (1901), obtained data in close agreement with the above.

CH

SOLUBILITY OF BARIUM SUCCINATE IN AQUEOUS SOLUTIONS OF CALCIUM, MAGNESIUM AND SODIUM SUCCINATES AT 25°.

(Walker, 1925.)

In aq. Calcium Succinate Gms. per liter		In aq. Magnesium Succinate Gms. per liter		In aq. Sodium Succinate Gms. per liter	
$Ca(CH_2COO)_2$	$Ba(CH_2COO)_2$	$Mg(CH_2COO)_2$	$Ba(CH_2COO)_2$	$Na(CH_2COO)_2$	$Ba(CH_2COO)_2$
0.00	3.98	1.08	3.54	1.29	3.31
1.25	3.51	2.16	3.28	2.55	2.92
2.49	3.23	4.31	2.93	5.10	2.50
4.98	2.93	6.48	2.70	7.66	2.31
		8.63	2.60		

The original results are in terms of gm. mols. of the saturating salt per 1000 gms. H_2O "Corresponding to the weight-molar concentration of the added salt".

BARIUM CACODYLATE $Ba[(CH_3)_2AsOO]_2.9H_2O$

SOLUBILITY OF BARIUM CACODYLATE IN WATER.

(Tiollais, 1938.)

t°	Gms. $Ba[(CH_3)_2AsOO]_2$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Ba[(CH_3)_2AsOO]_2$ per 100 gms. sat. sol.	Solid Phase
0	46.20	$Ba[(CH_3)_2AsOO]_2.9H_2O$	56.0	71.90	$Ba[(CH_3)_2AsOO]_2.3H_2O$
8	48.30	"	61.5	72.90	"
12.5	49.26	"	67.0	74.64	"
15.0	50.24	"	72.0	76.20	"
20.0	51.66	"	77.0	76.62	$Ba[(CH_3)_2AsOO]_2$
28.5	55.09	"	80.0	76.95	"
32.5	57.32	"	82.0	77.24	"
37.0	58.76	"	88.0	78.01	"
42.5	61.61	"	90.0	78.26	"
47.5	64.55	"	94.0	78.60	"
53.0(tr.t)	71.72	" + $.3H_2O$	99.0	78.85	"

BARIUM CACODYLATE

SOLUBILITY OF BARIUM CACODYLATE IN ALCOHOLS.

(Tiollais, 1936.)

Solvent	t°	Gms. per 100 gms. sat. sol. $Ba[(CH_3)_2AsOO]_2$	Gms. per 100 gms. sat. sol. $Ba[(CH_3)_2AsOO]_2.9H_2O$
Methyl alcohol	17	61.46	—
"	18	—	69.82
Ethyl alcohol(95%)	12	41.27	7.75
"	15	44.11	9.32
"	17	46.20	10.65
"	18	—	11.26
" (abs.)	15	42.97	27.03
"	17	—	27.49
"	19	—	28.04

BARIUM PROPIONATE $Ba(C_3H_5O_2)_2.H_2O$.

SOLUBILITY OF BARIUM PROPIONATE IN WATER.

(Wing and Thompson, 1926.

CH

t°.	Gms. $Ba(C_3H_5O_2)_2$ per 100 gms. Sat. sol.	Gms. $Ba(C_3H_5O_2)_2$ per 100 gms. Water.	Solid Phase.	t°.	Gms. $Ba(C_3H_5O_2)_2$ per 100 gms. Sat. sol.	Gms. $Ba(C_3H_5O_2)_2$ per 100 gms. Water.	Solid Phase
0.3....	36.5	57.5	$Ba(C_3H_5O_2)_2.H_2O$	65.3....	38.9	63.7	$Ba(C_3H_5O_2)_2.H_2O$
5.1....	36.2	56.7	»	75.6....	39.8	66.1	»
15.0....	36.0	56.3	»	80.4....	40.2	67.8	»
24.8....	36.2	56.7	»	85.6....	41.2	70.1	»
34.8....	36.6	57.7	»	90.5....	42.2	73.0	»
44.8....	37.1	59.0	»	95.4....	43.2	76.1	»
55.0....	38.0	61.3	»	100.7....	44.7	82.7	»

The mixtures were constantly stirred for 8 hrs. at the lower temperatures, and for 2-3 hrs. at the higher temperatures. Since barium propionate is hydrolyzed by water in warm solutions the barium was determined as Ba SO_4 and the amount of propionate calculated.

The earlier determinations by Krasnicki, 1887, are lower than the above at the lower temperatures and slightly higher at the higher temperatures.

100cc 95% ethyl alcohol dissolve 0.1631 gm. $Ba(C_3H_5O_2)_2$ at room temperature. (Crowell, 1918.)

BARIUM Sulfon PROPIONATE (neutral) $BaC_3H_4O_5S.4H_2O$, *r* and *d*.

100 gms. sat. solution in water contains 6.63 gms. of the anhydrous *r* salt at 24°.6.
100 » » » » 2.00 » » » *d* salt at 24°.6.

(Franchimont and Backer, 1920.)

BARIUM α Sulfo PROPIONATE $CH_3.CH(SO_3)(CO_2)Ba.1\frac{1}{2}H_2O$

100 gms. H_2O dissolve 7.28 gms. $CH_3CH(SO_3)(CO_2)Ba$ at 25°. (Backer, 1927.)

BARIUM α Brom Sulfo PROPIONATE $CH_3CBr(SO_3)(CO_2)Ba.3H_2O$

100 gms. H_2O dissolve 4.36 gms. $CH_3CBr(SO_3)(CO_2)Ba$ at 25°. (Backer, 1927.)

BARIUM α Chlor α Sulfo PROPIONATE $CH_3CCl(SO_3)(CO_2)Ba.3H_2O$.

100 gms. H_2O dissolve 2.88 gms. $CH_3CCl(SO_3)(CO_2)Ba$ at 25°. (Backer, 1927.)

BARIUM LACTATE $(CH_3CHOHCOO)_2Ba$

100 gms. pure methyl alcohol dissolve 1.14 gms. $(CH_3CHOHCOO)_2Ba$ at 15° and 1.30 gm. at the b. pt. (66.2°). (Henstock, 1934.)

BARIUM β Methyl **ADIPATE** (Racemic).

100 gms. sat. solution in water contain 27.6 gms. of the salt at 20° (Meurisse.)

BARIUM n BUTYRATE $Ba(CH_3.(CH_2)_2COO)_2$

SOLUBILITY OF n BARIUM BUTYRATE IN WATER.
(Wing, 1927.)

t°	Gms. $Ba(C_4H_7O_2)_2$ per 100 gms. Sat. Sol.	Gms. $Ba(C_4H_7O_2)_2$ per 100 gms. Water	t°	Gms. $Ba(C_4H_7O_2)_2$ per 100 gms. Sat. Sol.	Gms. $Ba(C_4H_7O_2)_2$ per 100 gms. Water
0.06	27.0	37.0	50.05	26.5	36.1
9.92	26.5	36.1	59.97	27.1	37.2
19.86	26.1	35.4	70.08	28.0	39.0
26.50	25.9	34.9	80.05	29.5	41.7
33.00	25.9	34.9	90.27	31.3	45.5
39.98	26.0	35.2	94.96	32.5	48.1

The solid phase in all cases is the anhydrons salt. The above determinations which were made with great care are believed to be more accurate than the previous results of Deszathy, 1893.

BARIUM α Sulfo **BUTYRATE** $C_2H_5.CH(SO_3)(CO_2)Ba.2H_2O$

100 gms. H_2O dissolve 6.04 gms. $C_2H_5.CH(SO_3)(CO_2)Ba$ at 25°. Backer, 1927.)

BARIUM n VALERATE $Ba(C_4H_9.COO)_2$

SOLUBILITY OF BARIUM n VALERATE IN WATER.
(Furth, 1888)

t°	0	20	40	60	70
Gms. $Ba(C_4H_9.COO)_2$ per 100 gms. H_2O	22	20	20	21	22

BARIUM α Sulfo **VALERATE** $C_3H_7.CH(SO_3)(CO_2)Ba$

100 gms. H_2O dissolve 5.7 gms. $C_3H_7.CH(SO_3)(CO_2)Ba$ at 25°. (Backer, 1927.)

BARIUM CAMPHORATE $BaC_{10}H_{14}O_4.4H_2O$.

SOLUBILITY OF BARIUM CAMPHORATE IN AQUEOUS SOLUTIONS OF CAMPHORIC ACID AT 16°-17°.
(Jungfleisch and Landrieu, 1914.)

Gms. per 100 Gms. Sat. Sol. Camphoric Acid.	Gms. per 100 Gms. Sat. Sol. Barium Camphorate.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. Camphoric Acid.	Gms. per 100 Gms. Sat. Sol. Barium Camphorate.	Solid Phase.
0.68	0.134	*d* Camphoric ac. + 1.3	0.48	22.71	1.3
0.84	0.150	"	0.45	32.19	"
0.693	0.20	1.3	0.50	37.22	"
0.38	2.59	"	0.51	40.99	1.3 + Ba Camphorate
0.44	11.10	"	0	42.59	Ba Camphorate

1.3 = Barium tetracamphorate, $C_{10}H_{14}O_4Ba.3C_{10}H_{16}O_4$.

BARIUM CITRATE $Ba_3(C_6H_5O_7)_2.7H_2O$.

SOLUBILITY IN WATER AND IN ALCOHOL.

100 grams water dissolve 0.0406 gram $Ba_3(C_6H_5O_7)_2.7H_2O$ at 18°, and 0.0572 gm. at 25°.

100 grams 95% alcohol dissolve 0.0044 gram $Ba_3(C_6H_5O_7)_2.7H_2O$ at 18°, and 0.0058 gm. at 25°.

(Partheil and Hübner — Archiv. Pharm. 241, 413, '03.)

BARIUM PICRATE $[C_6H_2(NO_2)_3O]_2Ba.5H_2O$.

SOLUBILITY IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 25°.

(Fischer. 1914, 1918.)

Volume per cent C_2H_5OH.	Gms. $[C_6H_2(NO_2)_3O]_2Ba$ per 100 cc. sat. sol.	Solid Phase.	Volume per cent C_2H_5OH.	Gms. $[C_6H_2(NO_2)_3O]_2Ba$ per 100 cc. sat. sol.	Solid Phase.
0.0	1.260	$[C_6H_2(NO_2)_3O]_2Ba.5H_2O$	50.0	3.184	$.5H_2O + .4H_2O$
10.0	1.037	»	55.0	3.335	»
15.0	0.889	»	60.0	3.483	$[C_6H_2(NO_2)_3O]_2Ba.4H_2O$
20.0	0.963	»	65.0	3.483	»
25.0	1.260	»	70.0	3.335	»
30.0	1.482	»	75.0	3.261	»
35.0	1.704	»	80.0	3.187	»
40.0	2.149	»	85.0	3.187	»
45.0	1.260		90.0	3.113	»
	1.842	»	95.0	2.964	»
	2.340	$+[C_6H_2(NO_2)_3O]_2Ba.4H_2O$	100.0	5.336	»

CH

At 45.0 per cent alcohol variable results are obtained for the compound containing 5 H_2O. Between 40 and 60 per cent alcohol there is a gradual dehydration of the compound and the curve shows a break. The exact position of the intersection of the two curves could not be determined.

BARIUM CAPROATE AND BARIUM ISO CAPROATE.

SOLUBILITY IN WATER.

	(Kulisch, 1893.) Barium Caproate (Methyl 3 Pentan.) $Ba(CH_3.CH_2CH(CH_3)CH_2COO)_2$.			(König, 1893.) Barium Iso Caproate (Methyl 2 Pentan.) $Ba(CH_3CH(CH_3)CH_2.CH_2COO)_2$.		
t°.	Gms. $Ba(C_6H_{11}O_2)_2$ per 100 Gms. Water.	Gms. $Ba(C_6H_{11}O_2)_2$ per 100 Gms. Solution.	Solid Phase.	Gms. $Ba(C_6H_{11}O_2)_2$ per 100 Gms. Water.	Gms. $Ba(C_6H_{11}O_2)_2$ per 100 Gms. Solution.	Solid Phase.
0	11.71	10.49	$Ba(C_6H_{11}O_2)_2.3\frac{1}{2}H_2O$	14.34	12.54	$Ba(C_6H_{11}O_2)_2.4H_2O$
10	8.38	7.73	"	13.33	11.77	"
20	6.89	6.45	"	12.67	11.26	"
30	5.87	5.55	"	12.37	11.01	"
40	5.79	5.47	"	12.42	11.05	"
50	6.63	6.21	"	12.83	11.38	"
60	8.39	7.74	"	13.63	11.99	"
70	11.09	9.98	"	14.68	12.80	"
80	14.71	12.82	"	16.24	13.97	"
90	19.28	16.16	"	17.95	15.23	"

BARIUM GLUCONATE d $Ba[CH_2OH(CHOH)_4COO]_2$

100cc. sat. solution of d Barium Gluconate in Water contain 8.7 gms. $Ba[CH_2OH(CHOH)_4COO]_2$ at 25°. (May, Weisberg and Herrick, 1929.)

BARIUM BENZENE SULFONATE $Ba[C_6H_5SO_3]_2.H_2O$

SOLUBILITY OF BARIUM BENZENE SULFONATE IN AQUEOUS SOLUTIONS OF BENZENE SULFONIC ACID AT 25°.

(Dunn and Philip, 1934.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$C_6H_5SO_3H$	$Ba[C_6H_5SO_3]_2$		$C_6H_5SO_3H$	$Ba[C_6H_5SO_3]_2$	
0.0	14.33	$Ba[C_6H_5SO_3]_2.H_2O$	28.67	1.10	$Ba[C_6H_5SO_3]_2.H_2O$
9.71	6.20	"	35.96	0.37	"
14.60	3.92	"	43.8	0.23	"
19.62	2.65	"	50.0	0.12	"

100cc. of sat. solution of Barium Benzene Sulfonate in Water contain 14.35 gms. $Ba[C_6H_5SO_3]_2$ at 20°. (Ephraim and Pfister, 1925, 1925a.)

100 gms. of methyl alcohol dissolve 0.40 gm. barium benzene sulfonate at 15° and 0.40 gms. at the b. pt. (66.0°). (Henstock, 1934.)

BARIUM Bromo BENZENE SULFONATE $Ba[C_6H_4BrSO_3]_2$

100 gms. H_2O dissolve 3.31 gms. $Ba[C_6H_4BrSO_3]_2$ at 17.5°. (Meyer, 1875.)

BARIUM m and p Chloro BENZENE SULFONATES $Ba[C_6H_4ClSO_3]_2$ CH

SOLUBILITY OF EACH IN WATER.

(Bollinger, 1928.)

Results for m (1.5?) $Ba[C_6H_4ClSO_3]_2$		Results for p (1.4) $Ba[C_6H_4ClSO_3]_2$	
t°	Gms. per 100cc. sat. sol.	t°	Gms. per 100cc. sat. sol.
18	0.64	18	0.08
98	4.33	98	0.46

BARIUM *p* Iodo BENZENE SULFONATE $Ba[C_6H_4SO_3I]_2$

SOLUBILITY OF BARIUM *p* IODO BENZENE SULFONATE IN AQUEOUS SOLUTIONS OF SALTS AT 20°.

(Strucek, 1938.)

Salt	Gm. Mols. Salt per liter aq. Solvent	Gm. $Ba[C_6H_4SO_3I]_2$ per 100 gms. H_2O	Salt	Gms Mols. Salt per liter aq. Solvent	Gm. $Ba[C_6H_4SO_3I]_2$ per 100 gms. H_2O
None(=H_2O)	0.0	0.8598	KCl	0.01	0.9054
KNO_3	0.01	0.9120	"	0.02	0.9320
"	0.05	1.0415	"	0.03	0.9614
"	0.10	1.1579	"	0.05	0.9969
"	0.50	1.6415	"	0.075	1.0433
$MgCl_2$	0.005	0.9051	"	0.2	1.1754
"	0.01	0.9369	LaCl	0.00333	0.9748
"	0.025	1.0089	"	0.00667	1.0394
"	0.05	1.0939	"	0.01667	1.1490

Data for the solubility in water of the Barium, Calcium, Magnesium and Sodium Salts of the 5 and 7-isoquinoline carboxy acids at approx. 25° and 100°, are given by Tyson, 1939.

BARIUM, 3.4 and 2.5 Diiodo **BENZENE SULFONATES** $Ba[C_6H_3I_2SO_3]_2$

100 gms. water dissolve 0.27 gm. of the 3.4 compound at 21.5°.
100 gms. water dissolve 0.522 gm. of the 2.5 compound at 20°.
(Boyle, 1909.)

BARIUM Phenyl **SULFATE** $(C_6H_5SO_4)_2Ba$

100 gms. sat. solution in alcohol contain 15.0 gms. $(C_6H_5SO_4)_2Ba$ at (hot or cold). (Burkhardt and Lapworth, 1926.)

BARIUM BENZOATE $(C_6H_5COO)_2Ba.2H_2O$

SOLUBILITY OF BARIUM BENZOATE IN WATER.

t°	Gms. $(C_6H_5COO)_2Ba$ per 100cc. sat. sol.	Solid Phase	Authority
15	4.3	$(C_6H_5COO)_2Ba.2H_2O$	(Tarugi and Checchi, 1901.)
18	4.9	"	(Fredholm, 1934.)
20	4.96	"	(Ephraim and Pfister, 1925.)
100	10.1	" (?)	(Tarugi and Checchi, 1901.)

SOLUBILITY OF BARIUM BENZOATE IN WATER AND IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE AT 18°.

(Fredholm, 1934.)

CH

Solvent Gm. Equiv. per liter	Gm. Equiv. $Ba(C_6H_5COO)_2$ per liter	
Water alone	0.2597	(= 49.2 gms. per liter)
0.1992 NH_4Cl	0.2752	
" " + 0.539 NH_3	0.2755	
" " + 0.897 "	0.2757	

100 gms. methyl alcohol dissolve 0.47 gm. $(C_6H_5COO)_2Ba$ at 15° and 0.60 gm. at the b. pt. (66°). (Henstock, 1934.)

BARIUM p Brom **BENZOATE** $(C_6H_4BrCOO)_2Ba.H_2O$
BARIUM p Chlor **BENZOATE** $(C_6H_4ClCOO)_2Ba.H_2O$
BARIUM p Iodo **BENZOATE** $(C_6H_4ICOO)_2Ba.H_2O$

100cc. of 94 percent acetone dissolve 0.007 millimols $(C_6H_5BrCOO)_2Ba$ at room temperature, and less than 0.003 millimols of the chloro Benzoate and less than 0.003 millimols of the iodo benzoate (Bailar, Jr., 1931.)

BARIUM p Oxy **BENZOATE** etc.

SOLUBILITY OF EACH IN WATER AT 20°.

(Ephriam and Pfister, 1925.)

Compound	Formula	Gms. Anhydrous compound per 100cc sat. sol.
Barium p Chlor Benzoate	$(C_6H_4ClCOO)_2Ba.H_2O$	0.109
" " Oxy "	$(C_6H_4.OH.COO)_2Ba.2H_2O$	0.367
" " Methoxy "	$(C_6H_4OCH_3COO)_2Ba.H_2O$	0.0752
" " Nitro "	$(C_6H_4.NO_2.COO)_2Ba$	0.127

BARIUM SALICYLATE $Ba(C_6H_4OHCOO)_2.H_2O$.

100 gms. sat. aqueous solution contain 28.65 gms. anhydrous salt at 15° and 54.08 gms. at 100°. (Tarugi and Checchi, 1901.)

BARIUM Dinitro **SALICYLATE** $Ba[C_6H_2(NO_2)_2OHCOO]_2$.

SOLUBILITY IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 25°. (Fischer, 1914, 1918.)

Vol. per cent C_2H_5OH.	Gms. $Ba[C_6H_2(NO_2)_2.OHCOO]_2$ per 100 cc. sat. sol.	Vol. per cent C_2H_5OH.	Gms. $Ba[C_6H_2(NO_2)_2.OHCOO]_2$ per 100 cc. sat. sol.	Vol. per cent C_2H_5OH.	Gms. $Ba[C_6H_2(NO_2)_2.OHCOO]_2$ per 100 cc. sat. sol.
0.0	0.630	40.0	0.794	80.0	0.894
10.0	0.524	50.0	1.124	90.0	0.320
20.0	0.438	60.0	0.945	100.0	0.382
30.0	0.570	70.0	0.915		

The results are not of the highest accuracy since the saturated solutions were not perfectly clear and the determinations were made by evaporating and drying the dissolved compound.

BARIUM MANDELATES racemic and active $Ba[C_8H_7O_3]_2.½H_2O$

SOLUBILITY OF RACEMIC BARIUM MANDELATE IN AQUEOUS SOLUTIONS OF RACEMIC MANDELIC ACID AT 25°.

(Ross and Morrison, 1933.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$C_8H_8O_3$	$Ba[C_8H_7O_3]_2$		$C_8H_8O_3$	$Ba[C_8H_7O_3]_2$	
0.0	7.9	$Ba[C_8H_7O_3]_2.½H_2O$	9.1	1.3	1:1 Salt
0.3	7.8	"	11.5	1.1	"
1.2	6.4	1:1 Salt	13.4	1.0	"
1.7	4.7	"	14.1	1.0	"
2.0	4.2	"	15.2	1.1	"
3.2	2.6	"	17.0	1.1	"
3.8	2.3	"	17.9	1.1	"+$C_8H_8O_3$
6.6	1.7	"	16.9	0.0	$C_8H_8O_3$
7.8	1.4	"			

1:1 Salt = $Ba(C_8H_7O_3)_2.(C_8H_8O_3)_2.H_2O$

SOLUBILITY OF ACTIVE (−) BARIUM MANDELATE IN AQUEOUS SOLUTIONS OF ACTIVE (−) MANDELIC ACID AT 25°.

(Ross, Morrison and Johnstone, 1937.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$C_8H_8O_3$	$Ba[C_8H_7O_3]_2$		$C_8H_8O_3$	$Ba[C_8H_7O_3]_2$	
0.0	6.0	$Ba[C_8H_7O_3]_2.½H_2O$	7.8	4.2	Acid Salt
2.0	5.9	"	10.0	3.7	"
3.5	6.2	"	10.9	3.7	"+$C_8H_8O_3$
4.0	6.3	"	10.7	3.2	$C_8H_8O_3$
4.1	6.2	Acid Salt	10.4	2.3	"
5.7	6.2	"	10.1	0.0	"

Acid Salt = $Ba(C_8H_7O_3)_2.2C_8H_8O_3.½H_2O$.

BARIUM CINNAMATE $C_{18}H_{14}O_4Ba.2H_2O$.

100 cc. sat. solution in water contain 0.0444 gm. $C_{18}H_{14}O_4Ba$ at 20°. (Ephraim and Pfister, 1926.)

BARIUM CINNAMATES.

SOLUBILITY OF BARIUM CINNAMATES IN WATER, METHYL ALCOHOL AND ACETONE.

Compound.	Formula.	t°.	Solvent.	Gms. Anhydrous Salt per 100 Gms. Sat. Sol.	Authority.
Barium Cinnamate	$Ba(C_9H_7O_2)_2.2H_2O$	15	H_2O	0.726	(Tarugi and Checchi, 1901.)
" "	"	100	"	2.27	" "
" Allocinnamate	$Ba(C_9H_7O_2)_2.H_2O$	19	CH_3OH	15.8	(Liebermann, 1903.)
" "	"	12	"	15.4	(Michael and Garner, 1903.)
" "	$Ba(C_9H_7O_2)_2.3H_2O$	20	"	2.56	(Michael, 1901.)
" "	"	20	$(CH_3)_2CO$	0.80	"
" "	"	20	H_2O	6	"
" Hydrocinnamate	$Ba(C_9H_7O_2)_2.2H_2O$	27	"	2.9	"
" "	"	25	CH_3OH	0.1	"
" "	"	16	"	9.7	(Michael and Garner, 1903.)
" Isocinnamate	"	20	"	70	(Michael, 1901.)
" "	"	20	$(CH_3)_2CO$	20	"
" "	"	20	H_2O	17	"

BARIUM β TRUXILATE. $BaC_{18}H_{14}O_4.2H_2O$.

100 cc. sat. solution in water contain 0.028 gm. of the salt at 26°. (de Jong, 1912.)

BARIUM α NAPHTHALENE -2- SULFONATE $Ba(C_{10}H_7SO_3)_2.H_2O$.

CH

100cc sat. solution of Barium α Naphthalene -2- Sulfonate in Water contain 0.387 gm. $Ba(C_{10}H_7SO_3)_2$ at 16.5. (Ephraim and Pfister, 1925, 1925(a)).

SOLUBILITY OF BARIUM α NAPHTHALENE -2- SULFONATE IN WATER AND IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE AT 18°.

(Fredholm, 1934.)

Solvent Gm. Equiv. per liter	Gm. Equiv. $Ba(C_{10}H_7SO_3)_2$ per liter
Water alone	0.00938 (= 5.17 gms.)
NH_4Cl 0.0996	0.0120
" " + 0.539 NH_3	0.0121
" " + 0.897 "	0.0125

BARIUM α NAPHTHALENE and α NAPHTHYLAMINE SULFONATES

SOLUBILITY OF EACH IN WATER.

Compound	Formula	t°	Gms. anhydrous cmpd. per 100cc. sat. sol.
Barium naphthalene-5-chlor-1-sulfonate	$Ba(C_{10}H_6ClSO_3)_2.?H_2O$	20	.0.275(1)
" " 1.4chloro sulfonate	$Ba(C_{10}H_6ClSO_3)_2?H_2O$	18	0.08(2)
" " " " "	"	98	0.48(2)
" " 1.5 " "	"	18	0.64(2)
" " " " "	"	98	4.33(2)
" " -6-oxy-2-sulfonate	$Ba(C_{10}H_6.OH.SO_3)_2 6H_2O$	20	1.742(1)
"-2-naphthylamine-6-8-disulfonate	$Ba(C_{10}H_5NH_2SO_3)_2$	15	12.0(3)
" " " -5-7 "	"	15	22.7(3)
"-1- " -2-4-7 trisulfonate	$Ba\ C_{10}H_5NH_2(SO_3)_3$	20	25.0(4)
" " " " "	"	80	257.0(4)

(1) Ephriam and Pfister, 1925, 1925(a); (2) Ferrero and Bolliger, 1928; (3) Braunschweig, 1922, 1925; (4) Frisch, 1930.

BARIUM ANTHRAQUINONE, ANTHRACENE and PHENANTHRENE SULFONATES

SOLUBILITY OF EACH IN WATER.

Compound	Formula	t°	Gms. anhydrous salt per 100 cc. sat. sol.
Barium anthraquinone-1-Sulfonate	$Ba(C_{14}H_7O_2SO_3)_2 \cdot H_2O$	18	0.040(1)
" " 1.5 "	"	100	0.100(1)
" " 1.5 Disulfonate	$BaC_{14}H_7O_2SO_3 \cdot 2H_2O$	18-100	0.048(1)
" " 1.8 "	$BaC_{14}H_7O_2SO_3 \cdot 3\frac{1}{2}H_2O$	18-100	0.028(1)
' " 1.6 "	$BaC_{14}H_7O_2SO_3 ?H_2O$	18	0.066(1)
" " " "	"	100	0.154(1)
" " 1.7 "	$BaC_{14}H_7O_2SO_3 \cdot 2\frac{1}{2}H_2O$	18	0.190(1)
" " " "	"	100	1.111(1)
" " 1.8 Chlor Sulfonate	$Ba(C_{14}H_6O_2ClSO_3)_2 \cdot 3H_2O$	18	0.180(1)
" " " " "	"	100	1.000(1)
" " 1.5 Nitro Sulfonate	$Ba(C_{14}H_6O_2NO_2SO_3)_2$	20	0.0715(2)
" " 1.8 " "	"	20	0.2478(2)
" Anthracene -1- Sulfonate	$Ba(C_{14}H_9SO_3)_2 \cdot 3H_2O$	20	0.069(3)
" " -2- "	$Ba(C_{14}H_9SO_3)_2 \cdot H_2O$	20	0.0048(3)
" Phenanthrene -2- "	$Ba(C_{14}H_9SO_3)_2 \cdot \frac{1}{2}H_2O$	20	0.016(4)
" " -3- "	$Ba(C_{14}H_9SO_3)_2 \cdot 3H_2O$	20	0.03(4)
" " -10- "	$Ba(C_{14}H_9SO_3)_2 \cdot 3H_2O$	20	0.13(4)
" " 10-Chlor-3- or-6-Sulfonate	$Ba(C_{14}H_8ClSO_3)_2 \cdot 2\frac{1}{2}H_2O$	20	0.01(5)

CH

(1) Fierz-David, Krebser and Anderan, 1927; these authors give their results in terms of the ccH_2O required to dissolve 1.0 gm. of the hydrated(?) compound. (2) Ullmann and Kertesz, 1919; (3) Ephraim and Pfister, 1925, 1925(a); (4) Sandquist, 1912; (5) Sandquist, 1917.

BARIUM HELIANTHATE $(C_{14}H_{14}N_3SO_3)_2Ba.\frac{1}{2}H_2O$.

1000 gms. H_2O dissolve 0.201 gm. Barium Helianthate at 20-25°. (Stark and Dohn, 1918.)

BARIUM PALMITATE $[CH_3(CH_2)_{14}COO]_2Ba$.

100 cc. abs. alcohol dissolve 0.0041 gm. barium palmitate at t° (?).

(Straüli, 1918, 1926.)

BARIUM STEARATE and Salts of Other Fatty Acids.

SOLUBILITY OF BARIUM STEARATE, PALMITATE, MYRISTATE AND LAURATE IN SEVERAL SOLVENTS. (Jacobson and Holmes, 1916.)

Solvent.	t°.	Gms. Each Salt (Determined Separately) per 100 Gms. Solvent.			
		Ba Stearate.	Ba Palmitate.	Ba Myristate.	Ba Laurate.
Water	15.3	0.004	0.004	0.007	0.008
"	50	0.006	0.007	0.010	0.011
Abs. Ethyl Alcohol	16.5	0.006	0.009	0.009	0.010
" "	50	0.003	0.004	0.004	0.007
Methyl Alcohol	15	0.042	0.045	0.057	0.084
" "	50.5	0.077	0.088	0.108	0.163
Ether	25	0.001	0.001	0.003	0.007
Amyl Alcohol	25	0.007	0.008	0.009	0.009

BARIUM HYDNOCARPATE $Ba[CH{=}CH.CH_2.CH_2CH(CH_2)_{10}COO]_2$
BARIUM CHAULMOOGRATE $Ba[CH{=}CH.CH_2.CH_2CH(CH_2)_{12}COO]_2$

SOLUBILITY OF EACH SEPARATELY IN SEVERAL SOLVENTS.

(Cole, 1932.)

Solvent	t°	Gms. Hydnocarpate per 100cc. solvent	Gms. Chaulmoograte per 100cc. solvent
95% Ethyl Alcohol	15	0.07	0.03
"	30	0.08	0.05
"	b. pt.	0.39	0.34
Ethyl Ether	15	0.03	0.02
"	30	0.04	0.02
"	b. pt.	0.06	0.04
Benzene	15	0.025	0.02
"	30	0.04	0.03
"	b. pt.	0.13	0.07
Petroleum Ether (b. pt. 30°-60°)	30	0.022	0.016

An excess of each compound was shaken with the solvent for one hour at constant temperature and 5cc. of the sat. solution evap. to dryness.

CN

BARIUM CYANIDE $Ba(CN)_2$.

SOLUBILITY IN WATER AND IN ALCOHOL AT 14°.

(Joannis — Ann. chim. phys. [5] 26, 489, '82.)

100 parts water dissolve 80 parts $Ba(CN)_2$.
100 parts 70% alcohol dissolve 18 parts $Ba(CN)_2$.

BARIUM FERROCYANIDE AND BARIUM POTASSIUM FERROCYANIDE.

(Wyrouboff — Ann. chim. phys. [4] 16, 292, '69.)

100 parts water dissolve 0.1 part $Ba_2Fe(CN)_6.6H_2O$ at 15°, and 1.0 part at 75°.

100 parts water dissolve 0.33 part $BaK_2Fe(CN)_6.5H_2O$ at ord. temp.

BARIUM THIOCYANATE $Ba(SCN)_2.3H_2O$

100 gms. sat. solution in water contains 62.87 gms. $Ba(SCN)_2$ at 25°. (Cuvelier, 1933.) This author also gives results for the system $Ba(SCN)_2 + Co(SCN)_2 + H_2O$ at 25°.

SOLUBILITY OF BARIUM THIOCYANATE IN AQUEOUS SOLUTIONS OF BARIUM HYDROXIDE AND VICE VERSA AT 25°.

(Foote and Hickey, 1937.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$Ba(OH)_2$	$Ba(SCN)_2$		$Ba(OH)_2$	$Ba(SCN)_2$	
0.0	62.63	$Ba(SCN)_2.3H_2O$	8.47	50.94	$BaOHSCN+Ba(OH)_2.8H_2O$
2.05	61.97	"	5.89	47.51	$Ba(OH)_2.8H_2O$
3.17	61.67	"+BaOHSCN	3.44	26.54	"
4.75	57.34	BaOHSCN	3.58	15.83	"
6.16	54.49	"	4.489	0.0	"

SOLUBILITY OF BARIUM THIOCYANATE IN AQUEOUS SOLUTIONS OF POTASSIUM THIOCYANATE AND VICE VERSA AT 25°.

(Occleshaw, 1931.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
KSCN	$Ba(SCN)_2$		KSCN	$Ba(SCN)_2$	
0.0	62.61	$Ba(SCN)_2.3H_2O$	43.92	31.73	$2Ba(SCN)_2.3KSCN.5H_2O$
14.45	55.72	"	45.00	30.75	"
19.46	53.14	"	47.67	28.96	"
26.04	46.60	$2Ba(SCN)_2.3KSCN.5H_2O$	48.28	28.68	" +KSCN
28.95	43.66	"	52.42	22.78	KSCN
34.02	39.45	"	62.32	10.24	"
37.18	37.04	"	70.89	0.0	"

SOLUBILITY OF BARIUM THIOCYANATE IN AQUEOUS SOLUTIONS OF AMMONIUM THIOCYANATE AND VICE VERSA AT 25°.

(Occleshaw, 1934.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
NH_4SCN	$Ba(SCN)_2$		NH_4SCN	$Ba(SCN)_2$	
0.0	62.61	$Ba(SCN)_2.3H_2O$	31.52	48.43	1:1:1
15.48	55.51	"	31.85	48.33	"+$NH_4(SCN)$
20.75	54.51	"	34.73	41.66	$NH_4(SCN)$
24.70	53.47	"	42.72	28.88	"
24.69	53.65	" + 1:1:1	52.36	15.31	"
m 23.53	54.61	1:1:1	57.72	8.38	"
25.64	53.37	"	64.33	0.00	"
26.73	52.36	"	m 32.19	48.05	$NH_4(SCN)$
27.41	51.63	"	m 29.90	52.12	"
28.85	50.36	"	m 29.76	52.54	"+$Ba(SCN)_2.3H_2O$
29.52	49.76	"	m 28.47	54.08	$Ba(SCN)_2.3H_2O$
29.64	49.68	"	m 35.83	53.67	"
30.78	48.96	"	m 25.28	53.57	"
31.00	48.52	"			

1:1:1 = $Ba(SCN)_2.NH_4SCN.H_2O$ m = metastable equilibrium

SOLUBILITY OF BARIUM THIOCYANATE IN AQUEOUS SOLUTIONS OF SODIUM THIOCYANATE AND VICE VERSA AT 25°.

(Occleshaw, 1931.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
NaSCN	$Ba(SCN)_2$		NaSCN	$Ba(SCN)_2$	
0.0	62.61	$Ba(SCN)_2.3H_2O$	46.03	19.77	$NaSCN.2H_2O$
12.96	49.83	"	54.14	7.07	"
19.93	43.53	"	58.78	0.0	"
24.64	39.73	"	m 45.09	23.21	NaSCN
31.11	34.93	"	m 50.60	15.18	"
39.33	30.94	"	m 62.39	0.0	"
41.60	29.99	$NaSCN.2H_2O$			

m = metastable equilibrium.

BARIUM CARBONATE $BaCO_3$.

SOLUBILITY IN WATER.

(Holleman, Kohlrausch and Rose, 1893.)

Electrolytic conductivity method used.

1 liter H_2O dissolves 0.016 gm. $BaCO_3$ at 8.8°, 0.022 gm. at 18°, and 0.024 gm. at 24.2°.

SOLUBILITY OF BARIUM CARBONATE IN WATER CONTAINING CO_2.

The average of several determinations at about 10°, by Bineau, Lassaigne, Foucroy and Bergmann is 1.10 gms. $BaCO_3$ per liter water. Wagner (Z. anal. Ch. 6, 167, '67) gives 7.25 gms. $BaCO_3$ per liter of water saturated with CO_2 at 4–6 atmospheres pressure.

Eleven determinations by McCoy and Smith (1911), of the solubility of barium carbonate at 25° in water in contact with pressures of CO_2 varying from 0.2 to 30 atmospheres, showed that a maximum solubility is reached at 22 atmospheres (see also calcium carbonate) at which point the saturated solution contains 0.727 mols. = 45.1 gms. H_2CO_3 per liter and 0.028 mols. = 7.3 gms. $Ba(HCO_3)_2$ per liter. The equilibrium constant is $k = 2.24 \times 10^{-2}$ and the solubility product $Ba \times CO_3 = k_2 = 8.1 \times 10^{-9}$.

CO

BARIUM CARBONATE $BaCO_3$.

SOLUBILITY IN WATER SATURATED WITH CARBON DIOXIDE AT A PRESSURE OF ONE ATMOSPHERE AND OF TWENTY-FIVE ATMOSPHERES AT 18°.

(Haehnel, 1924.)

The flask containing the mixture was placed inside an autoclave which was shaken from time to time. By inverting the autoclave the saturated solution was filtered through a thimble into a receiver. Thus the entire operation was conducted at the desired pressure of carbon dioxide.

Pressure of Carbon Dioxide.	Gms. per 100 gms. sat. sol.	
	Carbonate.	Bicarbonate.
1.0 atmosphere	0.27	0.37
25.0 atmospheres	0.59	0.79

The limit of solubility at 18° was at 25 atmospheres pressure of CO_2.

SOLUBILITY OF BARIUM CARBONATE IN WATER FREE OF CARBON DIOXIDE AT 18°.

(Heyrovsky and Berezicky, 1929.)

The authors used the "polarographic" method which consists in registering current voltage curves obtained on electrolysis of solutions. When using as kathode mercury dropping slowly from a thick walled capillary drawn to a narrow tip, and as anode a large mercury layer at the bottom of the electrolyte vessel. This method permits the estimation of traces of reducible matter in solutions down to concentrations 10^{-5} to 10^{-6} molar, and is highly suitable for the estimation of the solubilities of sparingly soluble compounds. It has the advantage over the conductance method, that even in presence of a great excess of other electrolytes the concentration of small quantities of certain ions can be determined.

The following values were obtained for water and aqueous lithium chloride solutions in contact with an atmosphere of pure hydrogen

Normality of aq. LiCl solution	Gm. Equiv. of $BaCO_3$ dissolved per liter
0.0	5.7×10^{-4}
0.001	3.5×10^{-4}
0.01	3.5×10^{-4}
0.1	8.2×10^{-4}

SOLUBILITY OF BARIUM CARBONATE IN AQUEOUS SOLUTIONS OF CHLORIDES FREE OF CARBON DIOXIDE.

(Townley, Whitney and Felsing, 1937.)

Molality of aq. salt solution	Results at 25° Gm. Mols. $BaCO_3 \times 10^{-4}$ per 1000 gms. H_2O in aqueous solution of: LiCl	NaCl	KCl	Results at 40° Gm. Mols. $BaCO_3 \times 10^{-4}$ per 1000 gms. H_2O in aqueous solution of: LiCl	NaCl	KCl
0.00	0.9114	0.9114	0.9114	1.2217	1.2217	1.2217
0.02	1.345	1.170	1.083	1.670	1.705	1.670
0.05	1.970	1.515	1.330	2.175	2.220	2.075
0.10	2.895	2.030	1.700	2.875	2.810	2.500
0.20	4.325	2.875	2.260	4.060	3.680	3.025
0.30	5.390	3.570	2.685	5.090	4.295	3.355
0.40	6.260	4.180	3.005	6.075	4.655	3.590
0.50	6.980	4.735	3.285	7.015	5.130	3.760
1.00	10.05	6.900	4.160	11.505	6.210	4.190
3.00	24.84	9.950	4.685	29.795	8.615	4.950

SOLUBILITY OF BARIUM CARBONATE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AND OF SODIUM CHLORIDE.

(Cantoni and Goguelia, 1905.)

CO

In KCl at B.pt. of Sol.		In NaCl at B.pt. of Sol.		In 10% KCl Sol.		In 10% NaCl Sol.	
Gms. KCl per 100 Gms. Sol.	Gms. $BaCO_3$ per 1000 cc. Sat Sol.	Gms NaCl per 100 Gms. Sol.	Gms. $BaCO_3$ per 1000 cc. Sat. Sol.	t°.	Gms $BaCO_3$ per 1000 cc. Sat. Sol.	t°.	Gms. $BaCO_3$ per 1000 cc. Sat. Sol.
0.15	0.0847	0.15	0.0587	10	0.2175	10	0.1085
1.00	0 1781	1	0.0787	20	0.2408	20	0.1126
3	0 2667	3	0.1056	40	0 2972	40	0 1231
10	0 4274	10	0 1575	60	0 3491	40	0 1303
30	0.5550	30	0.2784	80	0.4049	40	0 1418

Barium carbonate boiled with aqueous NH_4Cl is slowly but completely decomposed. The time required varies inversely as the concentration of the NH_4Cl solution.

Data are also given for solubility in 10% aqueous KCl and NaCl at the boiling point, the time factor being varied from 1 to 198 hours.

Data for lowering of the melting point of $BaCO_3$ by Na_2CO_3 are given by Sackur (1911-12).

SOLUBILITY OF BARIUM CARBONATE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE AT 30°.

(Kernot, d'Agostino and Pellegrino, 1908.)

Gms. per 1000 cc. H_2O. $BaCO_3$.	NH_4Cl.	Solid Phase.	Gms. per 1000 cc. H_2O. $BaCO_3$.	NH_4Cl.	Solid Phase.
0.035	0	$BaCO_3$	2.245	335.70	$BaCO_3$
0.521	8.099	"	2.706	358.66	"
1.333	64.536	"	2.630	418.33	NH_4Cl
1.596	92.593	"	2.151	414.71	"
2	160.265	"	1.558	413.77	"
2.093	186.775	"	0.730	410.16	"
2.256	268.920	"	0	397.58	"

Data are also given for 25°. Some uncertainty exists as to the terms in which the results are expressed. In some cases the column headings read "Gms. per liter of H_2O" and in others "Gms. per liter of solution." The saturation was effected by adding just the necessary amount of one constituent to cause the disappearance of the last particle of the other. The amounts so added were determined by weighing the flasks. At high concentrations of the two salts, the sudden increase in solubility appears to indicate a molecular combination.

SIMULTANEOUS SOLUBILITY OF BARIUM CARBONATE AND SULFATE IN AQUEOUS SOLUTIONS OF POTASSIUM SALTS. (Ramann and Sallinger, 1921.)

Barium chloride solutions were added to various mixtures of K_2CO_3 and K_2SO_4 dissolved in water, and the distribution of barium between CO_3 and SO_4 determined at various temperatures and after various lengths of time.

Data for solubility of barium carbonate in aqueous hydroxylamine solutions are given by Hahn and Brunngässer, 1926.

BARIUM OXALATE BaC_2O_4.

SOLUBILITY OF THE THREE HYDRATES IN WATER.

(Groschuff — Ber. 34, 3318, '01.)

	$BaC_2O_4.3\frac{1}{2}H_2O$.		$BaC_2O_4.2H_2O$.		$BaC_2O_4.\frac{1}{2}H_2O$.	
t°	Gms BaC_2O_4 per 1000 g. Sol.	G. M. BaC_2O_4 per 100 Mol. H_2O.	Gms. BaC_2O_4 per 1000 g. Sol.	G. M. BaC_2O_4 per 100 G. M. H_2O.	Gms. BaC_2O_4 per 1000 g. Sol.	G. M. BaC_2O_4 per 100 Mol. H_2O.
0	0.058	0.00046	0.053	0.00042	0.089	0.00070
9.5	0.082	0.00066	...	...	...	...
18	0.112	0.00090	0.089	0.00071	0.124	0.00099
30	0.170	0.00136	0.121	0.00097	0.140	0.00112
40	...	...	0.152	0.00122	0.151	0.00121
45	...	...	0.169	0.00135	...	...
50	...	...	...	...	0.164	0.00131
55	...	...	0.212	0.00170	...	...
60	...	...	...	...	0.175	0.00140
65	...	...	0.250	0.00200	...	...
73	...	...	0.285	0.00228	...	...
75	...	...	...	...	0.188	0.00151
90	...	...	...	...	0.200	0.00160
100	...	...	...	...	0.211	0.00169

The following additional data for the solubility of the above three hydrates in water are given by (Kohlrausch, 1908).

$BaC_2O_4.3\frac{1}{2}H_2O$.		$BaC_2O_4.2H_2O$		$BaC_2O_4.\frac{1}{2}H_2O$.	
t°	Gms per Liter	t°.	Gms per Liter.	t°	Gms per Liter.
2.07	0.0553	3	0.0519	0.08	0.0499
4.2	0.059	5.47	0.0575	2.46	0.053
16.1	0.0962	11.28	0.0693	9.62	0.0619
17.8	0.1047	17.9	0.085	15.04	0.0699
		23.3	0.0987	17.54	0.0751
		28.4	0.1124	27.02	0.091
				33.73	0.1018

Cantoni and Diotalevi (1905) obtained higher results than either of the above.

Scholder, Gadenne and Niemann, 1937, using both conductivity and titrametric methods obtained the following results for the solubility of the three hydrates in water.

t°	Gms. BaC_2O_4 per 1000cc. sat. solution	Solid Phase
18	0.1129	$BaC_2O_4.3\frac{1}{2}H_2O$
18	0.0880	$BaC_2O_4.2H_2O$
18	0.1165	$BaC_2O_4.2H_2O$

Money and Davis, 1934, found the solubility of $BaC_2O_4.2H_2O$ in water at 25° to be 0.0004826 gm. mols (= 0.1087 gm. BaC_2O_4) per liter.

BARIUM ACID OXALATE $BaC_2O_4.H_2C_2O_4.2H_2O$.

SOLUBILITY IN WATER.

(Groschuff.)

t°.	Gms. per 100 Gms. Solution.		Mols. per 100 Mols. H_2O.		Mols. $H_2C_2O_4$ per 1 Mol. BaC_2O_4.
	$H_2C_2O_4$.	BaC_2O_4.	$H_2C_2O_4$.	BaC_2O_4.	
0	0.27	0.030	0.054	0.0024	22
18	0.66	0.070	0.130	0.0056	24
20.5	0.76	0.076	0.15	0.0061	25
38	1.61	0.16	0.33	0.013	25
41	1.82	0.18	0.37	0.015	25
53	2.92	0.31	0.60	0.026	24
60	3.60	0.40	0.75	0.033	22.5
80	6.21	0.81	1.34	0.070	19
90	7.96	1.11	1.75	0.098	18
99	10.50	1.55	2.39	0.141	17

Experiments designed to show the solubility of barium acid oxalate in aqueous solutions of hydrochloric acid at 20° are described by Trapp, 1935. Aqueous solutions of barium chloride and oxalic acid were mixed and shaken until equilibrium was reached. The supernatant solution was then analyzed for hydrochloric acid, oxalic acid, and barium. Additional volumes of barium chloride and oxalic acid solution were then added to the original mixture and the operation repeated. The results, plotted in terms of BaO and HCl, show a break in the curve corresponding to a transition from $BaC_2O_4.H_2C_2O_4.3H_2O$ to $BaC_2O_4.H_2C_2O_4.2H_2O$.

CO

BARIUM OXALATE

SOLUBILITY OF BARIUM OXALATE IN AQUEOUS SOLUTIONS OF SALTS AT 25°.

(Money and Davies, 1938.)

Salt	Gm. Mols. Salt per liter aq. solution	Gm. Mols. BaC_2O_4 per liter sat. sol.	Salt	Gm. Mols. Salt per liter aq. solution	Gm. Mols. BaC_2O_4 per liter sat. sol.
None (= H_2O)	0.0	0.000483	KNO_3	0.000984	0.000509
KCl	0.00096	0.000496	"	0.00493	0.000558
"	0.00480	0.000563	"	0.00992	0.000643
"	0.00747	0.000588	"	0.04966	0.000938
"	0.00994	0.000616	"	0.100	0.001226
"	0.020	0.000700	$MnCl_2$	0.0005	0.000698
"	0.050	0.000891	"	0.00225	0.001350
"	0.100	0.001118	"	0.00512	0.002103

SOLUBILITY OF BARIUM OXALATE IN AQUEOUS SOLUTIONS OF AMMONIUM OXALATE AT 25°.

(Money and Davies, 1934.)

Gm. Mols. per liter		Solid Phase
$(NH_4)_2C_2O_4$	BaC_2O_4	
0.00054	0.000393	$BaC_2O_4.2H_2O$
0.00258	0.000070	"
0.00491	0.000050	"

SOLUBILITY OF BARIUM OXALATE IN AQUEOUS SOLUTIONS OF URANYL OXALATE AND VICE VERSA.

(Colani, 1934.)

Weighed amounts of barium oxalate and uranyl oxalate were adddd to a given volume of water and the mixtures agitated until attainment of equilibrium. The supernatant solutions were analyzed gravimetrically. This method is not sufficiently accurate for the determination of the solubility of the alkaline earth oxalates but, due to the considerable increase in the solubility of those oxalates by very small quantities of uranyl oxalate, it yields satisfactorily concordant results.

CO

Results at 15°			Results at 50°		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$UO_2C_2O_4$	BaC_2O_4		$UO_2C_2O_4$	BaC_2O_4	
0.0221	0.0209	$BaC_2O_4.2H_2O$	0.0461	0.0366	$BaC_2O_4.2H_2O$
0.0432	0.0315	"	0.166	0.102	"
0.0449	0.0306	$Ba_2UO_2(C_2O_4)_3.7H_2O$	0.239	0.130	$Ba_2UO_2(C_2O_4)_3.7H_2O$
0.0548	0.0353	"	0.368	0.186	"
0.0777	0.0479	"	0.443	0.211	"
0.140	0.0592	$BaUO_2(C_2O_4)_2.5H_2O$	0.684	0.251	$BaUO_2(C_2O_4)_2.5H_2O$
0.166	0.0600	"	0.911	0.315	"
0.422	0.0640	"	1.54	0.354	"
0.525	0.0706	"	1.62	0.370	"
0.563	0.0772	"	1.58	0.343	$UO_2.C_2O_4.3H_2O$
0.460	0.0252	$UO_2C_2O_4.3H_2O$	1.30	0.193	"
0.453	0.0137	"	1.00	0.0	"
0.470	0.0	"			

SOLUBILITIES OF BARIUM OXALATE ($BaC_2O_4.\frac{1}{2}H_2O$) IN AQUEOUS ACETIC ACID AT 26°–27°.

(Herz and Muhs, 1903.)

Normality of Acetic Acid.	G. Residue* per 50.05 cc. Sol.	Gms. per 100 cc. Solution.		Normality of Acetic Acid.	G Residue* per 50 cc. Sol	Gms. per 100 cc. Solution	
		CH_3COOH.	Ba Oxalate.			CH_3COOH.	Ba Oxalate
0	0.0077	0.00	0.0154	3.85	0.0564	23.12	0.1127
0.565	0.0423	3.39	0.0845	5.79	0.0511	34.76	0.1021
1.425	0.0520	8.55	0.1039	17.30	0.0048	103.90	0.0096
2.85	0.0556	17.11	0.1111	...	...	...	...

* Dried at 70°.

The equations for the solubility of barium oxalate precipitated in presence of sodium oxalate are deduced by Babko, 1935 and a few experimental results are given.

Cl

BARIUM CHLORIDE $BaCl_2.2H_2O$.

SOLUBILITY IN WATER.

(Mulder, Engel, 1888; Etard, 1894.)

t°.	Gms $BaCl_2$ per 100 Gms Water.	Gms $BaCl_2$ per 100 Gms Solution.	t°	Gms $BaCl_2$ per 100 Gms. Water	Gms $BaCl_2$ per 100 Gms. Solution.
0	31.6	24	60	46.4	31.3
10	33.3	25	70	49.4	33.1
20	35.7	26.3	80	52.4	34.4
25	37	27	100	58.8	37
30	38.2	27.7	130	59.5	37.3
40	40.7	28.9	160	63.6	38.9
50	43.6	30.4	215	75.9	43.1

Sp. Gr. of solution saturated at 0° = 1.25; at 20° = 1.27.

More recent determinations of the solubility of barium chloride in water are as follows:

t°	Gms. BaCl per 100 gms. sat. solution
0	23.49 (10), 23.57 (6), 23.70 (2)
20	26.20 (8), 26.28 (7), 26.32 (11), 26.31 (14)
25	26.93 (9), 27.02 (15), 27.08 (12), 27.09 (10) 27.10 (5) (6), 27.16 (13)
30	27.61 (1), 27.84 (4)
60	31.57 (3)

(1) Schreinemakers, 1909-10, 1910b; (2) Schreinemakers, 1910; (3) Schreinemakers and Messinik, 1910; (4) Masson, 1911, 1912-13; (5) Wolkow, 1926; (6) Wolkow, 1927; (7) Benrath, 1927; (8) DiCapua and Bertoni, 1928; (9) Benrath and Ammer, 1929; (10) Jelissejew, 1926; (11) Findlay and Cruickshank, 1926; (12) Bassett, Barton, Foster and Patemann, 1933; (13) Foote and Hickey, 1937; (14) Taylor, Caley and Evring, 1933; (15) Politzsch, 1928, 1929.

100 gms. water containing 92% H_2H_2O (heavy water) dissolve 28.9 gms. $BaCl_2$ at 20°. (Taylor, Caley, and Evring, 1933.)

SOLUBILITY OF BARIUM CHLORIDE IN AQUEOUS SOLUTIONS OF BARIUM CHLORATE AND VICE VERSA AT 20°.

Cl

(DiCapua and Bertoni, 1928.)

Gms. per 100 gms. sat sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$Ba(ClO_3)_2$	$BaCl_2$		$Ba(ClO_3)_2$	$BaCl_2$	
0.0	26.20	$BaCl_2.2H_2O$	19.21	19.55	$BaCl_2.2H_2O$
5.51	24.11	"	22.84	17.00	" + $Ba(ClO_3)_2.H_2O$
9.32	24.00	"	24.39	7.69	$Ba(ClO_3)_2.H_2O$
13.03	22.0	"	25.16	0.0	"
17.48	19.50	"			

The results in the author's printed tables differ from his figures for the solubility of each salt separately in water by an amount which is exactly equal to the water of hydration in each salt. The above results have, therefore, been calculaged from those in the a author's table, which had evidently been erroneously corrected for water of hydration in $BaCl_2$ and $Ba(ClO_3)_2$.

BARIUM CHLORIDE $BaCl_2.2H_2O$.

SOLUBILITY OF BARIUM CHLORIDE AT 20° IN AQUEOUS SOLUTIONS OF :

(Findlay and Cruickshank, 1926.)

Barium Nitrate.

Gms. per 100 gms. sat. sol.		Solid Phase.
$Ba(NO_3)_2$.	$BaCl_2$.	
0.0	26.32	$BaCl_2.2H_2O$
1.31	26.07	»
6.93	25.09	» + $Ba(NO_3)_2$
6.54	20.81	$Ba(NO_3)_2$
6.72	12.31	»
7.17	7.51	»
8.41	0.00	»

Sodium Chloride.

Gms. per 100 gms. sat. sol.		Solid Phase.
NaCl.	$BaCl_2$.	
7.80	16.89	$BaCl_2.2H_2O$
9.54	14.99	»
14.50	10.04	»
18.52	6.51	»
21.23	4.17	»
24,59	3.07	» + NaCl
25.28	1.65	NaCl

The following data for quarternary solutions are also given.

Gms. per 100 gms. sat. solution.				Solid Phase.
NaCl.	$NaNO_3$.	$Ba(NO_3)_2$.	$BaCl_2$.	
6.57	37.82	1.62	-	$NaNO_3 + Ba(NO_3)_2$
15.79	24.08	0.14	-	$NaCl + Ba(NO_3)_2$
2.02	-	6.49	22.66	$BaCl_2.2H_2O + Ba(NO_3)_2$
14.23	29.75	0.13	-	$NaCl + NaNO_3 + Ba(NO_3)_2$
*24.16	0.50	7.14	-	$BaCl_2.2H_2O + NaCl + Ba(NO_3)_2$

* This solution is incongruently saturated.

SOLUBILITY OF MIXTURES OF BARIUM CHLORIDE AND BARIUM NITRATE IN WATER:

At 30°. (Coppadoro, 1912, 1913.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.
$BaCl_2$.	$Ba(NO_3)_2$.	
6.06	9.55	$Ba(NO_3)_2$
13.75	8.20	"
16.14	7.92	"
22.70	7.94	"
26.11	7.88	$Ba(NO_3)_2 + BaCl_2.2H_2O$
26 64	5.37	$BaCl_2.2H_2O$
26.91	4.13	"
27.38	1.58	"

At Varying Temps. (Etard, 1894.)

t°.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
	$BaCl_2$.	$Ba(NO_3)_2$.	
0	22.5	4.3	$BaCl_2.2H_2O + Ba(NO_3)_2$
20	24.5	6	"
40	26.5	7.5	"
60	28.5	9.5	"
100	31	14	"
140	32	20	"
180	33	26	"
210	32	32	"

C1 Results for the system $BaCl_2.2H_2O + Ba(NO_3)_2 + NaNO_3 + NaCl + H_2O$ at 30° are given by Coppadoro, 1913.

Results for the system $BaCl_2.2H_2O + BaO + Na_2O + H_2O$ at 30° are given by Schreinemakers, 1910b.

SOLUBILITY OF BARIUM CHLORIDE IN AQUEOUS SOLUTIONS OF BARIUM HYDROXIDE AT 25° AND VICE VERSA.

(Foote and Hickey, 1937.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$Ba(OH)_2$	$BaCl_2$		$Ba(OH)_2$	$BaCl_2$	
0.0	27.16	$BaCl_2.2H_2O$	4.12	19.31	$BaOHCl.2H_2O + Ba(OH)_2.8H_2O$
0.89	26.94	"	4.06	17.05	$Ba(OH)_2.8H_2O$
1.39	26.83	"	4.05	15.33	"
1.77	26.72	"	4.03	12.62	"
1.94	26.70	" + $BaOHCl.2H_2O$	4.04	10.10	"
2.65	23.57	$BaOHCl.2H_2O$	4.10	6.788	"
3.13	22.05	"	4.224	3.649	"
3.38	20.79	"	4.489	0.0	

SOLUBILITY OF BARIUM CHLORIDE IN AQUEOUS SOLUTIONS OF BARIUM HYDROXIDE AND VICE VERSA AT 30°.

(Schreinemakers, 1909-1910, 1910b.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
$BaCl_2$.	BaO.		$BaCl_2$.	BaO.	
27.6	0	$BaCl_2.2H_2O$	18.67	4.61	$BaCl(OH).2H_2O + BaO.9H_2O$
27.42	1.78	"	18.04	4.62	$BaO.9H_2O$
27.36	1.77	" $+BaCl(OH).2H_2O$	17.08	4.60	"
24.98	2.33	$BaCl(OH).2H_2O$	12.81	4.58	"
21.46	3.27	"	10.77	4.45	"
19.18	4.67	"	0	4.99	"

BARIUM CADMIUM CHLORIDE $BaCl_2 . 2(CdCl_2).5H_2O$.

SOLUBILITY IN WATER.

(Rimbach — Ber. 30, 3083, '97.)

t°.	100 Gms. Solution contain Gms.			Gms. $BaCl_2 . 2(CdCl_2)$ per 100 Gms.	
	Cd.	Cl.	Ba.	Solution.	Water.
22.6	17.71	16.89	11.0	45.60	83.82
41.3	19.22	18.15	11.77	49.14	96.62
53.9	19.85	18.75	12.41	51.04	104.25
62.2	20.59	19.66	12.83	53.08	113.13
69.5	21.20	20.18	13.09	54.47	119.64
107.2	24.25	23.23	14.90	62.38	165.85

BARIUM CADMIUM CHLORIDE $BaCl_2 . CdCl_2.4H_2O$.

SOLUBILITY IN WATER.

(Rimbach.)

t°.	100 Gms. Solution contain Gms.			Gms. $BaCl_2 . CdCl_2$. per 100 Gms.	
	Cd.	Cl.	Ba.	Solution.	Water.
22.5	11.98	15.19	14.71	41.88	72.06
32.9	12.40	16.18	16.09	44.67	80.73
41.4	13.05	16.95	16.81	46.81	88.01
53.4	13.96	18.21	18.13	50.30	101.21
62.0	14.73	18.81	18.74	52.28	109.56
97.8	17.57	22.48	22.00	62.05	163.50
108.3	18.53	23.51	22.79	64.83	184.33
109.2	18.67	23.69	29.95	65.31	188.27

C1

SOLUBILITY OF BARIUM CHLORIDE IN AQUEOUS SOLUTIONS OF COBALT CHLORIDE AT 20°.

(Mazzetti. 1926.)

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
$CoCl_2$.	$BaCl_2$.		$CoCl_2$.	$BaCl_2$.	
6.34	16.50	$BaCl_2 . 2H_2O$	29.57	0.88	$BaCl_2 . 2H_2O$
13.14	10.03	»	33.80	0.38	»
19.52	5.48	»	34.15	0.37	»
24.92	2.01	»	34.43	0.45	» + $CoCl_2 . 6H_2O$

SOLUBILITY OF BARIUM CHLORIDE IN AQUEOUS SOLUTIONS OF COPPER CHLORIDE AT 30° AND VICE VERSA.

(Schreinemakers and de Baat, 1908–09.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
$BaCl_2$.	$CuCl_2$.		$BaCl_2$.	$CuCl_2$.	
0	43.95	$CuCl_2.2H_2O$	5.49	30.76	$BaCl_2.2H_2O$
1.25	42.45	"	10.13	21.76	"
3.08	42.07	" (unstable)	17.08	11.49	"
2.72	42.36	$CuCl_2.2H_2O + BaCl_2.2H_2O$	22.78	5.13	"
2.84	41.18	$BaCl_2.2H_2O$	27.6	0	"
3.98	37.42	"			

Solubility data have been determined for the following systems:

$BaCl_2.2H_2O + CuCl_2.2H_2O + NH_4Cl + H_2O$ at 30°. (Schreinemakers, 1909.)
" + " + $KCl + H_2O$ at 40° and 60°. (" and de Baat, 1914.)
" + " + $NaCl + H_2O$ at 30°. (" and de Baat, 1908–09.)

EQUILIBRIUM IN THE SYSTEM BARIUM OXIDE, HYDROCHLORIC ACID AND WATER AT 30°. (Millikan, 1918.)

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
HCl.	BaO.	Solid Phase.	HCl.	BaO.	Solid Phase.
0.0	4.99	$BaO.9H_2O$	9.58	21.90	$BaCl_2.BaO.5H_2O + BaCl_2.2H_2O$
3.77	12.38	»	9.60	21.97	$BaCl_2.2H_2O$
4.49	14.01	»	9.66	20.32	»
6.32	17.90	»	9.66	18.21	»
6.34	17.98	» + $BaCl_2.BaO.5H_2O$	10.48	9.55	»
6.57	18.40	» »	12.90	2.83	»
6.72	18.79	$BaCl_2.BaO.5H_2O$	18.27	0.16	»
7.51	19.07	»	32.35	0.0	»
8.47	20.32	»	37.34	0.0	» + $BaCl_2.H_2O$
8.75	20.72	»	38.63	0.0	$BaCl_2.H_2O$

SOLUBILITY OF BARIUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID:

Cl

At 0°. (Engel, 1888.)			At 30°. (Masson, 1911, 1912–13; Schreinemakers, 1909–10.)		
Sp. Gr Sat. Sol.	Gms per 100 Gms. Sat. Sol.		Sp. Gr Sat. Sol.	Gms. per 100 Gms. Sat. Sol.	
	HCl.	$BaCl_2$.		HCl.	$BaCl_2$.
1.250	0	24.07	1.3056	0	27.84
1.242	0.32	23.31	1.2651	1.36	24.02
1.228	0.83	22.11	1.2147	3.32	19.20
1.210	1.51	20.14	1.1789	5.01	15.2
1.143	4.58	12.76	1.1419	7.13	11.1
1.118	6.13	9.37	1.1068	10	5.8
1.099	7.55	6.33	1.0880	13.43	2.4
1.079	10.81	2.64	1.0895	16.92	0.38
1.088	16.92	0.78	1.1024	20.62	0
			1.1609	32.18	0

The results of Schreinemakers show that at 37.34% HCl the barium chloride dihydrate is converted into monohydrate.

Less than 1 part of $BaCl_2$ is soluble in 20,000 parts of concentrated HCl and in 120,000 parts of conc. HCl containing ½ volume of ether. (Mar, 1892.)

SOLUBILITY OF BARIUM CHLORIDE IN AQUEOUS SOLUTIONS OF MERCURIC CHLORIDE AT 25° AND VICE VERSA.

(Bassett, Barton, Foster and Pateman, 1933.)

Gms. per 100 gms. sat. sol.		Solid	Gms. per 100 gms. sat. sol.		Solid
$HgCl_2$	$BaCl_2$	Phase	$HgCl_2$	$BaCl_2$	Phase
0.0	27.08	$BaCl_2.2H_2O$	53.83	23.11	$BaCl_2.2H_2O$
8.10	26.54	"	54.84	22.85	" $+HgCl_2$
14.98	26.73	"	54.43	21.96	$HgCl_2$
32.45	26.07	"	44.58	16.23	"
43.51	25.22	"	35.36	11.19	"
51.34	23.82	"	15.07	3.28	"
53.69	23.23	"	6.90	0.0	"

Results for the system $BaCl_2.2H_2O + HCl + NaCl + H_2O$ at 30° are given by Schreinemakers 1909-10, 1910b.

SOLUBILITY OF BARIUM CHLORIDE IN AQUEOUS SOLUTIONS OF MERCURIC CHLORIDE:

At 0°. (Schreinemakers, 1910) | At 30°. (Schreinemakers, 1910.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms per 100 Gms Sat. Sol.		Solid Phase.
$HgCl_2$.	$BaCl_2$.		$HgCl_2$.	$BaCl_2$.	
0	23.70	$BaCl_2.2H_2O$	0	27.77	$BaCl_2$ $2H_2O$
14.25	24	"	2.90	27.56	"
36.20	24.89	"	12.98	26.99	"
46.08	24.05	$BaCl_2.3HgCl_2.6H_2O+BaCl_2.2H_2O$	34.57	26.69	"
46.59	23.28	$BaCl_2.3HgCl_2.6H_2O$	46.50	25.22	"
47.78	21.05	"	55.22	23.17	" $+HgCl_2$
48.46	20.67	" $+HgCl_2$	48.97	17.87	$HgCl_2$
44.33	18.50	$HgCl_2$	41.30	14.26	"
29	11.59	"	27.62	8.41	"
16.36	6.11	"	14.19	2.65	"
3.95	0	"	7.67	0	"

SOLUBILITY OF MIXTURES OF BARIUM CHLORIDE AND MERCURIC CHLORIDE IN WATER.

(Foote and Bristol — Am. Ch. J. 32, 248, '04.)

t°.	Gms. per 100 Gms. Solution.		Solid Phase.	t°.	Gms. per 100 Gms. Solution.		Solid Phase.
	$BaCl_2$.	$HgCl_2$.			$BaCl_2$.	$HgCl_2$.	
10.4	23.58	50.54	$BaCl_2.2H_2O+$ $HgCl_2$.	10.4	22.10	51.66	Double Salt $BaCl_2.3HgCl_2.6H_2O$.
10.4	23.44	50.74	Double Salt $BaCl_2.3HgCl_2.6H_2O$.	10.4	21.64	51.74	$BaCl_2.2H_2O+HgCl_2$.
10.4	22.58	51.23		25	23.02	54.83	
10.4	22.48	51.41					

SOLUBILITY OF MIXTURES OF BARIUM CHLORIDE AND POTASSIUM CHLORIDE IN WATER. (Foote. 1904.)

100 gms. saturated solution contain 13.83 gms. $BaCl_2$ + 18.97 gms. KCl at 25°.

SOLUBILITY OF MIXTURES OF BARIUM CHLORIDE AND AMMONIUM CHLORIDE IN WATER.

At 30°. (Schreinemakers, 1908.)

Gms. per 100 Gms. Sat Sol		Solid Phase.
$BaCl_2$.	NH_4Cl	
22.16	5.71	$BaCl_2.2H_2O$
18.36	10.06	"
15.42	13.84	"
10.89	20.01	"
8.33	24.69	"
7.97	25.92	$BaCl_2$ $2H_2O+NH_4Cl$
3.56	27.47	NH_4Cl

At Varying Temps. (Schreinemakers, 1910b.)

t°.	Gms per 100 Gms Sat Sol.		Solid Phase.
	$BaCl_2$.	NH_4Cl	
16.2	8.07	16.10	$BaCl_2.2H_2O+NH_4Cl$
0	8.22	19.26	"
30	8.19	24.89	"
40	8.40	26.93	"
50	8.55	29.53	"

SOLUBILITY OF MIXTURES OF BARIUM CHLORIDE AND SODIUM CHLORIDE IN WATER:

At 30°.

(Schreinemakers and de Baat, 1908-09)

Gms. per 100 Gms. Sat Sol.		Solid Phase.	Gms per 100 Gms. Sat Sol.		Solid Phase.
$BaCl_2$.	NaCl.		$BaCl_2$.	NaCl.	
0	26.47	NaCl	12.25	13.39	$BaCl_2.2H_2O$
2.28	25.28	"	15.83	10.06	"
3.80	23.77	" $+BaCl_2$ $2H_2O$	20.93	5.39	"
5.76	20.25	$BaCl_2.2H_2O$	24.24	2.76	"
8.19	17.89	"	27.60	0	"

At Varying Temps.

(Precht and Wittgen, 1881; Rüdorff, 1885)

t°.	Gms per 100 Gms. Sat. Sol.	
	$BaCl_2$.	NaCl.
20	2.9	25
40	4.5	23
60	6.8	23.4
80	9.4	22.8
100	11.8	22.2

SOLUBILITY OF BARIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AT 20° AND VICE VERSA

(DiCapua and Bertoni, 1928.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
NaCl	$BaCl_2$		NaCl	$BaCl_2$	
0.0	26.20	$BaCl_2.2H_2O$	19.53	18.52	NaCl
4.03	25.00	"	20.32	12.10	"
8.00	24.50	"	22.01	9.98	"
12.00	22.12	"	23.51	4.26	"
14.56	21.51	"	26.5	0.0	"
16.50	21.29	"			

The above results for $BaCl_2$ have been calculated from the figures in the author's table which had evidently been erroneously corrected for water of crystallization.

SOLUBILITY OF BARIUM CHLORIDE IN AQUEOUS SOLUTIONS OF LEAD CHLORIDE AT 0° AND AT 25° AND VICE VERSA.

(Wolkow, 1927.)

Cl

t°	Gms. per 100 gms. H_2O		Solid Phase	t°	Gms. per 100 gms. H_2O		Solid Phase
	$PbCl_2$	$BaCl_2$			$PbCl_2$	$BaCl_2$	
0	0.0	30.82	$BaCl_2.2H_2O$	25	0.531	37.48	$BaCl_2.2H_2O$
0	0.25	31.05	" + $PbCl_2$	25	0.745	37.55	"
0	0.0627	12.42	$PbCl_2$	25	0.87	37.55	" + $PbCl_2$
0	0.0635	5.16	"	25	0.659	33.88	$PbCl_2$
0	0.625	0.0	"	25	0.420	26.91	"
25	0.0	37.18	$BaCl_2.2H_2O$	25	0.333	23.00	"
25	0.183	37.35	"	25	0.22	15.50	"
25	0.309	37.49	"	25	0.183	10.36	"
25	0.447	37.59	"	25	0.198	5.08	"
25	0.462	37.59	"	25	1.08	0.0	

Results for the system $BaCl_2 + PbCl_2 + HCl + H_2O$ at 0° and at 25° are also given by Wolkow, 1927.

SOLUBILITY OF BARIUM CHLORIDE IN AQUEOUS ETHYL ALCOHOL SOLUTIONS.

At 15°. (Schiff, 1861; Rohland, 1897.)		At 30°.			At 60°. (Schreinemakers and Messink, 1910)		
Wt. % C_2H_5OH.	Gms. $BaCl_2$ per 100 Gms. Solvent.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
		C_2H_5OH.	$BaCl_2$.		C_2H_5OH.	$BaCl_2$.	
10	31.1	0	27.95	$BaCl_2.2H_2O$	0	31.57	$BaCl_2.2H_2O$
20	21.9	32.67	10.63	"	16.68	20.16	"
30	14.7	50.16	5.68	"	34.10	13.21	"
40	10.2	60.72	2.23	"	66.02	2.82	"
60	3.5	92.53	0.05	"	88.55	0.25	"
80	0.5	94.73	0.06	" $+BaCl_2.H_2O$	90.25	0.09	" $+BaCl_2.H_2O$
97	0.014	97.14	...	$BaCl_2.H_2O$	93.95	...	$BaCl_2.H_2O$
		98.17	0.08	" $+BaCl_2$			
		99.41	...	$BaCl_2$			

100 gms. methyl alcohol dissolve 2.18 gms. $BaCl_2$ at 15.5° and 7.3 gms. $BaCl_2.2H_2O$ at 6°. (de Bruyn, 1892.)

100 gms. glycerol dissolve 9.73 gms. $BaCl_2$ at 15°–16°. (Ossendowski, 1907.)

100 cc. anhydrous hydrazine dissolve 31 gms. $BaCl_2$ at room temp. (Welsh and Broderson, 1915.)

100 gms. 95% formic acid dissolve 7.3 gms. $BaCl_2$ at 19°. (Aschan, 1913.)

One liter sat. sol. in nitrobenzene contains 0.167 gm. $BaCl_2$ at 20°, 0.33 gm. at 50° and 0.40 gm. at 100°. (Lloyd, 1918.)

Data for the system $BaCl_2$ + Triethylamine + H_2O are given by Timmermans (1907).

SOLUBILITY OF MIXTURES OF BARIUM CHLORIDE AND GLYCINE IN WATER AT 20°. (Pfeiffer and Modelski, 1912.)

Gms. per 100 cc. Sat. Sol.		Solid Phase.
NH_2CH_2COOH.	$BaCl_2$.	
5.5	37	$BaCl_2.2H_2O + BaCl_2.2NH_2CH_2COOH.H_2O$
26	16	$NH_2CH_2COOH + BaCl_2.2NH_2CH_2COOH.H_2O$

SOLUBILITY OF BARIUM CHLORIDE IN MIXTURES OF WATER AND TERTIARY BUTYL ALCOHOL AT 25°.

(Ginnings, Herring and Webb, 1933.)

Cl

The composition of the homogeneous mixture (plait point) of the three components, as determined by the synthetic method, is 7.2 gms. $BaCl_2$, 34.1 gms. $(CH_3)_3COH$ and 58.7 gms. H_2O. Equations for the composition of the binodal curve are also given.

SOLUBILITY OF BARIUM CHLORIDE IN AQUEOUS SOLUTIONS OF URETHAN AT 25°.

(Palitzsch, 1928, 1929.)

Gm. Mols. per 1000 gms. H_2O		Solid Phase
$NH_2COOC_2H_5$	$BaCl_2$	
0.0	1.784	$BaCl_2.2H_2O$
1.1067	1.789	"
7.435	1.397	" + $NH_2COOC_2H_5$

SOLUBILITY OF BARIUM CHLORIDE IN ANHYDROUS ACETIC ACID.

(Davidson and Chappell, 1938.)

t°	Gm. Mol. $BaCl_2$ per 100 Gm. Mol. $BaCl_2$ + CH_3COOH
30	0.0077
45	0.0100

SOLUBILITY OF BARIUM CHLORIDE IN ANHYDROUS ACETIC ACID CONTAINING INCREASING AMOUNTS OF SODIUM BROMIDE AT 25°.

(Scholl, Hutchinson and Chandler, 1933.)

The weight concentrations as determined analytically were converted to molar concentrations by using the density of the pure acetic acid.

Molar concentration		Gms. per liter sat. sol.	
NaBr x 10^3	$BaCl_2$ x 10^3	NaBr	$BaCl_2$
0.00	1.04	0.00	0.217
0.10	1.09	0.010	0.227
0.25	1.13	0.026	0.235
0.35	1.18	0.036	0.246
0.50	1.21	0.051	0.252
0.75	1.23	0.077	0.255
1.20	1.38	0.124	0.287
1.60	1.48	0.165	0.308

SOLUBILITY OF BARIUM CHLORIDE IN SELENIUM OXYCHLORIDE ($SeOCl_2$). (Wise, 1928)

t°	25°.	40°.	50°.	70°
Gms. $BaCl_2$ per 100 gms. sat. sol.	3.95	2.35	1.23	0.71

Cl

INFLUENCE OF WATER UPON THE SOLUBILITY OF BARIUM CHLORIDE IN SELENIUM OXYCHLORIDE AT 25°.

Moles H_2O per mol. $SeOCl_2$	0.0	0.0625	0.125	0.25	0.5	1.0
Gms. $BaCl_2$ per 100 gms. sat. sol.	3.95	3.86	3.37	2.32	1.40	0.45

Fusion-point data have been determined for the following mixtures:

$BaCl_2$ + $BaCO_3$ (1)
" + $BaCrO_4$ (1)
" + BaO (1)(2)
" + $BaSO_4$ (1)(3)
" + BaF_2 (3)(4)(5)
" + BaI_2 (3)
" + $BeCl_2$ (6)
" + $CdCl_2$ (3)(7)(18)
" + $CaCl_2$ (3)(7)(8)(18)
" + " + $SrCl_2$ (9)
" + CuCl (18)

$BaCl_2$ + KCl (3)(11)(12)(23)
" + " + $MgCl_2$ (13)(14)
" + " + NaCl (15)(16)
" + LiCl (17)(18)
" + $MgCl_2$ (10)(18)
" + $MnCl_2$ (3) (10)
" + NaCl (1) (3)(12)(19)
" + RbCl (20)
" + $SrCl_2$ (3)(7)(18)(12)
" + TlCl (21)
" + $ZnCl_2$ (22)(18)

(1) Sackur, 1911-12; (2) Arndt, 1907; (3) Ruff and Plato, 1903; (4) Botta, 1911; (5) Plato, 1907; (6) Schmidt, 1926, 1929; (7) Sandonini, 1911; (8) Schaefer, 1914; (9) Schaefer, 1919; (10) Sandonini, 1912; (11) Sandonini, 1911; (12) Vortisch, 1914; (13) Valentin, 1922; (14) Matignon and Valentin, 1923; (15) Vortisch, 1914(a); (16) Gemsky ___; (17) Sandonini, 1913; (18) Sandonini, 1914; LeChatelier, 1894; (20) Hofmann, 1927; (21) Korreng, 1914; (22) Sandonini, 1912(a); (23) Elchardus and Laffitte, 1932.

BARIUM CHLORITE $Ba(ClO_2)$

SOLUBILITY OF BARIUM CHLORITE IN WATER.

(Levi, 1923.)

t^0	Gms. $Ba(ClO_2)_2$ per 100 gms. sat. sol.	t^0	Gms. $Ba(ClO_2)_2$ per 100 gms. sat. sol.
0	30.5	50	33.4
15	31.0	75	38.6
35	31.6	100	44.7

BARIUM CHLORATE $Ba(ClO_3)_2.H_2O$.

C10

SOLUBILITY IN WATER.

(Carlson, 1910; Trautz and Anschutz, 1906.)

t°.	Sp. Gr. of Sat. Sol.	Gms. $Ba(ClO_3)_2$ per 100 Gms. Sat. Sol.		t°.	Sp. Gr. of Sat. Sol.	Gms. $Ba(ClO_3)_2$ per 100 Gms. Sat. Sol.	
0	1.195	20.3*	16.90†	40	1.355	35.8*	33.16†
10	...	24.3	21.23	60	1.433	42.6	40.05
20	1.274	28.2	25.26	80	1.508	48	45.90
25	...	30	27.53	100	1.580	53.1	51.2
30	...	32	29.43	105.6 b. pt.	1.600	54.6	52.62

* *C.* † (*T* and *A*.)

The determinations of Trautz and Anschütz appear to have been made with very great care. The original paper of Carlson was not available and it has been impossible to explain the discrepancy between the two sets of results.

SOLUBILITY OF BARIUM CHLORATE IN AQUEOUS SOLUTIONS OF BARIUM HYDROXIDE AT 25° AND VICE VERSA.

(Foote and Hickey, 1937.)

Gms. per 100 gms. sat. sol. $Ba(OH)_2$	Gms. per 100 gms. sat. sol. $Ba(ClO_3)_2$	Solid Phase	Gms. per 100 gms. sat. sol. $Ba(OH)_2$	Gms. per 100 gms. sat. sol. $Ba(ClO_3)_2$	Solid Phase
0.0	27.58	$Ba(ClO_3)_2$	3.85	15.98	$Ba(OH)_2.8H_2O$
1.87	27.17	"	4.02	8.79	"
3.71	26.58	" + $Ba(OH)_2.8H_2O$	4.489	0.0	"
3.77	21.85	$Ba(OH)_2.8H_2O$			

BARIUM CHLORATE

SOLUBILITY OF BARIUM CHLORATE IN AQUEOUS SOLUTIONS OF SODIUM CHLORATE AT 20° AND VICE VERSA.

(DiCapua and Bertoni, 1929.)

Gms. per 100 gms. sat. sol. $NaClO_3$	Gms. per 100 gms. sat. sol. $Ba(ClO_3)_2$	Solid Phase	Gms. per 100 gms. sat. sol. $NaClO_3$	Gms. per 100 gms. sat. sol. $Ba(ClO_3)_2$	Solid Phase
0.0	25.16	$Ba(ClO_3)_2.H_2O$	29.52	5.01	$Ba(ClO_3)_2.H_2O$
4.52	17.92	"	36.5	3.49	"
8.5	10.90	"	43.2	2.89	" + $NaClO_3$
15.52	8.53	"	45.0	1.11	$NaClO_3$
25.32	6.49	"	49.7	0.0	"

BARIUM Per**CHLORATE** $Ba(ClO_4)_2.3H_2O$.

SOLUBILITY IN WATER.

(Carlson, 1910.)

t°.	Sp. Gr. Sat. Sol.	Gms. $Ba(ClO_4)_2$ per 100 Gms. Sat. Sol.	t°.	Sp. Gr. Sat. Sol.	Gms. $Ba(ClO_4)_2$ per 100 Gms. Sat. Sol.
0	1.782	67.3	80	2.114	83.2
20	1.912	74.3	100	2.155	84.9
40	2.009	78.2	120	2.195	86.6
60	2.070	81	140	2.230	88.3

BARIUM Per**CHLORATE** $Ba(ClO_4)_2$.

C10 SOLUBILITY OF ANHYDROUS BARIUM PERCHLORATE IN WATER AND IN SEVERAL ANHYDROUS SOLVENTS AT 20°. (Willard and Smith, 1923.)

Solvent.	$d\frac{25}{4}$ of solvent.	$d\frac{25}{4}$ of sat. sol.	Gms. $Ba(ClO_4)_2$ per 100 gms. sat. sol.	Solvent.	$d\frac{25}{4}$ of solvent.	$d\frac{25}{4}$ of sat. sol.	Gms. $Ba(ClO_4)_2$ per 100 gms. sat. sol.
Water...........	–	1.9403	66.48	*n* Butyl alcohol...	0.8059	1.1342	36.78
Methyl alcohol...	0.78705	1.7507	68.46	*iso* Butyl alcohol.	0.7981	1.1171	35.99
Ethyl alcohol....	0.78517	1.4157	55.48	Acetone.........	0.7852	1.4607	55.49
n Propyl alcohol.	0.7989	1.2145	43.07	Ethyl acetate....	0.8923	1.5236	53.04

100cc. of furfurol dissolve about 50 gms. $Ba(ClO_4)_2$ at about 20°

100cc. of "cellosolve" (mono ethyl ether of ethylene glycol) dissolve about 100 gms. of $Ba(ClO_4)_2$ at about 20°. (Chaney and Mann, 1931.)

BARIUM Hexa Artipyrine Per **CHLORATE** $Ba(COC_{10}H_{12}N_2)_6\ (ClO_4)_2$

100cc. sat. solution of the salt in water contain 91.1 gm. $Ba(COC_{10}H_{12}N_2)_6\ (ClO_4)_2$ at 20°. (Wilke-Dörfurt and Schliephake, 1929.)

BARIUM CHROMATE $BaCrO_4$.

SOLUBILITY OF BARIUM CHROMATE IN WATER.

CrO One liter of sat. solution contains 0.002 gm. of the salt at 0°; 0.0028 gm. at 10°; 0.0037 gm. at 20° and 0.0046 gm. at 30°. (Kohlrausch, 1908.)

Results higher than the above are given by Schweitzer, 1890, as follows: One liter of aqueous solution saturated at room temp. contains 0.01 gm. $BaCrO_4$; if ignited barium chromate is used, only 0.0062 gm. dissolves.

One liter sat. sol. contains 0.043 gm. of the salt at boiling point. (Mescherzski, 1882.)

Fresenius (1890) gives the following: 1 liter of sat. sol. at room temp. contains 0.02 gm. of the salt, the solvent being 1.5% sol. of $CH_3CO_2NH_4$ and 0.022 gms. when the solvent is 0.5% sol. of NH_4NO_3.

One liter of 45% aq. ethyl alcohol solution dissolves 0.000022 gm. at room temp. (Guerini, 1912.)

APPROXIMATE SOLUBILITY OF BARIUM CHROMATE IN AQUEOUS SALT-SOLUTIONS.

(Waddell, 1918.)

Freshly precipitated barium chromate was successively washed on a 11 cm. filter paper with 100 cc. portions of water and of various salt solutions. The dissolved chromate in the washings was determined by a new method of titration proposed by the author. The results do not show the maximum solubility but only the relative solubility under ordinary conditions of washing.

Solvent.	Gms. $BaCrO_4$ per 100.000 cc. wash solution.	Solvent.	Gms. $BaCrO_4$ per 100.000 cc wash solution.
Water......................	0.78	10.0 % aq. Am. nitrate.....	4.89
1.0 % aq. Am. acetate......	2.80	10.0 » » Pot. »	1.78
10.0 » » » »	3.58	10.0 » » Sod. chloride....	2.39
20.0 » » » »	5.07	1.0 » » Acetic acid......	11.04
10.0 » » » »+10% acetic ac.	8.77		

BARIUM FLUORIDE BaF_2.

SOLUBILITY IN WATER.

(Kohlrausch, 1908.)

One liter sat. sol. contains 1.586 gms. of the salt at 10°; 1.597 gms. at 15°; 1.607 gms. at 20°; 1.614 gms. at 25° and 1.620 gms. at 30°.

One liter sat. solution in water contains 1.21 gm. BaF_2 at 25° and the pH of the solution is 4.4. (Carter, 1928.)

SOLUBILITY OF BARIUM FLUORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID.

(Tananoew and Tchrelachwili, 1936.)

Paraffined vessels were used and the solutions were shaken 6 to 10 days. The normality of the HCl solutions used used was 20.01, 10.1 and 1.on. The barium was determined as sulfate, temp.?.

Normality of HCl at begining	Gm. Mols. BaF_2 dissolved per liter.	P_H of sat. sol.
0.01	0.0123	3.0
0.10	0.0414	1.6
1.0	0.1140	0.11

Fusion point data have been determined for the following mixtures:

BaF_2 + BaI_2 (Ruff and Plato, 1903.)
" + CaF_2 (Fuseya-Mori-Imamura, 1933.)
" + KF (Puschin and Baskov, 1913.)
BaF_2 + MgF_2 (Grube, 1927, Jaisle, 1926.)
" + MgF_2 (Fuseya-Mori-Imamura, 1933.)
" + NaF (Grube, 1927, Jaisle, 1926.)

BARIUM Phospho FLUORIDE $BaPO_3F$

One liter sat. solution in water contains 6.1 x 10^{-4} gm. mol. (= 0.0141 gm.) $BaPO_3F$ at 20°. (Lange, 1929.)

BARIUM Silico FLUORIDE $BaSiF_6$.

SOLUBILITY OF BARIUM SILICO FLUORIDE IN WATER.

(Carter, 1930.)

The purity of the sample was at least 98 percent, with only small amounts of silica or fluorides as impurities. The solutions were agitated for one hour and allowed to stand 24 hours.

t°	Gms. $BaSiF_4$ per 100cc. sat. sol.	t°	Gms. $BaSiF_4$ per 100 gms. sat. sol.
0	0.015	45	0.031
16	0.019	55	0.035
25	0.025	78	0.044
35	0.028		

100 gms. of a saturated solution in a solvent composed of 500 cc. H_2O + 30 cc. 1.0 n HCl + 5 gms. $(NH_4)_2SiF_6$ contain 0.013 gm. $BaSiF_6$ at 18.5°.
100 gms. of a sat. solution in a solvent composed of 270 cc. H_2O + 15 cc. 1.0 n HCl + 2.5 gm. $(NH_4)_2SiF_6$ + 95 cc. C_2H_5OH contain 0.0082 gm. $BaSiF_6$ at 18.5°.

(Leo, 1923.)

BARIUM Meta GERMANATE $BaGeO_3$

GeO 100 gms. sat. solution in water contain 0.07536 gm. $BaGeO_3$ at 25°.
(Miller and Gulezian, 1929.)

BARIUM IODIDE $BaI_2.7\frac{1}{2}H_2O$

SOLUBILITY OF BARIUM IODIDE IN WATER. (Packer and Rivett, 1926.)

t°.	$d\frac{t°}{4}$ of sat. sol.	Gms. BaI_2 per 100 gms. sat. sol.	Solid Phase.	t°.	$d\frac{t°}{4}$ of sat. sol.	Gms. BaI_2 per 100 gms. sat. sol.	Solid Phase.
- 1.0...	1.060	7.00	Ice	-5.8..	2.036	61.45	$2BaI_2.15H_2O$
- 1.7...	1.117	12.4	»	0.0..	2.071	62.5	»
- 3.7...	1.221	21.35	»	+5.0..	2.105	63.6	»
- 5.35..	1.281	26.05	»	10.0..	2.144	64.8	»
- 7.75 .	1.371	32.05	»	15.0..	2.176	65.75	»
- 9.35..	1.423	35.15	»	19.9..	2.222	67.15	»
-12.35..	1.507	39.90	»	25.0..	2.277	68.8	»
-14.95..	1.568	42.95	»	25.7..	–	68.9	»+$BaI_2.2H_2O$
-18.15..	1.634	46.1	»	26.0..	2.282	68.9	$BaI_2.2H_2O$
-22.9...	1.731	50.4	»	30.0..	2.287	64.1	»
-24.6...	1.764	51.5	»	40.0..	2.304	69.6	»
-30.2...	1.842	54.6	»	50.0..	2.32	70.1	»
-33.5...	–	56.0	» +$2BaI_2.15H_2O$	60.0..	2.331	70.7	»
-29.75..	1.905	56.8	$2BaI_2.15HO$	69.5..	2.35	71.15	»
-25.4...	1.927	57.5	»	87.7..	–	72.55	»
-20.0...	1.952	58.6	»	98.9..	–	73.35	»+$BaI_2.H_2O$
-15.4...	1.983	59.65	»	110.0..	–	74.0	$BaI_2.H_2O$
- 9.7...	2.012	60.65	»	120.0..	–	74 3	»

I

BARIUM IODIDE $BaI_2.2H_2O$.

EQUILIBRIUM IN THE SYSTEM $BaI_2 + BaO + H_2O$ AT 25°. (Millikan, 1917.)

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
BaO	BaI_2.	Solid phase.	BaO.	BaI_2.	Solid Phase
0.0	68.59	$BaI_2.2H_2O$	1.67	49.85	$BaI_2.BaO.9H_2O$
0.24	68.52	» + $BaI_2.BaO.9H_2O$	3.14	44.99	» + $BaO.9H_2O$
0.36	62.76	$BaI_2.BaO.9H_2O$	3.08	42.28	$BaO.9H_2O$
0.40	60.33	»	3.00	32.92	»
0.64	56.77	»	3.01	28.43	»
1.04	53.68	»	3.25	18.38	»
1.25	52.39	»	4.05	0.0	»

EQUILIBRIUM IN THE SYSTEM BARIUM IODIDE, IODINE AND WATER.

(Rivett and Packer, 1927.)

t°	d_4^t of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	t°	d_4^t of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
		I_2	BaI_2				I_2	BaI_2	
-15.8	—	15.9	50.4	$2BaI_2.15H_2O$	25	—	33.8	44.8	$BaI_2.2H_2O$
"	—	37.6	38.7	" "	"	—	46.8	36.4	"
"	—	51.4	32.2	" + I_2	"	—	58.6	28.8	"
"	—	50.8	31.2	I_2	"	—	61.0	27.4	" + I_2
"	—	47.5	30.8	"	"	—	50.0	26.6	I_2
"	—	37.6	28.6	" + Ice	"	1.827	33.2	24.8	"
"	—	31.3	31.4	Ice	"	1.438	19.5	19.3	"
"	—	12.7	38.7	"	"	1.214	10.0	12.4	"
"	—	0.0	43.5	"	"	1.081	3.7	5.8	"
0	2.071	0.0	62.5	$2BaI_2.15H_2O$	50	—	68.3	22.1	"
"	2.108	3.0	60.7	"	"	—	47.2	24.5	"
"	2.167	8.2	57.7	"	"	—	24.9	19.9	"
"	2.322	20.3	50.4	"	"	—	10.1	11.0	"
"	2.561	35.1	41.7	"	75.2	—	21.0	56.6	$BaI_2.2H_2O$
"	—	47.7	35.1	"	"	—	41.6	41.8	"
"	—	49.4	34.6	" + $BaI_2.2H_2O$	"	—	60.7	28.6	"
"	—	51.8	32.7	$BaI_2.2H_2O$	"	—	67.2	24.2	" + $BaI_2.H_2O$
"	—	54.0	31.4	" + I_2	"	—	74.9	18.9	$BaI_2.H_2O$
"	2.415	45.4	29.0	I_2	"	—	78.3	16.8	"
"	1.780	29.5	25.5	"	"	—	82.0	14.3	" + I_2
"	1.365	15.2	17.9	"	"	—	77.6	15.7	I_2
"	1.169	7.4	10.5	"	"	—	70.0	18.0	"
25	2.277	0.0	68.8	$BaI_2.2H_2O$	"	—	42.5	21.4	"
"	2.31	2.7	66.7	"	"	—	23.0	17.0	"
"	2.339	6.5	64.3	"	"	—	9.8	9.4	"
"	—	11.7	60.6	"	89.9	—	75.3	14.7	"
"	2.405	13.3	59.7	"	"	—	83.4	12.8	"
"	—	24.0	52.0	"					

I

SOLUBILITY OF BARIUM IODIDE IN ABSOLUTE ETHYL ALCOHOL.

(Bonnell and Jones, 1926.)

t°.	Gms. BaI_2 per 100 gms. C_2H_5OH.	t°.	Gms. BaI_2 per 100 gms. C_2H_5OH.
0	77.75	40	76.20
10	77.35	50	75.85
20	77.00	60	75.50
30	76.60	70	75.10

100 gms. 97% ethyl alcohol dissolve 1.07 gms. $BaI_2.2H_2O$ at 15°. (Rohland, 1897.)

100 gms. 95% HCOOH dissolve 75 gms. BaI_2 at 20.2°. (Aschan, 1913.)

100 cc. pyridine dissolve 8.22 gms. BaI_2 at 25°. (Müller, 1924.)

100 gms. sat. solution of barium iodide in liquid ammonia contain 0.231 gm. BaI_2 at 0°. (Linhard and Stephan, 1933, 1934.)

100 gms. liquid sulfur dioxide dissolve 0.71 gm. BaI_2 at 0°. (Jander and Ruppolt, 1937). (In a preceeding paper by Jander and Wickert, 1936, the figure 1.71 instead of 0.71 gm. BaI_2 is given.)

BARIUM PerIODIDE BaI_4.

Data for the formation of barium periodide in aqueous solutions at 25° are given by Herz and Bulla (1911). (See reference calcium perbromide, p. 186.)

BARIUM Mercuric IODIDE

A saturated solution of BaI_2 and HgI_2 in water at 23.5° was found by Duboin (1906) to have the composition $BaI_2.1.33HgI_2.7.76H_2O$, $d = 2.76$.

BARIUM IODATE $Ba(IO_3)_2.H_2O$.

SOLUBILITY IN WATER.

(Trautz and Anschutz, 1906.)

t°.	Gms. $Ba(IO_3)_2$ per 100 Gms. Solution	t°.	Gms. $Ba(IO_3)$ per 100 Gms. Solution.	t°.	Gms. $Ba(IO_3)_2$ per 100 Gms. Solution
− 0.046	0.008	30	0.031	70	0.093
+ 10	0.014	40	0.041	80	0.115
20	0.022	50	0.056	90	0.141
25	0.028	60	0.074	100	0.197

10 **One** liter sat. aqueous solution contains 0.3845 gm. $Ba(IO_3)_2$ at 25°.

(Harkins and Winninghoff, 1911.)

At room temperature Hill and Zink (1909), found 0.284 gm. $Ba(IO_3)_2$ per liter sat. aqueous solution.

SOLUBILITY OF BARIUM IODATE IN AQUEOUS SALT SOLUTIONS AT 25°.

(Harkins and Winninghoff, 1911.)

Added Salt.	Mols. Salt per Liter.	Gms. $Ba(IO_3)_2$ per Liter.	Added Salt.	Mols. Salt per Liter.	Gms. $Ba(IO_3)_2$ per Liter.	Added Salt.	Mols. Salt per Liter.	Gms. $Ba(IO_3)_2$ per Liter.
$Ba(NO_3)_2$	0.001	0.331	$Ba(NO_3)_2$	0.100	0.148	KNO_3	0.200	0.777
"	0.002	0.294	"	0.200	0.136	KIO_3	0.000106	0.368
"	0.005	0.237	KNO_3	0.002	0.396	"	0.000530	0.303
"	0.020	0.164	"	0.010	0.445	"	0.001061	0.229
"	0.050	0.149	"	0.050	0.643			

SOLUBILITY OF BARIUM IODATE IN AQUEOUS SALT SOLUTIONS AT 25°.

(MacDougall and Davies, 1935.)

In aq. KCl.		In aq. KNO_3		In aq. $KClO_3$		In aq. $KClO_4$	
Gm. Mols. per liter		Gm. Mols. per liter		Gm. Mols. per liter		Gm. Mols. per liter	
KCl	$Ba(IO_3)_2$	KNO_3	$Ba(IO_3)_2$	$KClO_3$	$Ba(IO_3)_2$	$KClO_4$	$Ba(IO_3)_2$
0.0	0.000810	0.001	0.000826	0.005	0.000880	0.004	0.000866
0.001	0.000827	0.002	0.000841	0.01	0.000924	0.008845	0.000905
0.002	0.000840	0.0035	0.000863	0.02854	0.001031	0.035	0.001045
0.0035	0.000859	0.005	0.000880	0.075	0.001184	0.075	0.001164
0.005	0.000874	0.0075	0.000906				
0.0075	0.000899	0.01	0.000932				
0.01	0.000918	0.02	0.001006				
0.02	0.000985	0.05	0.001156				
0.05	0.001117	0.10	0.001361				
0.10	0.001269						

In aq. $CaCl_2$	
Gm. Mols. per liter	
$CaCl_2$	$Ba(IO_3)_2$
0.002061	0.000884
0.004961	0.000955
0.009928	0.001046

BARIUM IODIDE

100 cc. conc. ammonia (Sp. Gr. 0.90) dissolve 0.0199 gm. $Ba(IO_3)_2$ at room temp. (Hill and Zink, 1909.)

100 cc. 95% ethyl alcohol dissolve 0.0011 gm. $Ba(IO_3)_2$ at room temp. (Hill and Zink, 1909.)

BARIUM MOLYBDATE $BaMoO_4$.

MoO

100 parts water dissolve 0.0058 part $BaMoO_4$ at 23°. (Smith and Bradbury, 1891.)

BARIUM NITRIDE $Ba(N_3)_2$.

N

SOLUBILITY OF BARIUM NITRIDE IN WATER.
(Curtius and Rissom, 1898.)

t°	0	10.5	15	17
Gms. $Ba(N)_3$ per 100 gms. sat. sol.	11.1	13.9	14.3	14.8

BARIUM NITRATE $Ba(NO_3)_2$

NO

SOLUBILITY OF BARIUM NITRATE IN WATER.

The closely agreeing determinations of Flottmann, 1928; Chlopin, Polessitzki and Tolmotschew, 1929; Friend and Wheat, 1933; and Sieverts and Petzold, 1933; were plotted on cross section paper and the following figures read from the curve. According to Friend and Wheat the grams of $Ba(NO_3)_2$ dissolved per 100 gms. of saturated solution in water is expressed by the equation $S = 4.70 + 0.173t + 0.00045t^2$. The results above 100° are by Benrath, Gjedebo, Schiffers and Wunderlich, 1937.

t°	Gms. $Ba(NO_3)_2$ per 100 gms. sat. sol.	t°	Gms. $Ba(NO_3)_2$ per 100 gms. sat. sol.	t°	Gms. $Ba(NO_3)_2$ per 100 gms. sat. sol.
-0.55(Eutec)	4.56	60	16.9	210	45.6
0	4.72	70	19.1	226	48.6
5	5.4	80	21.4	239	50.6
10	6.25	90	23.6	256	53.0
15(d=1.0616)	7.27	100	25.6	276	56.6
20(d=1.0691)	8.27	112	28.4	297	61.0
25(d=1.0768)	9.27	135	32.0	320	64.8
30	10.30	158	36.4	348	70.0
40	12.35	171	38.6	380	76.1
50	14.6	191	42.1	417	82.3

SOLUBILITY OF BARIUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 15°.
(Chlopin, 1925.)

Gms. per 100 cc. sat. sol.		Gms. per 100 cc. sat. sol.		Gms. per 100 cc. sat. sol.	
HNO_3.	$Ba(NO_3)_2$.	HNO_3.	$Ba(NO_3)_2$.	HNO_3.	$Ba(NO_3)_2$.
0.0	8.03	2.23	5.63	10.07	2.07
1.16	6.25	4.30	4.23	18.39	1.15

Data for the system $Ba(NO_3)_2 + HNO_3 + H_2O$ at 0° and at 25° are given by Tolmatschew, 1930.

BARIUM NITRATE

SOLUBILITY OF BARIUM NITRATE IN AQUEOUS SOLUTION OF NITRIC ACID AT 30°.

(Masson, 1911.)

$d_{\frac{30}{4}}$ of sat. sol.	Gms. per 100 cc. sat. sol.		$d_{\frac{30}{4}}$ of sat. sol.	Gms. per 100 cc, sat. sol.	
	HNO_3.	$Ba(NO_3)_2$.		HNO_3.	$Ba(NO_3)_2$.
1.0891	0.0	11.16	1.0633	7.854	2.76
1.0811	0.8303	9.624	1.0668	9.840	2.215
–	1 572	8.542	1.0783	12.59	1.563
1.0663	3.149	6.300	1.1050	18.86	0.873
1.0619	4.718	4.665	1.1341	25.16	0.576
1.0609	6.3	3.536	1.1645	31.57	0.384

SOLUBILITY OF BARIUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 18°.

(Fricke and Brummer, 1933.)

NO

d_{18} of sat. sol.	Gm. Equiv. per 1000 gms. sat. sol.		d_{18} of sat. sol.	Gm. Equiv. per 1000 gms. sat. sol.	
	HNO_3	$Ba(NO_3)_2$		HNO_3	$Ba(NO_3)_2$
1.0643	0.0	0.6018	1.0487	0.8572	0.1845
1.0617	0.0487	0.5612	1.0565	1.3206	0.1114
1.0602	0.0774	0.5383	1.0706	1.8345	0.0713
1.0563	0.1569	0.4817	1.1016	2.703	0.0412
1.0503	0.3212	0.3747	1.1295	3.4372	0.0256
1.045	0.6350	0.2419			

SOLUBILITY OF BARIUM NITRATE IN CONCENTRATED NITRIC ACID.

(Greene, 1937.)

Due to the possibility of error resulting from the action of light on concentrated nitric acid, the acid used for these experiments was distilled in a dark room exposed only to red light, and the solubility flasks were protected from white light at all times. Nitrous acid was determined in all solutions containing more than 50% HNO_3. The largest amount found in any sample was 0.003% while most of the samples contained less than 0.001%

d_{25} of sat. sol.	Gms. per 100 gms. sat. sol.		d_{25} of sat. sol.	Gms. per 100 gms. sat. sol.	
	HNO_3	$Ba(NO_3)_2$		HNO_3	$Ba(NO_3)_2$
	Results at 24.88°		1.442	78.51	0.000197
1.0769	0.0	9.23	1.463	85.37	0.0000257
1.1221	20.65	0.495	1.480	92.10	0.0000191
1.1966	32.71	0.199		Results at 0°	
1.2907	47.60	0.0484	1.3416	56.42	0.00982
1.343	56.60	0.0147	1.3558	59.00	0.00635
1.355	59.06	0.0100	1.3763	63.21	0.00224
1.373	62.77	0.00532	1.3975	67.88	0.00118
1.395	67.30	0.00223	1.4143	71.93	0.000506
1.415	71.45	0.000865	1.4177	72.82	0.000406
1.430	75.14	0.000404			

SOLUBILITY OF BARIUM NITRATE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE AND VICE VERSA AT 25° AND AT 50°.

(Glasstone and Riggs, 1925.)

t°.	Gms. per 100 gms. sat. sol.		Solid Phase.	t°.	Gms. per 100 gms. sat. sol.		Solid Phase.
	KNO_3.	$Ba(NO_3)_2$.			KNO_3.	$Ba(NO_3)_2$.	
25.	0.00	9.28	$Ba(NO_3)_2$	50.	18.76	10.14	$Ba(NO_3)_2$
»	3.80	7.72	»	»	24.14	10.43	»
»	9.13	6.57	»	»	28.86	10.81	» + $2KNO_3.Ba(NO_3)_2$
»	14.8	6.6	» + $2KNO_3.Ba(NO_3)_2$	»	30.08	10.16	$2KNO_3.Ba(NO_3)_2$
»	17.14	4.88	$2KNO_3.Ba(NO_3)_2$	»	35.75	6.99	»
»	27.67	2.44	» + KNO_3	»	40.31	5.64	»
»	27.39	0.0	KNO_3	»	44.66	5.11	» + KNO_3
50.	0.0	14.63	$Ba(NO_3)_2$	»	44.88	4.22	KNO_3
»	3.93	12.73	»	»	45.45	2.34	»
»	10.53	10.92	»				

SOLUBILITY OF MIXTURES OF BARIUM NITRATE AND POTASSIUM NITRATE IN WATER.

(Euler — Z. physik. Ch. 49, 313, '04.)

t°.	Sp. Gr. of Sat. Solution.	Grams per 100 Grams H_2O.
17	1.120	13.26 KNO_3 + 6.31 $Ba(NO_3)_2$
21.5	...	17.00 " + 7.58 "
30	1.191	24.04 " + 9.99 "
50	...	49.34 " + 18.09 "

SOLUBILITY OF MIXTURES OF BARIUM NITRATE AND POTASSIUM NITRATE IN WATER.

(Findlay, Morgan and Morris, 1914; Foote, 1904.)

t°.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.	t°.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
	$Ba(NO_3)_2$.	KNO_3.			$Ba(NO_3)_2$.	KNO_3.	
9.1	6.25	0	*a*	25*	6.62	14.89	*a+2b.a*
9.1	4.20	8.15	*a+2b.a*	25	5.49	16.30	*2b.a*
9.1	1.98	12.02	*2b.a*	25	3.04	21.99	"
9.1	0.98	16.80	*b+2b.a*	25	2.04	27.76	*b+2b.a*
9.1	0	16.76	*b*	35	11.39	0	*a*
21.1	8.46	0	*a*	35	8.18	12.99	"
21.1	7.47	2.12	"	35	8.08	17.48	"
21.1	6.35	5.98	"	35	8.42	19.75	*a+2b.a*
21.1	6.06	8.47	"	35	5.85	24	*2b.a*
21.1	5.98	13.24	*a+2b.a*	35	5.02	26.05	"
21.1	3.35	18.24	*2b.a*	35	3.02	34.87	*b+2b.a*
21.1	2.30	21.47	"	35	1.77	34.98	*b*
21.1	1.76	24.86	*b+2b.a*	35	0	35.01	"
21.1	0	24.77	*b*				

* Results by Foote.

a = $Ba(NO_3)_2$, *2b.a* = $2KNO_3.Ba(NO_3)_2$, *b* = KNO_3.

SOLUBILITY OF MIXTURES OF BARIUM NITRATE AND SODIUM NITRATE IN WATER.

(Coppadoro, at 0°, 1912; at 30°, 1913.)

Results at 0°.			Results at 30°.		
Gms. per 100 Gms Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
$Ba(NO_3)_2$.	$NaNO_3$.		$Ba(NO_3)_2$.	$NaNO_3$.	
4.33	0.41	$Ba(NO_3)_2$	10.33	0	$Ba(NO_3)_2$
3.34	1.68	"	8.58	2.33	"
2.50	3.54	"	5.28	7.09	"
1.60	8.02	"	3.89	12.07	"
1.56	12.71	"	3.54	14.41	"
1.53	20.24	"	3.20	17.87	"
1.56	27.74	"	3.07	19.06	"
1.55	30.81	"	2.81	23.55	"
1.49	35.83	"	2.27	41.22	"
1.55	40.85	98 % $Ba(NO_3)_2$ + 2 % $NaNO_3$	2.11	48.22	$Ba(NO_3)_2 + NaNO_3$
1.55	41.30	26 % " + 73.8% "	1	48.50	$NaNO_3$
1.54	42.06	2.6% " + 97.4% "	0	49.16	"
0.51	41.68	0 % " +100 % "			

NO

SOLUBILITY OF BARIUM NITRATE IN AQUEOUS SOLUTIONS OF SODIUM NITRATE AT 20°. (Findlay and Cruickshanks, 1926.)

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
$NaNO_3$.	$BaNO_3$.	Solid Phase.	$NaNO_3$.	$BaNO_3$.	Solid Phase.
5.61	3.89	$Ba(NO_3)_2$	37.07	2.07	$Ba(NO_3)_2$
14.59	2.49	»	45.74	1.86	» $+NaNO_3$

SOLUBILITY OF BARIUM NITRATE IN AQUEOUS SOLUTIONS OF AMMONIUM NITRATE AND VICE VERSA AT 30°.

(de Baat, 1918.)

Gms. per 100 gms sat. sol.			Gms. per 100 gms. sat. sol.		
$Ba(NO_3)_2$.	NH_4NO_3.	Solid Phase.	$Ba(NO_3)_2$.	NH_4NO_3	Solid Phase.
0.0	70.1	NH_4NO_3	4.85	42.17	$Ba(NO_3)_2$
3.71	67.18	»	4.82	41.70	»
4.02	66.81	» + $Ba(NO_3)_2$	4.23	21.82	»
4.62	59.27	$Ba(NO_3)_2$	5.09	9.95	»
4.83	52.39	»	10.4	0.0	»

EQUILIBRIUM IN THE SYSTEM $NH_4NO_3 + Ba(NO_3)_2 + AgNO_3 + H_2O$ AT 30°.

(de Baat, 1918.)

Gms per 100 gms. sat. sol.				Gms. per 100 gms. sat. sol.			
$AgNO_3$	NH_4NO_3.	$Ba(NO_3)_2$.	Solid Phase.	$AgNO_3$.	NH_4NO_3.	$Ba(NO_3)_2$.	Solid Phase.
6.45	62.79	3.53	$NH_4NO_3 + Ba(NO_3)_2$	67.31	6.17	2.33	$Ba(NO_3)_2 + AgNO_3$
14.13	57.91	3.10	» »	13.66	59.38	1.97	» »
38.34	34.70	2.15	» »	43.45	32.82	1.32	NH_4NO_3
49.50	26.94	1.74	D + »	66.15	8.63	1.04	D
61.60	15.08	1.90	» »	35.49	30.58	3.88	$Ba(NO_3)_2$

$D = AgNO_3.NH_4NO_3$.

SOLUBILITY OF MIXTURES OF BARIUM NITRATE AND LEAD NITRATE IN WATER AT 25°. (Fock, 1897; Euler, 1904.)

Sp. Gr. of Solution.	In Solution. Gms. per Liter. $Ba(NO_3)_2$.	In Solution. Gms. per Liter. $Pb(NO_3)_2$.	In Solution. Mg. Mols. per Liter. $Ba(NO_3)_2$.	In Solution. Mg. Mols. per Liter. $Pb(NO_3)_2$.	In Solution. Mol. % $Ba(NO_3)_2$.	In Solid Phase Mol. % $Ba(NO_3)_2$
1.079	102.2	0	391.0	0	100	100
1.088	54.9	17.63	210.1	53.3	79.78	98.30
1.108	86.5	49.80	330.7	150.7	68.70	96.74
1.119	79.7	68.10	304.9	205.7	59.69	94.80
1.140	77.0	97.20	294.4	293.6	50.09	93.62
1.163	69.8	130.7	266.8	395.0	40.31	92.49
1.198	66.0	177.3	252.5	535.6	32.03	90.07
1.252	57.5	247.7	222.6	748.5	22.91	83.47
1.294	25.9	334.3	99.2	1010.3	8.11	75.44
1.376	28.8	429.7	110.3	1298.0	7.77	35.11
1.459		553.8	0.0	1673.0	0.0	0 0

Tables of results are also given for 15°, 30°, and 47°.

SOLUBILITY OF MIXTURES OF BARIUM NITRATE AND LEAD NITRATE IN WATER AT 25° AND AT 50°. (Glasstone and Riggs, 1925.)

NO

t°.	Gms. per 100 gms. sat. sol. $Pb(NO_3)_2$.	Gms. per 100 gms. sat. sol. $Ba(NO_3)_2$.	% $Pb(NO_3)$ in Solid Phase.	t°.	Gms. per 100 gms. sat. sol. $Pb(NO_3)_2$.	Gms. per 100 gms. sat. sol. $Ba(NO_3)_2$.	% $Pb(NO_3)$ in Solid Phase.
25....	1.63	8.64	3.59	50....	5.72	12.68	6.67
»....	6.26	7.31	10.42	»....	10.34	11.05	8.78
»....	8.96	6.66	15.44	»....	17.05	9.12	–
»....	16.21	5.29	–	»....	29.31	6.32	41.25
»....	22.73	4.23	39.27	»....	37.78	3.83	69.02
»....	31.13	2.65	76.56	»....	40.82	2.57	88.31
»....	34.60	1.39	87.54				

The solid phase consists of mixed crystals in all cases.

The distribution of small amounts of Barium Nitrate between aqueous solutions and crystals of Lead Nitrate and of Strontium Nitrate, as determined by means of radio active indicators, is described by Polessitsky, 1933, 1935.

SOLUBILITY OF BARIUM NITRATE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 25°. (D'Ans and Siegler, 1913.)

Gms. C_2H_5OH per 100 Gms. Solvent.	Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	Gms. per 100 Gms. Sat. Sol. $Ba(NO_3)_2$.	Gms. C_2H_5OH per 100 Gms. Solvent.	Gms. per 100 Gms. Sat. Sol. C_2H_5OH	Gms. per 100 Gms. Sat. Sol. $Ba(NO_3)_2$.
0	0	9.55	58	57	1.85
10.25	9.5	7.63	78.7	78.2	0.62
18.6	17.5	6.02	90.1	89.9	0.18
25.05	23.7	5.25	99.4	99.39	0.005
40.2	38.3	3.53			

Data are also given by Vogel (1903), but as the results are given in gms. per 100 cc. and densities are omitted, no exact comparison can be made with the above.

100 gms. aq. 50 percent C_2H_5OH dissolve 1.0 gm. $Ba(NO_3)_2$ at 20° and 4.65 gms. at 100°. (Wright, 1927.)

SOLUBILITY OF BARIUM NITRATE IN AQUEOUS PHENOL SOLUTIONS AT 25°.

(Rothmund and Wilsmore — Z. physik. Chem. 40, 620, '02.)

G. Mols. per Liter.		Gms. per Liter.		G. Mols. per Liter.		Gms. per Liter.	
C_6H_5OH	$Ba(NO_3)_2$.	C_6H_5OH.	$Ba(NO_3)_2$.	C_6H_5OH.	$Ba(NO_3)_2$.	C_6H_5OH.	$Ba(NO_3)_2$
0.000	0.3835	0.0	100.2	0.310	0.3492	29.12	91.31
0.045	0.3785	4.23	98.97	0.401	0.3400	37.73	88.90
0.082	0.3746	7.71	97.95	0.501	0.3299	47.11	86.26
0.146	0.3664	13.73	95.81	0.728 (sat.)	0.3098	68.45	81.00

Data for the above system are also given by Timmermans (1907).

SOLUBILITY OF BARIUM NITRATE IN PURE METHYL ALCOHOL ($d\frac{25}{4}$= 0.78661.)

(Lloyd, Brown, Glynwyn, Bonnel and Jones, 1928.)

t°	Gms. $Ba(NO_3)_2$ per 100 gms. CH_3OH	t°	Gms. $Ba(NO_3)_2$ per 100 gms. CH_3OH
0	0.070	40	0.048
10	0.065	50	0.042
20	0.057	60	0.040
30	0.052		

NO

100 gms. methyl alcohol dissolve 0.5 gm. $Ba(NO_3)_2$ at 25°. (D'Ans and Siegler, 1913.)
100 gms. acetone dissolve 0.005 gm. $Ba(NO_3)_2$ at 25°. " "

100 gms. absolute ethyl alcohol (C_2H_5OH) dissolve 0.0016-0.0020 gm. $Ba(NO_3)_2$ at 25°.
100 gms. absolute iso propyl alcohol (2 Propanol)($CH_3CHOHCH_3$) dissolve 0.0016-0.0020 gm. $Ba(NO_3)_2$ at 25°. (Perner and Mellon, 1934.)

100 gms. hydroxylamine dissolve 11.4 gms. $Ba(NO_3)_2$ at 17°-18°. (de Bruyn, 1892.)
100 cc. anhydrous hydrazine dissolve 3 gms. $Ba(NO_3)_2$ at room temp. (Welsh and Broderson, 1915.)

SOLUBILITY OF BARIUM NITRATE IN ABSOLUTE ETHYL ALCOHOL IN THE PRESENCE OF AMMONIUM BROMIDE AT 25°.

(Seward and Schumb, 1930.)

Gm. Mols. per liter x10^5		Gms. per liter	
NH_4Br	$Ba(NO_3)_2$	NH_4Br	$Ba(NO_3)_2$
0.0	0.99	0.0	0.00259
20.3	1.43	0.0199	0.00374
33.0	1.70	0.323	0.00444
65.8	2.10	0.0645	0.00549

100 gms. pure acetic acid (CH_3COOH) dissolve 0.00217 gm. $Ba(NO_3)_2$ (= 0.0005 mol. percent) at 25°. (Davidson and Geer, 1933.)

SOLUBILITY OF BARIUM NITRATE IN LIQUID AMMONIA.

(Portnow and Wassiliew, 1925; Portnow and Schurawlew, 1935.)

t^0	Gms. $Ba(NO_3)_2$ per 100 gms. NH_3	t^0	Gms. $Ba(NO_3)_2$ per 100 gms. NH_3
-27	5.14	+2.5	36.24
-15.5	11.57	8.7	51.40
-9	13.80	12.7	67.60
-7	16.88	22.0	105.8
-0.5	27.84	51.0	194.8
+0.5	28.71		

At the lower temperatures ammoniates of the probable composition $Ba(NO_3)_2.4NH_3$ and $BaNO_3.8NH_3$ are believed to be formed.

100 gms. NH_3 dissolve 17.38 gms. $Ba(NO_3)_2$ at 0°. (Linhard and
100 gms. NH_3 dissolve 97.22 gms. $Ba(NO_3)_2$ at 25°. (Hunt and Boncyk, 1933.)

Fusion point data are given for the following mixtures:

$Ba(NO_3)_2$ + $Ca(NO_3)_2$ + KNO_3 (1)
" + KNO_3 (2) (3) (4)
" + " + $LiNO_3$ (4)
" + " + $Sr(NO_3)_2$ (2)

$Ba(NO_3)_2$ + KNO_3 + $NaNO_3$ (4)
" + $LiNO_3$ (4)
" + $NaNO_3$ (2) (3) (4)
" + " + $Pb(NO_3)_2$ (2)

(1) Labourn and Madgin, 1933; (2) Labourn, Madgin and Freeman, 1934; (3) Ricci, 1937; (4) Harkins and Clarke, 1915.

BARIUM NITRITE $Ba(NO_2)_2.H_2O$.

SOLUBILITY IN WATER.

(Oswald, 1914; see also, Vogel, 1903.)

t°.	Gms. $Ba(NO_2)_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $Ba(NO_2)_2$ per 100 Gms. Sat. Sol.	Solid Phase.
− 1.7	9.2	Ice	20	40.3	$Ba(NO_2)_2.H_2O$
− 3.2	19.5	"	43	50.3	"
− 5.8	33.1	"	61	58.6	"
− 6.5	34.5	" + $Ba(NO_2)_2.H_2O$	80	67.3	"
− 4.3	34.9	$Ba(NO_2)_2.H_2O$	92	71.7	"
+17	40*	"	110	82	"

* *d* of the sat. solution = 1.4897.

Later determinations of the solubility of Barium Nitrite in water by Bureau, 1937, are as follows.

t^0	Gms. $Ba(NO_2)_2$ per 100 gms. sat. sol.	Solid Phase	t^0	Gms. $Ba(NO_2)_2$ per 100 gms. sat. sol.	Solid Phase
-1.4	7.7	Ice	35.2	49.9	Balα
-3.05	17.05	"	37.0(d=1.612)	50.3	"
-5.25	26.8	"	40.4(d=1.616)	51.6	"
-5.85(Eutec.)	29.35	"+Balα	40.0	52.0	"+Balβ
+1.0((d=1.359)	31.8	Balα	56.0(d=1.814	58.12	Balβ
6.65	34.3	"	58.5	60.8	"
16.0	39.8	"	79.5(d=2.105)	67.9	"
21.0 (d=1.492)	41.7	"	98.2(d=2.308)	75.1	"
32.1((d=1.584)	47.9	"	114.5(b.pt.)	81.25	"

Balα = $Ba(NO_3)_2.H_2O$; Balβ = $Ba(NO_3)_2.H_2O$

The author thinks there are two varieties of $Ba(NO_3)_2.H_2O$ with a transition point at 40°, but due to viscosity and tendency for supersaturation he could not isolate the two forms.

BARIUM NITRITE

SOLUBILITY OF BARIUM NITRITE IN AQUEOUS ALCOHOL SOLUTIONS AT 19.5°-20.5°. (Vogel, 1903.)

% alcohol in solvent:	10	20	30	40	50	60	70	80	90
Gms. $Ba(NO_3)_2.H_2O$ per 100 cc. sat. sol.	49.3	29.3	18.4	13.3	9.1	4.8	2.7	0.98	0

BARIUM HYDROXIDE $Ba(OH)_2.8H_2O$.

SOLUBILITY IN WATER. SOLID PHASE $Ba(OH)_2.8H_2O$.

(Rosenthiel and Rühlmann — Jahresber. Chem. 314, '70.)

t°.	Gms. $Ba(OH)_2$ per 100 Gms. Water.	Gms. $Ba(OH)_2$ per 100 Gms. Solution.	t°.	Gms. $Ba(OH)_2$ per 100 Gms. Water.	Gms. $Ba(OH)_2$ per 100 Gms. Solution
0	1.67	1.65	30	5.59	5.29
5	1.95	1.92	40	8.22	7.60
10	2.48	2.42	50	13.12	11.61
15	3.23	3.13	60	20.94	17.32
20	3.89	3.74	75	63.51	38.85
25	4.68	4.47	80	101.40	50.35

Data are given by Sill (1916), for the influence of pressures up to 490 kgs. per sq. cm. on the solubility of $Ba(OH)_2.8H_2O$ in H_2O at 25°.

SOLUBILITY OF BARIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF BARIUM NITRATE AT 25° AND VICE VERSA. (Parsons and Carson, 1910.)

Sp. Gr. Sat. Sol.	Gms. per 100 Gms. H_2O. $Ba(OH)_2$.	Gms. per 100 Gms. H_2O. $Ba(NO_3)_2$.	Solid Phase.	Sp. Gr. Sat. Sol.	Gms. per 100 Gms. H_2O. $Ba(OH)_2$.	Gms. per 100 Gms. H_2O. $Ba(NO_3)_2$.	Solid Phase.
1.0512	4.29	0	$Ba(OH)_2.8H_2O$	1.1371	4.93	10.21	$Ba(OH)_2.8H_2O$
1.0651	4.35	1.88	"	1.1448	5.02	11.48	" $+Ba(NO_3)_2$
1.0790	4.48	3.47	"	1.1210	3.22	11.04	$Ba(NO_3)_2$
1.0975	4.40	5.66	"	1.1002	1.55	10.66	"
1.1220	4.72	7.55	"	1.0797	0	10.30	"

BARIUM HYDROXIDE $Ba(OH)_2.8H_2O$.

RECIPROCAL SOLUBILITY OF BARIUM HYDROXIDE AND BARIUM SULFHYDRATE IN WATER AT VARIOUS TEMPERATURES. (Terres and Brückner, 1920.)

t°.	Gms. per 100 gms. sat. sol. $Ba(OH)_2$.	Gms. per 100 gms. sat. sol. $Ba(SH)_2$.	t°.	Gms. per 100 gms. sat. sol. $Ba(OH)_2$.	Gms. per 100 gms. sat. sol. $Ba(SH)_2$.	t°.	Gms. per 100 gms. sat. sol. $Ba(OH)_2$.	Gms. per 100 gms. sat. sol. $Ba(SH)_2$.	t°.	Gms. per 100 gms. sat. sol. $Ba(OH)_2$.	Gms. per 100 gms. sat. sol. $Ba(SH)_2$.
0...	1.49	0.92	20...	1.95	17.1	60...	12.9	1.15	80...	4.6	25.0
0...	0.88	5.45	20...	1.1	26.2	60...	11.0	7.82	80...	4.0	30.0
0...	0.6	13.6	20...	1.0	29.0	60...	8.0	10.03	80...	4.2	31.4
0...	0.6	19.6	20...	0.9	30.0	60...	5.38	12.25	80...	3.7	34.95
0...	0.65	26.3	20...	1.18	32.8	60...	3.0	19.9	80...	2.05	39.0
0...	0.69	22.5	40...	4.65	4.5	60...	2.56	27.0	100...	41.9	1.32
0...	0.65	27.8	40...	3.8	9.55	60...	2.52	28.8	100...	30.5	7.1
0...	0.70	28.6	40...	1.9	15.3	60...	2.13	33.0	100...	29.5	7.6
0...	0.60	29.0	40...	1.5	20.4	60...	2.10	33.5	100...	27.3	11.9
0...	0.96	32.6	40...	1.5	27.5	60...	2.07	37.2	100...	24.4	13.0
20...	3.0	4.87	40...	1.65	17.6	80...	22.3	1.81	100...	5.8	35.2
20...	2.85	6.20	40...	1.44	20.7	80...	19.0	5.55	100...	5.0	41.8
20...	1.03	15.60	40...	1.39	25.1	80...	18.5	9.6	100...	1.96	43.7
20...	1.08	17.90	40...	1.32	30.6	80...	9.0	12.4			
20...	1.00	29.00	40...	1.29	35.2	80...	6.0	21.0			

Note.—The above results, when plotted on cross section paper, yield curves composed of three branches. The central branch of each curve corresponds to the double salt $Ba(OH)_2.Ba(SH)_2.10H_2O$.

SOLUBILITY OF BARIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF ALKALI CHLORIDES AT 25°. (Herz, 1910.)

In Lithium Chloride.		In Potassium Chloride.		In Rubidium Chloride.		In Sodium Chloride.	
Gms. per 100 cc. Sat. Sol.		Gms. per 100 cc. Sat. Sol.		Gms. per 100 cc. Sat. Sol.		Gms. per 100 cc. Sat. Sol.	
LiCl.	$Ba(OH)_2$.	KCl.	$Ba(OH)_2$.	RbCl.	$Ba(OH)_2$.	NaCl.	$Ba(OH)_2$.
9.75	11.45	25.95	5.93	15.11	5.55	16.51	6.91
6.02	8.03	13.05	5.66	0	4.76	8.37	5.99
3.18	6.39	8.60	5.53	...	...	4.27	5.40
0	4.76	0	4.76	...	...	0	4.76

SOLUBILITY OF BARIUM HYDROXIDE IN DILUTE SOLUTIONS OF SODIUM HYDROXIDE AT 25°.

(Neale and Stringfellow, 1932.)

Gm. Equiv. per liter		Gm. Equiv. per liter	
Na(OH)	$Ba(OH)_2$	Na(OH)	$Ba(OH)_2$
0.0	0.545	0.9177	0.1727
0.4417	0.3052	1.230	0.1211
0.6135	0.2445	1.837	0.084

SOLUBILITY OF BARIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE AT 30°. (Schreinemakers, 1909-10)

Gms per 100 Gms Sat. Sol.		Solid Phase.	Gms per 100 Gms. Sat Sol.		Solid Phase.
BaO.	Na_2O.		BaO	Na_2O.	
4.99	0	$BaO.9H_2O$	1.84	26.14	$BaO.4H_2O$
1.29	4.78	"	1.75	27.72	"
0.89	6.43	"	1.58	28.43	"
0.57	9.63	"	1.34	29.24	" $+BaO.2H_2O$
0.53	11.62	"	0.82	32.12	$BaO.2H_2O$
0.47	17.87	"	0.59	34.72	"
1.06	23.28	"	0.57	41.09	" $+NaOH\ H_2O$
1.87	24.63	$BaO.9H_2O+BaO.4H_2O$	0	+42	$NaOH.H_2O$

SOLUBILITY OF BARIUM HYDROXIDE IN AQUEOUS ACETONE AT 25°.

(Herz and Knoch — Z. anorg. Chem. 41, 321, '04.)

Sp. Gr. of Solutions.	Vol. % Acetone.	$Ba(OH)_2$ per 100 cc. Sat. Solution.		Gms. $Ba(OH)_2$ per 100 Gms. Solution.
		Millimols.	Grams.	
1.0479	0	55.08	4.722	4.506
1.0168	10	31.84	2.730	2.686
0.9927	20	17.79	1.525	1.536
0.9763	30	9.10	0.779	0.798
0.9561	40	4.75	0.407	0.426
0.9398	50	1.54	0.132	0.141
0.9179	60	0.48	0.041	0.045
0.8956	70	0.08	0.007	0.018

SOLUBILITY OF BARIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE AT 20°.

(Scholder and Patsch, 1935.)

The saturated solutions were prepared by constant agitation for 7 to 14 days, in closed nickel plated vessels. The excess solid phase was removed by filtration in an atmosphere of nitrogen. An excess of standard HCl was added and this back titrated with standard NaOH. Barium was determined as sulfate. The accuracy of Schreinemakers identification of the solid phases is questioned and repeated determinations at 25° and 30° are suggested.

OH

Normality of Aq. NaOH	Gms. BaO per 100cc. sat. sol.	Solid Phase	Normality of Aq. NaOH	Gms. BaO per 100cc. sat. sol.	Solid Phase
0.0	3.470	$BaO.9H_2O$	11.07	0.966	$BaO.9H_2O$
0.56	1.473	"	11.28	1.064	"
0.97	0.942	"	11.64	1.317	"
1.34	0.706	"	11.78	1.598	"
1.80	0.549	"	12.25	1.687	$BaO.5H_2O$
2.34	0.443	"	13.6	1.543	"
3.19	0.328	"	14.0	1.494	$BaO.2\frac{1}{2}H_2O$
3.75	0.292	"	14.8	1.102	"
4.57	0.247	"	14.9	1.081	"
5.70	0.241	"	16.5	0.714	"
7.0	0.244	"	17.0	0.675	"
7.92	0.274	"	18.9	0.641	$BaO.2H_2O$
9.17	0.386	"	19.2	0.638	"
9.9	0.553	"	19.4	0.645	"

The authors also give analyses of the solid phases in contact with solutions of 12.9-18.0 normal NaOH at 30° which show that only $BaO.2\frac{1}{2}H_2O$ is present instead of the hydrates $BaO.4H_2O$ and $BaO.2H_2O$ reported by Schreinemakers.

SOLUBILITY OF BARIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF PHENOL AND VICE VERSA AT 25°. (Van Meurs, 1916.)

Mols. per 100 mols. sat. sol.		Solid Phase.	Mols. per 100 mols. sat. sol.		Solid Phase.
C_6H_5OH.	$\frac{Ba(OH)_2}{2}$.		C_6H_5OH.	$\frac{Ba(OH)_2}{2}$.	
0.0	0.99	$Ba(OH)_2.8H_2O$	14.44	5.89	$(C_6H_5O)_2Ba.4H_2O$
0.76	1.54	»	19.25	6.70	»
1.48	2.19	»	33.57	7.53	»
2.51	3.09	»	50.25	7.06	»
3.06	3.63	» $+(C_6H_5O)_2Ba.4H_2O$	69.61	4.98	»
3.17	3.29	$(C_6H_5O)_2Ba.4H_2O$	70.74	5.04	»
4.78	3.67	»	70.36	4.94	»
12.03	5.44	»	73.48	3.28	»

Two liquid layers are formed at concentrations of $Ba(OH)_2$ less than 0.56 mol. %.

Aqueous layer.		Phenol layer.	
Mol. % C_6H_5OH.	Mol. % $\frac{Ba(OH)_2}{2}$.	Mol. % C_6H_5OH.	Mol. % $\frac{Ba(OH)_2}{2}$.
1.79	0.0	32.33	0.0
1.89	0.05	28.84	0.12
2.48	0.20	19.82	0.47
3.70	0.30	14.46	0.56

Solubility of Barium Hydroxide in Aqueous Solutions of Resorcinol and Vice Versa at 30°. (Van Meurs, 1916.)

Mols. per 100 mols. sat. sol. $\frac{C_6H_4(OH)_2}{2}$.	Mols. per 100 mols. sat. sol. $\frac{Ba(OH)_2}{2}$.	Solid Phase.	Mols. per 100 mols. sat. sol. $\frac{C_6H_4(OH)_2}{2}$.	Mols. per 100 mols. sat. sol. $\frac{Ba(OH)_2}{2}$.	Solid Phase.
0.0	1.17	$Ba(OH)_2.8H_2O$	18.00	14.45	$C_6H_4O_2Ba.2H_2O$
2.45	3.42	»	20.44	14.21	»
4.37	5.29	»	47.75	10.42	$C_6H_4(OH)_2$
5.77	6.62	»	43.63	6.86	»
9.40	10.38	»	40.71	3.30	»
13.96	14.56	» + $C_6H_4O_2Ba.2H_2O$			

Solubility of Barium Hydroxide in Aqueous Solutions of Saccharose (Cane Sugar).

(Nishizawa and Hachihama, 1929.)

Results at 25°: Gms. per 100 gms. sat. sol. $C_{12}H_{22}O_{11}$	BaO	Solid Phase	Results at 45°: Gms. per 100 gms. sat. sol. $C_{12}H_{22}O_{11}$	BaO	Solid Phase	Results at 75°: Gms. per 100 gms. sat. sol. $C_{12}H_{22}O_{11}$	BaO	Solid Phase
0.0	3.99	Ba.9	0.0	8.67	Ba.9	0.0	34.00	Ba.9
* 3.70	5.52	"	0.13	8.99	" + S.Ba	0.67	34.82	" + S.3Ba
* 5.47	6.23	"	0.14	7.32	S.Ba	0.83	33.34	S.3Ba
* 9.58	8.12	"	0.18	3.60	"	0.73	32.24	"
* 16.68	11.11	"	0.19	3.20	"	0.67	27.82	"
* 20.09	12.55	"	0.31	1.54	"	0.48	26.76	"
0.16	4.00	" + S.Ba	0.39	1.32	"	0.99	25.08	" + S.Ba
0.71	0.95	S.Ba	1.76	0.64	"	1.09	24.81	S.Ba
1.40	0.70	"	5.13	0.61	"	0.79	23.07	"
1.88	0.66	"	7.83	0.66	"	0.40	19.11	"
9.95	0.74	"	12.25	0.72	"	0.15	9.36	"
12.61	0.86	"	13.44	0.74	"	0.17	3.62	"
17.26	0.93	"	20.22	0.85	"	1.59	0.70	"
21.93	1.04	"	22.22	0.88	"	2.27	0.61	"
27.61	1.22	"	27.22	0.91	"	7.08	0.58	"
31.44	1.29	"	31.76	0.99	"	12.69	0.68	"
39.68	1.52	"	41.12	1.11	""	19.05	0.66	"
45.58	1.83	"	46.35	1.09	"	27.27	0.72	"
50.01	1.75	"	51.29	1.10	"	41.13	0.89	"
61.76	1.75"	"	51.50	1.12	"	51.95	1.03	"
67.41	1.48	" + S	63.65	1.08	"	62.94	0.73	"
68.23	0.33	S	72.52	1.25	" + S	79.43	0.47	" + S
67.32	0.0	"	71.05	0.0	S	78.58	0.0	S

* Supersaturated; Ba9 = $BaO.9H_2O$; S.Ba = $C_{12}H_{22}O_{11}.BaO$; S.3Ba = $C_{12}H_{22}O_{11}.3BaO$; S = $C_{12}H_{22}O_{11}$.

BARIUM OXIDE BaO

Fusion point data have been determined for the following mixtures:

BaO + $CaCl_2$ (Sackur, 1911-12.)
" + MgO (v. Wartenberg and Prophet, 1932.)
" + SiO_2 (Eskola, 1922; Grieg, 1927.)
" + $SrCl_2$ (Sackur, 1911-12.)
" + ZrO_2 (v. Wartenberg and Werth, 1930.)

BARIUM PHOSPHATES (Mono) $BaH_4(PO_4)_2$, (Di) $BaHPO_4$

EQUILIBRIUM IN THE SYSTEM $BaO + P_2O_5 + H_2O$ AT 25°.

(Tartar and Lorah, 1929.)

d_{25} of sat. sol.	Gms. per 100 gms. sat. sol. BaO	Gms. per 100 gms. sat. sol. P_2O_5	Solid Phase	d_{25} of sat. sol.	Gms. per 100 gms. sat. sol. BaO	Gms. per 100 gms. sat. sol. P_2O_5	Solid Phase
1.040	2.00	2.96	$BaHPO_4$	1.354	10.86	23.46	$BaHPO_4+BaH_4(PO_4)_2$
1.085	3.66	5.95	"	1.397	9.14	28.36	$BaH_4(PO_4)_2$
1.107	4.33	7.61	"	1.420	7.41	32.68	"
1.118	4.80	8.25	"	1.425	6.93	33.74	"
1.165	6.31	11.19	"	1.483	2.72	44.34	"
1.166	6.09	11.36	"	1.524	1.50	49.22	"
1.188	6.84	12.35	"	1.561	1.02	52.61	"
1.246	8.50	16.51	"	1.580	0.85	53.79	"

EQUILIBRIUM IN THE SYSTEM $Ba(OH)_2 + H_3PO_4 + CO_2 + H_2O$ AT 17°

(Pallu, 1929.)

PO

The author mixed in different proportions, a 0.248 normal solution of $Ba(OH)_2$ and a 0.248 normal solution of H_3PO_4 and bubbled CO_2 through 100cc portions of these mixtures for about a month. He measured the conductivities of the solutions at 17° and finally analyzed the saturated solutions and precipitates. The solid phase in contact with the solutions composed of up to two thirds $Ba(OH)_2$ and one third H_3PO_4 was the di barium phosphate, With greater amounts of $Ba(OH)_2$ the solid phase was a mixture of di barium phosphate and $BaCO_3$.

BARIUM Pyro PHOSPHATE $Ba_2P_2O_7$

Data for the solubility of Barium Pyrophosphate in aqueous solutions of hydrogen peroxide are given by Munzberg, 1928.

BARIUM Glycerol PHOSPHATES.

SOLUBILITY IN WATER.

t°.	Compound.	Formula.	Gms. Anhydrous Salt per 100 Gms. Sat. Sol.	Authority.
21	Barium Glycerolphosphate	$BaC_3H_7O_6P.H_2O$	4.5	(Rogier and Fiore, 1913.)
13	" α Glycerolphosphate	$BaC_3H_7O_6P$	1.4	(King and Pyman, 1914.)
12	" β "	$BaC_3H_7O_6P.\frac{1}{2}H_2O$	5.8	" "
21	" Glycerolphosphate	$BaC_3H_6O_6P.\frac{1}{2}H_2O$	8.4	(Langheld and Oppmann, 1912.)
22	" di Glycerolphosphate	....	3.76	" "

BARIUM Methyl, Glycero, etc. PHOSPHATES.

PO

Solubility of Each in Water. (Bailly, 1916, 1919; Bailly and Gaumé, 1924.)

			Gms. per 100 gms. sat. sol.	
Compound.	Formula.	t°.	Anhydrous cmpd.	Hydrated cmpd.
Neutral barium methyl phosphate	$BaCH_3.PO_4.H_2O$	10	2.54	2.72
» » » »	»	15	–	2.02 (Cavalier)
» » » »	»	50	1.05	1.12
» » » »	»	100	0.39	0.42
Acid » » »	$Ba(CH_3.HPO_4)_2\ H_2O$	17	23.50	24.68
Barium ethyl phosphate.......	$BaC_2H_5.PO_4.6H_2O$	20	–	6.72 (Pelouze)
» propyl »	$BaC_3H_7.PO_4.2H_2O$	20	–	8.08 (Cavalier)
» isopropyl »	$BaCH(CH_3)_2.PO_4.2H_2O$	16	–	3.52
» isobutyl »	$BaCH_2CH(CH_3)_2PO_4.2H_2O$	24	–	5.65
» allyl »	$BaCH_2.CH=CH_2PO_4$	15	12.0	–
Barium α glycerophosphate......	$BaC_3H_5(OH)_2PO_4.\frac{1}{2}H_2O$	16	1.87	–
» β » (cryst.).....	» $\frac{1}{2}H_2O$	18	3.58	–
» » » »	» »	21	4.31	–
» » » »	» $1H_2O$	21	5.25	–
» » » (amorph.)...	»	soluble in all proportions		
Neutral barium glycero phosphate	$BaPO_4.C_3H_5OH\ H_2O$	16	7.27	–
» » » »	»	55	3.50	–
Acid » » »	$Ba(PO_4.HC_3H_5(OH)_2)_2 3H_2O$	deliquescent		

Note. — In the above experiments constant agitation was not employed and the variations in results for the several forms and for different preparations of the same form, are probably due to incomplete equilibrium.

The following determinations are by Fischer and Pfähler, 1920.

Barium α glycerophosphate......	$BaC_3H_5(OH)_2PO_4$	22	1.28	–
» acetone »	$BaC_6H_{11}O_6P.3H_2O$	25	3.51	–

BARIUM Per RHENATE $Ba(ReO_4)_2$

ReO

One liter sat. solution in water contains about 150 gms. $Ba(ReO_4)_2$ at 20°. (Noddack, 1929.)

One liter of 89.7 percent ethyl alcohol dissolve 2.45 gms. $Ba(ReO_4)_2$ at 18°.5. (Tolbert, 1932.)

BARIUM SULFIDE BaS.

Solubility of Commercial Barium Sulfide in Water. (Terres and Brückner, 1920.)

S

The sample of barium sulfide contained 87.2 % Ba S, 4.33 % $Ba(OH)_2$ and 8.47 % Fe and Mn oxides. Due to the oxidizing action of air upon the sulfhydrate the solubility determinations were conducted in an atmosphere of hydrogen. The mixtures were constantly agitated for many hours.

	Gms. per 100 gms. sat. sol.			Solid Phase changed in Composition between.	
t°.	$Ba(OH)_2$.	$Ba(SH)_2$.	Corresponding BaS in solution.		
0...	2.05	2.42	4.03	44.24 % BaS	14.2 % BaO
20...	3.28	3.90	6.48	–	–
40...	5.32	6.32	10.5	–	–
60...	8.14	9.68	16.5	–	–
80...	10.62	12.61	21.0	–	–
100...	12.80	15.25	25.25	39.0 % BaS	19.5 % BaO

Fusion point data for certain regions of the system BaS + S are given by Robinson and Scott, 1931.

BARIUM SulfHYDRATE $Ba(SH_2).4H_2O$.

SOLUBILITY IN WATER. (Terres and Brückner, 1920.)

t°.	Gms. $Ba(SH_2)$ per 100 gms. sat. sol.	t°.	Gms. $Ba(SH)_2$ per 100 gms. sat. sol.
—15	32.0	60	36.2
0	32.6	80	39.0
20	32.8	100	43.7
40	34.5		

BARIUM SULFITE $BaSO_3$.

SOLUBILITY IN WATER AND IN AQUEOUS SUGAR SOLUTIONS.
(Rogowicz — Z. Ver Zuckerind. 938, 1905.)

Conc. of Sugar Sol.	Gm. $BaSO_4$ per 100 cc. Sol. at 20°.	Gm. $BaSO_4$ per 100 cc. Sol. at 80°.	Conc. of Sugar Sol.	Gm. $BaSO_4$ per 100 cc. Sol. at 20°.	Gm. $BaSO_4$ per 100 cc. Sol. at 80°.
0° Bx	0.0197	0.00177	40° Bx	0.0048	0.00158
10° "	0.0104	0.00335	50° "	0.0030	0.00149
20° "	0.0097	0.00289	60° " (sat.)	0.0022	0.00112
30° "	0.0078	0.00223	...	...	...

BARIUM SULFATE $BaSO_4$.

SOLUBILITY IN WATER. (Kohlrausch, 1908)

One liter of sat. solution contains 0.00115 gm. $BaSO_4$ at 0°; 0.0020 gm. at 10°; 0.0024 gm. at 20° and 0.00285 gm. at 30°.

Melcher (1910) obtained results a little lower than the above. His data for higher temperatures are 0.00336 gm. at 50° and 0.0039 gm. at 100°.

Kohlrausch obtained the following results for the solubility of heavy spar ($BaSO_4$); 0.0019 gm. at 0°, 0.0023 gm. at 10°; 0.0027 gm. at 20°; 0.00315 gm at 30° and 0.0033 gm. at 33.5°.

SO

The solubility of Barium Sulfate in Water at 25°, calculated from determinations of its solubility in dilute aqueous salt solutions, is reported by Neuman, 1933, to be 0.957×10^{-5} mols. (= 0.00223 gms.) per liter.

The solubility product of Barium Sulfate at 18° is given by Ruff, 1929, as 0.9×10^{-18}.

The solubility of Barium Sulfate in Water at 100° is given by Lemarchands, 1928, as 0.0118 gm. per liter. For particles smaller than 1.7μ the solubility may increase to three times this figure.

Determinations of the solubility of Barium Sulfate in Water and in aqueous solutions of lithium chloride at 18° made by the "polarographic method" (See Solubility of Barium Carbonate in Water free of CO_2) (Heyrovsky and Berezicky, 1929.) gave the following results.

Normality of aq. LiCl solution	Gm. Equiv. of $BaSO_4$ dissolved per liter
0.0	2.10×10^{-5}
0.001	3.10×10^{-5}
0.010	3.10×10^{-5}

The authors found that the solubility of freshly precipitated barium sulfate is about 8 times greater than that of the 30 hours old precipitate.

SOLUBILITY OF BARIUM SULFATE IN AQUEOUS SOLUTIONS OF IRON, ALUMINIUM AND MAGNESIUM CHLORIDES AT 20°–25°. (Fraps, 1901)

Gms. Chloride per Liter.	Milligrams $BaSO_4$ per Liter in Aq FeCl₃.	Milligrams $BaSO_4$ per Liter in Aq. AlCl₃.	Milligrams $BaSO_4$ per Liter in Aq MgCl₂.	Gms. Chloride per Liter.	Mgs. $BaSO_4$ per Liter in: Aq. FeCl₃.	Mgs. $BaSO_4$ per Liter in: Aq. AlCl₃.	Mgs. $BaSO_4$ per Liter in: Aq. MgCl₂.
1	58	33	30	25	150	116	50
2½	72	43	30	50	160	170	50
5	115	60	33	100	170	175	50
10	123	94	33	...	...	...	..

BARIUM SULFATE $BaSO_4$.

SOLUBILITY IN WATER AND IN AQUEOUS SOLUTIONS OF SALTS AND ACIDS.

(Karaoglanow, 1917.)

A weighed amount of $BaSO_4$ was boiled in 200 cc. of water or salt solution for 2 hours under a reflux condenser, and allowed to stand 24 hours with frequent shaking. The undissolved residue of $BaSO_4$ was filtered, washed, ignited and weighed. The amount dissolved in the wash water was determined by a special experiment and a correction made for it. By this method the solubility of $BaSO_4$ in water was found to be 0.0043 gms. per liter at room temperature.

Similar determinations were made for aqueous solutions of $BaCl_2$, H_2SO_4, KCl, KNO_3, K_2SO_4, $CaCl_2$, $SrCl_2$, $Pb(NO_3)_2$, $Fe_2(SO_4)_3$, $FeCl_3$, HCl, HNO_3 and various mixtures of these salts and acids. The results obtained for aq. HNO_3 and aq. HCl are as follows :

In Aqueous HNO_3.		In Aqueous HCl.	
Normality of HNO_3.	Gms. $BaSO_4$ per 1000 cc. sat. sol.	Normality of HCl.	Gms. $BaSO_4$ per 1000 cc. sat. sol.
0.05	0.014	0.00	0.0043
0.10	0.026	0.10	0.010
0.30	0.076	0.30	0.029
0.50	0.124	0.50	0.0047
1.00	0.237	1.00	0.087
2.00	0.393	2.00	0.146

SOLUBILITY OF BARIUM SULFATE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC AND OF NITRIC ACID. (Kolthoff and Vogelenzang, 1919.)

One-half gram of a specially prepared sample of $BaSO_4$ (preparation D) was shaken for 7-8 hours at constant temperature with 250 cc. of the acid solution. After subsidence a sample of the clear filtrate was evaporated in a platinum dish and the residue ignited and weighed.

Results for Aq. HCl at : 12°.		90°.		Results for Aq. HNO_3 at 19°.	
Normality of HCl.	Gms. $BaSO_4$ per 1000 cc. sat. sol.	Normality of HCl.	Gms. $BaSO_4$ per 1000 cc. sat. sol.	Normality of HNO_3.	Gms. $BaSO_4$ per 1000 cc. sat. sol.
0.098	0.011	0.00(= H_2O)	0.0070	0.05	0.000 (9)
0.49	0.031	0.05	0.0077	0.10	0.0012
0.98	0.0538	0.50	0.0265	0.5	0.0039
		1.00	0.0416	1.0	0.0077
				2.0	0.0119

The authors also agitated samples of $BaSO_4$, prepared in different ways, with conductivity water at 18° and after subsidence determined the conductivity of the saturated solution. After decantation the preparations were again shaken with fresh portions of H_2O and this repeated untill the conductivity became constant. The following results were obtained :

Preparation No.	$K_{18} \times 10^{-6}$.	Milligrams $BaSO_4$ per liter.
A	2.25	2.11
B	2.50	2.35
C	2.20	2.07
D	2.40	2.25
E	2.69	2.53

In a discussion of the variation in solubility of $BaSO_4$ with the size of the grain Balarew, 1925, points out that samples of $BaSO_4$ precipitated from aqueous solutions with $BaCl_2$ always contain occluded $BaCl_2$ which can be present to the extent of one per cent. Due to this source of error he questions the accuracy of Hulett's observations. Samples of $BaSO_4$ which no longer give a test for chlorides in the wash water, may yield $BaCl_2$ on prolonged grinding.

SOLUBILITY OF BARIUM SULFATE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC AND OF NITRIC ACIDS.

(Banthisch, 1884.)

In Hydrochloric Acid.				In Nitric Acid.			
cc containing 1 Mg. Equiv. of HCl.	Mgs. $BaSO_4$ per 1 Mg. Equiv. of HCl.	Gms. per 100 cc. Solution.		cc. containing 1 Mg. Equiv. of HNO_3.	Mgs. $BaSO_4$ per 1 Mg. Equiv. of HNO_3.	Gms. per 100 cc. Solution.	
		HCl.	$BaSO_4$.			HNO_3.	$BaSO_4$.
2.	0.133	1.82	0.0067	2.	0.140	3.15	0.0070
1.	0.089	3.65	0.0089	1.	0.107	6.31	0.0107
0.5	0.056	7.29	0.0101	0.5	0.085	12.61	0.0170
0.2	0.017	18.23	0.0086	0.2	0.048	31.52	0.0241

100 cc. HBr dissolve 0.04 gm. $BaSO_4$; 100 cc. HI dissolve 0.0016 gm. $BaSO_4$ at the boiling point. (Haslam, 1886.)

SOLUBILITY OF BARIUM SULFATE IN CONCENTRATED AQUEOUS SOLUTIONS OF SULFURIC ACID AT 20°.

(Von Weimarn, 1911.)

Gms. H_2SO_4 per 100 Gms. Solvent.	Gms $BaSO_4$ per 100 cc. Sat. Sol.	Gms. H_2SO_4 per 100 Gms. Solvent.	Gms. $BaSO_4$ per 100 cc. Sat. Sol.
73.83	0.0030	85.78	0.3215
78.04	0.0135	88.08	1.2200
80.54	0.0285	93	...*
83.10	0.0800	96.17	4.9665
84.15	...†	96.46	18.6900

* Solid Phase = $BaSO_4(H_2SO_4)_2\,H_2O + BaSO_4.H_2SO_4$. † Solid Phase = $BaSO_4 + BaSO_4.H_2SO_4.H_2O$.

Data for the above system are also given by Volkhouskii (1910).

100 cc. sat. solution of $BaSO_4$ in abs. H_2SO_4 contain 28.51 gms. $BaSO_4$, solid phase = $BaSO_4.3OH_2SO_4$. (Bergius, 1910.)

100 cc. of 97.86 per cent H_2SO_4 constantly agitated with Ba SO_4 in a thermostat at 25° for 96 hours contain 14.91 gms. Ba SO_4. (Meyer and Friedrich. 1922.)

SOLUBILITY OF BARIUM SULFATE IN CONCENTRATED AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°.

(Trenner and Taylor, 1931.)

The mixtures were sealed in glass tubes and rotated for seven days. After standing for 24 hours the supernatant liquid was transferred to a Lunge pipette for analysis. The acid was titrated with standard carbonate-free sodium hydroxide using methyl orange as indicator. The sulfate was determined gravimetrically.

Percent conc. of H_2SO_4 in sat. sol.	Gms. per 100 gms. sat. sol.		Percent conc. of H_2SO_4 in sat. sol.	Gms. per 100 gms. sat. sol.	
	H_2SO_4	$BaSO_4$		H_2SO_4	$BaSO_4$
83.25	83.21	0.050	96.70	88.45	8.53
85.08	84.92	0.203	97.80	87.22	10.95
85.63	85.50	0.210	97.99	86.54	11.68
86.10	85.90	0.230	98.12	86.06	12.29
87.96	87.45	0.486	98.61	86.06	12.79
92.58	90.75	1.97	98.65	85.57	13.17
92.91	90.58	2.51	98.91	85.80	13.25
94.44	90.57	4.10	98.97	85.49	13.62
94.79	90.40	4.63	99.95	85.27	13.83
95.19	86.68	5.79	99.47	84.84	14.70
95.85	89.28	6.86	99.80	84.22	15.61
96.14	89.13	7.29	99.75	84.05	15.74
96.08	88.86	7.05	100.00	84.11	15.89

The solid phases are probably $BaSO_4$ and $BaSO_4.H_2SO_4$ with a transition point at an acid concentration of about 85 percent.

SOLUBILITY OF BARIUM SULFATE IN DILUTE AQUEOUS SOLUTIONS OF SALTS AT 25°.

(Newman, 1933.)

Ionic strength of aq. solvent salt solution	Gm. mols. $BaSO_4$ per liter	Ionic strength of aq. solvent salt solution	Gm. mols. $BaSO_4$ per liter
0.0000	0.957 x 10^{-5}	0.000010 $Mg(NO_3)_2$	1.007 X 10^{-5}
0.000020 KCl	1.002 "	0.0001199 "	1.098 "
0.000263 "	1.067 "	0.0002856 "	1.172 "
0.002526 "	1.274 "	0.002686 "	1.633 "
0.02631 "	2.090 "	0.01199 "	2.458 "
0.03501 "	2.320 "	0.0000067 $LaCl_2$	1.003 "
0.000020 "	1.007 "	0.0000592 "	1.112 "
0.0003566 "	1.085 "	0.0001447 "	1.182 "
0.002456 "	1.277 "	0.0002599 "	1.290 "
0.02252 "	2.010 "	0.002400 "	2.014 "
0.03602 "	2.355 "	0.004296 "	2.394 "
0.000010 $MgCl_2$	1.002 "	0.0000067 $La(NO_3)_2$	1.003 "
0.0001198 "	1.035 "	0.00005923 "	1.112 "
0.0002856 "	1.167 "	0.0001447 "	1.182 "
0.002113 "	1.547 "	0.0002599 "	1.290 "
0.006410 "	2.015 "	0.002374 "	2.037 "
0.01064 "	2.340 "	0.004276 "	2.405 "

"The activity coefficients, and the apparent ionic diameters, were calculated, and were used as a means of comparison of the data with recent developments in the interionic attraction theory of solutions."

An investigation of the reciprocal salt pair $BaSO_4 + 2KMnO_4 \rightleftarrows Ba(MnO_4)_2 + K_2SO_4$ at 25° is reported by Benrath and Schackmann, 1934. Data for the component systems $BaSO_4 + Ba(MnO_4)_2 + H_2O$, $BaSO_4 + KMnO_4 + H_2O$, $BaSO_4 + K_2SO_4 + H_2O$, $Ba(MnO_4)_2 + KMnO_4 + H_2O$ and $K_2SO_4 + KMnO_4 + H_2O$ were determined but the numerical results are not reported in the present paper.

100 gms. sat. solution of $BaSO_4$ in 21.37% aqueous ammonium acetate solution contain 0.016 gm. at 25°. (Marden, 1916.)

SOLUBILITY OF BARIUM SULFATE IN AQUEOUS SOLUTIONS OF THORIUM CHLORIDE AT ROOM TEMPERATURE.

(Raicar and Stegmann, 1928.)

To solutions of varying concentration of Thorium Chloride, strongly illuminated by a converging beam of light, equivalent solutions of barium chloride and sulfuric acid were added and the point determined at which the Tyndall cone became permanent. This was taken as the point representing saturation of the solution.

Gm. mols. $ThCl_4$ per liter	0.0871	0.0467	0.0251	0.0102	0.0052
Gm. mols. $BaSO_4$ per liter	0.0153	0.0103	0.0066	0.0055	0.0025

Results are also shown for the solubility of Barium Sulfate in the presence of varying amounts of Barium Chloride.

100 cc. of sat. solution of $BaSO_4$ in 95% formic acid contain 0.01 gm. $BaSO_4$ at 18.5°. (Aschan, 1913.)

BARIUM SULFATE

Fusion-point data have been determined for the following mixtures:

$BaSO_4 + H_2SO_4$	(Kendall and Davidson, 1921.)
" $+ CaCl_2$	(Sakur, 1911-12.)
" $+ KCl$	"
" $+ NaCl$	"
" $+ K_2SO_4$	(Grahmann, 1913; Calcagni, 1912.)
" $+ Li_2SO_4$	(Calcagni and Marotta, 1912.)
" $+ Na_2SO_4$	(Calcagni, 1912.)

BARIUM PerSULFATE $BaS_2O_8.4H_2O$.

100 parts water dissolve 39.1 parts BaS_2O_8 or 52.2 parts $BaS_2O_8.4H_2O$ at 0°.

(Marshall — J. Ch. Soc. 59, 771, '91.)

BARIUM Amyl SULFATE $Ba(C_5H_{11}SO_4)_2.2H_2O$.

SOLUBILITY OF MIXED CRYSTALS OF THE ACTIVE AND INACTIVE SALT IN WATER AT 20.5°.

(Marckwald, 1904.)

SO

Gms. Salt per 100 Gms. H_2O.	Per cent Active Salt in Dissolved Salt.	Gms. Salt per 100 Gms. H_2O.	Per cent Active Salt in Dissolved Salt.
28.2	100	18.3	49.6
26.3	91.6	16.6	36.3
24.8	84.5	15	25.8
21.7	71.2	13.6	10.6
19.5	59.5	12.8	0

Mixed crystals of the active and inactive barium amyl sulfate were dissolved in water by warming, then cooled to the beginning of crystallization and shaken two hours at 20.5°. The percentage of the active salt was determined by the polariscope. Its specific rotation was $[\alpha]_D = +2.52°$.

BARIUM Isoamyl SULFATE $Ba(C_5H_{11}SO_4)_2.2H_2O$.

100 gms. H_2O dissolve 9.71 gms. of the anhydrous salt at 10°, 11.85 gms. at 19.3° and 12.15 gms. at 20.5°. (Marckwald, 1902.)

BARIUM THIOSULFATE BaS_2O_3.

SOLUBILITY IN WATER AND IN AQUEOUS SOLUTIONS AT 18°.5.

(Leo. 1922.)

Solvent.	Gms. BaS_2O_3 per 100 gms. sat. sol.
Water	0.2100
250 cc. H_2O + 3.2 gms. $Na_2S_2O_3.5H_2O$	0.1375
200 » » + 20.0 » »	0.1480
100 » » + 100 cc. acetone	0.0318

BARIUM DITHIONATE $BaS_2O_6.2H_2O$, and $BaS_2O_6.4H_2O$

SOLUBILITY IN WATER.

(de Baat, 1926; Schreiber, 1933.)

t°	Gms. BaS_2O_4 per 100 gms. sat. sol.	Solid Phase	t°	Gms. BaS_2O_4 per 100 gms. sat. sol.	Solid Phase
-0.46 (Eutec)	6.0	Ice + $BaS_2O_6.4H_2O$	-0.59 (Eutec)	7.7*	Ice + $BaS_2O_6.2H_2O$
0.	6.08	$BaS_2O_6.4H_2O$	0.	7.80*	$BaS_2O_6.2H_2O$
5.	8.40	"	5.	9.63*	"
8.	9.92	"	12.	12.40	"
12.	12.22	"	15.	13.60	"
13. tr.pt.	—	" + $BaS_2O_6.2H_2O$	20.	15.70	"
15.	13.92	$BaS_2O_6.4H_2O$	30.	19.86	"

* Unstable.

SOLUBILITY OF BARIUM DITHIONATE IN AQUEOUS SOLUTIONS OF MAGNESIUM DITHIONATE AND VICE VERSA AT 20° AND AT 30°. (de Baat, 1926.)

Results at 20°. Gms. per 100 gms. sat. sol.			Results at 30°. Gms. per 100 gms. sat. sol.		
BaS_2O_6.	MgS_2O_6.	Solid Phase.	BaS_2O_6.	MgS_2O_6	Solid Phase
15.75	0.0	$BaS_2O_6.2H_2O$	13.37	7.05	$BaS_2O_6.2H_2O$
10.61	6.93	»	5.85	18.91	»
1.29	31.14	»	1.92	29.16	»
0.69	33.95	» + $MgS_2O_6.6H_2O$	0.90	34.57	» + $MgS_2O_6.6H_2O$
0.0	33.91	$MgS_2O_6.6H_2O$	0.0	35.24	$MgS_2O_6.6H_2O$

SO

SOLUBILITY OF BARIUM DITHIONATE IN AQUEOUS SOLUTIONS OF POTASSIUM DITHIONATE AND VICE VERSA AT SEVERAL TEMPERATURES. (de Baat, 1926.)

Results at 0°. Gms. per 100 gms. sat. sol.		Results at 20°. Gms. per 100 gms. sat. sol.		Results at 30°. Gms. per 100 gms. sat. sol.		
BaS_2O_6.	$K_2S_2O_6$.	BaS_2O_6	$K_2S_2O_6$.	BaS_2O_6.	$K_2S_2O_6$.	Solid Phase at Each Temp.
8.02	1.21	16.43	2.69	20.64	4.16	$BaS_2O_6.2H_2O$
8.88	2.75	17.15	6.03	20.69	8.03	» + $K_2S_2O_6$
4.69	2.60	11.82	6.02	20.50	8.11	$K_2S_2O_6$
0.0	2.52	0.0	6.23	11.74	8.33	»
				6.02	8.49	»
				0.0	8.54	»

SOLUBILITY OF BARIUM DITHIONATE IN AQUEOUS SOLUTIONS OF AMMONIUM DITHIONATE AT 30° AND VICE VERSA.

(de Baat, 1926.)

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
BaS_2O_6.	$(NH_4)_2S_2O_6$.	Solid Phase.	BaS_2O_6.	$(NH_4)_2S_2O_6$.	Solid Phase.
0.0	64.60	$(NH_4)_2S_2O_6.{}^1/_2H_2O$	6.92	40.15	not stated
0.35	58.64	not stated	8.31	37.90	»
0.62	56.26	»	10.26	37.26	»
1.05	53.81	»	11.21	33.62	»
2.75	48.45	»	17.20	11.0	»
5.28	43.22	»	19.76	0.0	$BaS_2O_6.2H_2O$

SOLUBILITY OF BARIUM DITHIONATE IN AQUEOUS SOLUTIONS OF SODIUM DITHIONATE AND VICE VERSA AT SEVERAL TEMPERATURES. (de Baat, 1923, 1926.

Results at 0°. Gms. per 100 gms. sat. sol.		Results at 12°. Gms. per 100 gms. sat. sol.		Results at 20°. Gms. per 100 gms. sat. sol.		Results at 30°. Gms. per 100 gms. sat. sol.		Solid Phase at Each Temp.
BaS_2O_6.	$Na_2S_2O_6$.	BaS_2O_6.	$Na_2S_2O_6$.	BaS_2O_6.	$Na_2S_2O_6$.	BaS_2O_6.	$Na_2S_2O_6$.	
7.45	2.74	11.05	6.95	13.81	6.63	17.06	6.36	$BaS_2O_6.2H_2O$
5.86	6.23	10.76	9.27	12.66	11.02	14.45	13.09	"$+Na_2S_2O_6.2H_2O$
2.51	6.94	7.57	9.82	7.45	12.12	13.23	13.31	$Na_2S_2O_6.2H_2O$
0.0	6.05	0.0	10.63	0.0	13.39	7.32	14.87	»
						0.0	17.23	»

SOLUBILITY OF BARIUM DITHIONATE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 30°. (de Baat, 1926.)

Gms. per 100 gms. sat. sol BaS_2O_6.	C_2H_5OH.	Solid Phase.	Gms. per 100 gms. sat. sol. BaS_2O_6.	C_2H_5OH.	Solid Phase.
19.86	0.0	$BaS_2O_6.2H_2O$	0.37	42.53	$BaS_2O_6.2H_2O$
12.74	4.67	»	0.03	61.24	»
4.24	16.86	»	0.01	76.61	»
2.74	21.36	»	0.009	87.00	»
0.86	31.91	»	0.000	98.81	»

SeO BARIUM SELENITE $BaSeO_3$

EQUILIBRIUM IN THE SYSTEM BARIUM SELENITE, SELENIUM DIOXIDE AND WATER.

(Neal and McCrosky, 1938.)

Results at 0° Gms. per 100 gms. sat. sol.			Results at 25° Gms. per 100 gms. sat. sol.			Results at 50° Gms. per 100 gms. sat. sol.		
Free SeO_2	$BaSeO_3$	Solid Phase	Free SeO_2	$BaSeO_3$	Solid Phase	Free SeO_2	$BaSeO_3$	Solid Phase
0.0	0.005	N	0.0	0.005	N	0.0	0.005	N
0.17	0.39	"	0.25	0.58	"	0.26	0.67	"
0.27	0.64	"+P	0.42	0.97	"+P	0.52	1.18	"+P
1.11	0.65	P	0.41	0.95	P	1.34	1.16	P
2.04	0.58	"	1.27	0.96	"	4.87	1.28	"
4.57	0.58	"	5.94	0.97	"	13.7	1.45	"
8.80	0.69	"	13.5	1.09	"	24.7	1.80	"
17.9	0.89	"	23.3	1.38	"	37.1	2.38	"
26.6	1.10	"	33.2	1.74	"	44.7	2.81	"
30.6	1.18	"	44.7	2.42	"	57.8	3.90	"
35.6	1.44	"	59.9	3.84	"	68.3	5.32	"
44.3	1.99	"	63.6	4.36	"	71.8	6.42	"
49.7	2.44	"	67.2	5.06	"+A	73.4	6.63	"+A
57.8	3.42	"	67.3	4.61	A	73.8	5.80	A
58.6	3.53	"+A	67.7	3.13	"	74.8	3.66	"
58.7	2.51	A	68.3	1.54	"	75.4	2.75	"
58.8	1.24	"	68.8	0.0	"	76.2	1.51	"
58.9	0.0	"				76.6	0.0	"

N = Barium Selenite, $BaSeO_3$; P = Barium Pyroselenite, $BaSeO_5$;
A = Selenious Acid, H_2SeO_3.

BARIUM Tetra THIONATE $BaS_4O_6.2H_2O$

SOLUBILITY OF BARIUM TETRATHIONATE IN WATER.
(Portillo, 1929.)

t°	0°	12°.8	27°.5
Gms. BaS_4O_6 per 100 gms. sat. sol.	26.57	29.85	36.0

BARIUM SELENATE $BaSeO_4$.

One liter of H_2O saturated with $BaSeO_4$ by constant agitation at 25° for 96 hours contained 0.0792 gm. when saturation was approached from below and 0.082 gm. when approached from above. (Meyer and Friedrich, 1922a.)

BARIUM SILICATE $BaSiO_3$.

S10

Fusion point curves for mixtures of:

$BaSiO_3+CaSiO_3$ and $BaSiO_3+MnSiO_3$ are given by (Lebedeu, 1911).
$BaSiO_3+Li_2SiO_3$ and $BaSiO_3+Na_2SiO_3$ are given by Wallace, 1909.
$BaSiO_3+BaTiO_3$ are given by Smolensky (1911-12).

BeBr

BERYLLIUM BROMIDE $BeBr_2$.

100 cc. pyridine dissolve 18.56 gms. $BeBr_2$ at 25°. (Muller, R. 1924.)

BERYLLIUM CHLORIDE $BeCl_2.4H_2O$

SOLUBILITY OF BERYLLIUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID.
(Leikina and Nowoselowa, 1937.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$BeCl_2$	HCl (free)		$BeCl_2$	HCl (free)		$BeCl_2$	HCl (free)	
Results at 0°			Results at 0° (Con.)			Results at 20° (Con.)		
40.64	0.0	Be4	20.64	22.65	Be2	25.08	17.83	Be2
40.44	0.62	"	13.38	29.90	"	24.00	19.35	"
39.45	3.25	SS	10.20	33.31	"			
39.34	3.80	"	9.21	34.85	"	Results at 30°		
37.44	3.64	Be4				43.52	0.0	Be4
35.83	5.58	"	Results at 20°			42.79	0.65	"
34.56	6.86	"				40.00	3.00	"
33.60	8.19	"	42.24	0.0	Be4	38.10	4.93	"
32.10	10.01	"	40.90	0.82	"	37.76	4.84	"+Be2
30.88	11.63	"	39.36	2.79	"	36.05	8.44	Be2
29.60	13.14	"	36.16	6.27	"	34.20	9.31	"
29.12	13.83	"+Be2	33.47	10.43	"+Be2	33.60	10.04	"
26.91	15.41	Be2	31.36	11.52	Be2			
23.68	19.69	"	30.40	12.77	"	Results at 50°		
			29.41	13.52	"	44.17	0.75	Be4

Be4 = $BeCl_2.4H_2O$; Be2 = $BeCl_2.2H_2O$; SS = Solid Solution.

BERYLLIUM CHLORIDE $BeCl_2$

SOLUBILITY IN SEVERAL ORGANIC SOLVENTS AT 20°.
(Schmidt, 1929.)

Solvent	Formula	Gms. $BeCl_2$ per liter sat. sol.
Methyl alcohol	CH_3OH	256.7
Ethyl alcohol	C_2H_5OH	151.1
Amyl alcohol	$C_5H_{11}OH$	153.6
Pyridine	$CH<(CH.CH.)_2>N$	133.3

Cl

100 gms. liquid SO_2 dissolve 0.046 gm. $BeCl_2$ at 0°. (Jander and Ruppold, 1937.)

Fusion point determinations are given by Schmidt, 1926, 1929 for mixtures of $BeCl_2$ and each of the following compounds, $CaCl_2$, $CdCl_2$, LiCl, $MgCl_2$, NaCl, $PbCl_2$, TlCl, and $ZnCl_2$. Fusion point data are given by Frick and Rode, 1927 for mixtures of $BeCl_2$ and Capronitrile, Propionitrile and Tolunitrile.

BERYLLIUM Per**CHLORATE** $Be(ClO_4)_2.4H_2O$.

100 gms. sat. sol. of beryllium perchlorate in water contain 59.5 gms. $Be(ClO_4)_2$ at 25°. (Sidgwick and Lewis, 1926.)

CH **BERYLLIUM ACETATE** (basic) $Be_4O(CH_3COO)_6$.

100 gms. chloroform dissolve 33.3 gms. $Be_4O(CH_3COO)_6$ at 18°. (Wirth, 1914.)

BERYLLIUM SALICYLATE $C_7H_4O_3.2H_2O$

1000 gms. H_2O dissolve 0.0256 gm. mols. $BeC_7H_4O_3$ at 17°.92, 0.0311 gm. mols. at 26°.15 and 0.038 gm. mols. at 35°. (Jones, Hamer, Davies and Bury, 1930.)

BERYLLIUM Benzene and Toluene **SULFONATES**

SOLUBILITY OF EACH IN WATER AT 25°.

Compound.	Formula.	Gms. anhydrous compd. per 100 gms. sat. sol.	Authority.
Beryllium benzene sulfonate...	$Be(C_6H_5SO_3)_2.4H_2O$	53.8	(Sidgwick and Lewis, 1926
Beryllium *p* toluene sulfonate.	$Be(C_7H_7SO_3)_2.4H_2O$	39.2	"

BERYLLIUM PALMITATE and Salts of Other Fatty Acids.

SOLUBILITIES IN ETHYL AND METHYL ALCOHOLS AT 25°. (Jacobson and Holmes, 1916.)

Solvent.	Gms. of Each Salt (Determined Separately) per 100 Gms. Solvent.			
	Be Palmitate.	Be Stearate.	Be Laurate.	Be Myristate.
Ethyl Alcohol	0.004	...	0.004	0.004
Methyl Alcohol	0.042	0.040	0.050	0.047

BERYLLIUM OXALATE $BeC_2O_4.3H_2O$.

100 gms.	water	dissolve	63.2	gms. $BeC_2O_4.3H_2O$	at	25°	(Wirth, 1914.)
"	0.1 *n* oxalic acid	"	75.92	"	"	"	"
"	0.1 *n* sulfuric "	"	72.65	"	"	"	"
"	1.0 *n* " "	"	52.8	"	"	"	"

SOLUBILITY OF BERYLLIUM OXALATE IN AQUEOUS SOLUTIONS IN PRESENCE OF BERYLLIUM OXIDE AT 25°. (Sidgwick and Lewis, 1926.)

$d_{\frac{25}{4}}$ of sat. sol.	Gms. per 100 gms. sat. solution. BeC_2O_4.	BeO.	Solid Phase
1.179	28.20	0.08	$BeC_2O_4.3H_2O$
1.224	31.73	1.31	"
1.259	35.01	2.35	"
1.282	37.17	3.23	"
—	41.69	4.02	"
2.290	38.20	3.52	"

CO

EQUILIBRIUM IN THE SYSTEM BERYLLIUM OXALATE, OXALIC ACID AND WATER AT 25°. (Sidgwick and Lewis, 1926.)

$d_{\frac{25}{4}}$ of sat. sol.	Gms. per 100 gms. sat. sol. BeC_2O_4.	$H_2C_2O_4$.	Solid Phase	$d_{\frac{25}{4}}$ of sat. sol.	Gms. per 100 gms. sat. sol. BeC_2O_4.	$H_2C_2O_4$.	Solid Phase.
1.178	26.55	1.81	M. C.*	1.168	20.78	7.63	$H_2C_2O_4.2H_2O$
1.187	25.33	4.42	"	1.139	15.79	8.46	"
1.188	25.23	4.79	"	1.112	11.24	9.07	"
1.197	24.49	6.88	"	1.087	7.60	9.52	"
1.184	23.90	7.51	"	1.064	3.45	10.03	"
1.197	24.01	7.46	"	1.043	0.00	10.23	"

* Mixed Crystals of $BeC_2O_4\,3H_2O + H_2C_2O_4.2H_2O$.

BERYLLIUM Potassium **FLUORIDE**, etc.

F

SOLUBILITY IN WATER AND IN ACETIC ACID SOLUTIONS.

(Marignac; Sestini, 1890.)

Salt.	Formula.	Solvent.	Gms. Anhydrous Salt per 100 Gms. Solvent. At 20°.	At 100°.
Beryllium potassium fluoride	$BeF_2.KF$	Water	2.0	5.2
" sodium "	$BeF_2.NaF$	"	1.4	2.8
" hydroxide	$Be(OH)_2$	Water + CO_2 sat.	0.0185 (BeO)	...
" phosphate	$Be_3(PO_4)_2.6H_2O$	2% CH_3COOH	0.055	...
" "	"	10% "	0.1725	...

BERYLLIUM Ammonium FLUORIDES $BeF_2.NH_4F$, $BeF_2.2NH_4F$.

EQUILIBRIUM IN THE SYSTEM BERYLLIUM FLUORIDE AMMONIUM FLUORIDE AND WATER AT 0°.

(Novosajolova, 1939.)

Gms. per 100 gms. sat. sol. NH_4F	BeF_2	Solid Phase	Gms. per 100 gms. sat. sol. NH_4F	BeF_2	Solid Phase.
15.45	33.70	$BeF_2.NH_4F$	18.97	17.75	SS
15.60	30.40	"	17.50	18.21	"
16.50	28.50	"	16.20	10.60	" + $BeF_2.2NH_4F$
18.76	26.90	"	17.40	8.76	$BeF_2.2NH_4F$
19.90	25.10	"	19.08	7.00	"
21.80	24.70	"	20.60	6.30	"
21.74	25.00	"	25.85	5.06	"
21.80	25.10	" + SS	37.30	4.14	"
21.57	22.48	SS	43.40	2.49	" + NH_4F
20.37	22.05	"	43.20	0.50	NH_4F
20.15	20.16	"	43.40	0.0	"

SS = Solid Solution.

BERYLLIUM NITRATE $Be(NO_3)_2.4H_2O$

SOLUBILITY OF BERYLLIUM NITRATE IN WATER.

(Sieverts and Petzold, 1933.)

t°	Gms. $Be(NO_3)_2$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Be(NO_3)_2$ per 100 gms. sat. sol.	Solid Phase
- 6.3	13.0	Ice	-59.0	37.7	Ice
-15.3	20.9	"	-40.0	46.2	$Be(NO_3)_2.4H_2O$
-23.0	24.8	"	+ 0.4	49.4	"
-27.3	27.5	"	15.0	51.2	"
-29.7	28.3	"	30.0	52.3	"
-34.4	30.9	"	50.0	58.6	"
-46.0	34.0	"	61.0	64.8	"

The curves plotted from the above results indicate that the eutectic temperature is lower than -90°.

NO

SOLUBILITY OF BERYLLIUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID.

(Momasselowa and Nogorukaya, 1938.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
HNO_3	$Be(NO_3)_2$		HNO_3	$Be(NO_3)_2$	
Results at 0° (stable)			Results at 0° (unstable)		
0.0	49.66	$Be(NO_3)_2.4H_2O$	59.49	26.49	$Be(NO_3)_2.3H_2O$
30.40	28.87	"	56.84	31.71	"
43.26	20.31	"	55.21	34.21	"+$Be(NO_3)_2.2H_2O$
55.77	14.04	"	57.92	32.06	$Be(NO_3)_2.2H_2O$
64.84	10.26	"	62.13	28.50	"+$Be(NO_3)_2.H_2O$
69.42	8.34	"	62.25	28.60	$Be(NO_3)_2.H_2O$
68.86	10.10	"	61.70	29.30	"
62.51	22.33	"+$Be(NO_3)_2.3H_2O$	Results at 20°		
65.11	21.16	$Be(NO_3)_2.3H_2O$	0.0	51.69	$Be(NO_3)_2.4H_2O$
65.05	22.28	"	22.63	37.97	"
65.52	21.96	"	38.28	28.93	"
64.72	24.04	"	38.11	29.24	"
63.83	26.16	"	45.68	25.66	"
63.19	27.65	"+$Be(NO_3)_2.2H_2O$	55.12	23.24	"
57.36	31.16	$Be(NO_3)_2.2H_2O$	52.90	25.95	"
65.31	26.42	"	50.91	29.40	"+$Be(NO_3)_2.3H_2O$
69.78	22.49	"	50.84	29.51	$Be(NO_3)_2.3H_2O$
74.97	18.88	"+$Be(NO_3)_2.H_2O$	51.20	32.01	"

100 cc. of a saturated solution of $Be(NO_3)_2.4H_2O$ in ethyl ether, prepared by frequent agitation and allowing to stand at least 20 hours, contain 0.027 gm. BeO. A saturated etheral solution prepared as above but with beryllium nitrate previously dehydrated at 150° contains only 0.002 gm. BeO per 100 cc. (Wells, 1930.)

O

BERYLLIUM OXIDE BeO.

SOLUBILITY IN WATER. (Remy, 1925; Remy and Kuhlmann, 1924.)

One liter of H_2O dissolves 0.00005 to 0.00020 gm. Be O at about 20°, as determined by electrolytic conductivity of the saturated solution, assuming complete dissociation of the hydroxide.

BERYLLIUM HYDROXIDE $Be(OH)_2$.

SOLUBILITY IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE.

(Rubenbauer — Z. anorg. Chem. 30 334, '02.)

Moist $Be(OH)_2$ used, solutions shaken 5 hours, temperature probably about 20°.

Per 20 cc. Solution.		Molecular Dilution of the NaOH.	Gms. per 100 cc. Solution.	
Gms. Na.	Gms. Be.		NaOH.	$Be(OH)_2$.
0.3358	0.0358	1.37	2.917	0.850
0.6716	0.0882	0.68	5.840	2.094
0.8725	0.1175	0.53	7.585	2.789
1.7346	0.2847	0.27	18.310	6.760

SOLUBILITY IN AQUEOUS SODIUM HYDROXIDE AT DIFFERENT TEMPERATURES.

(Haber and Oordt, 1904.)

Normality of Aq. NaOH.	Gm. BeO per Liter Sat. Sol. at:		
	20–25°.	50–53°.	100°.
0.5	0.060	0.080	0.080
1	0.170	0.230	0.290
2	0.570	0.900	1.020

OH

EQUILIBRIUM IN THE SYSTEM BERYLLIUM HYDROXIDE, SODIUM HYDROXIDE AND WATER AT 30°.

(Fricke and Humme, 1929.)

Beryllium hydroxide was precipitated from beryllium sulfate solution by addition of ammonia. This precipitate was washed and digested on a sand bath under reflux condenser with aqueous 10% ammonia. It was a fine white powder corresponding in composition to $BeO.H_2O$, Its solubility in aqueous sodium hydroxide solutions was independant of the relative excess of solid used. The time allowed for equilibrium varied from 3 to 14 days. Two röntgenographic easily distinguishable modification exist.

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
NaOH	BeO		NaOH	BeO	
14.10	0.159	Double pyramids	36.32	3.22	Fine needles
16.20	0.197	" of $BeO.H_2O$	39.00	3.04	" of $BeO.NaOH.H_2O$
19.52	0.352	"	40.04	3.06	"
24.16	0.780	"	43.38	3.35	"
28.27	1.66	"	43.89	3.40	"
31.00	2.95	"	46.47	3.78	"
34.10	4.66	"			

BERYLLIUM Ammonium PHOSPHATE $Be(NH_4)PO_4.H_2O(?)$

PO

One liter water dissolves 0.012 gm. $Be(NH_4)PO_4$ at room temperature. (Cupr, 1929.)

BERYLLIUM SULFATE $BeSO_4.4H_2O$

SOLUBILITY OF BERYLLIUM SULFATE IN WATER.

(Levi-Malvino, 1906; Schreiner and Sieverts, 1935 Schröder, 1936.)

t^0	Gms. $BeSO_4$ per 100 gms. sat. sol.	Solid Phase
- 2.0	10.0	Ice
- 4.0	15.0	"
- 6.0	17.0	"
- 8.0	19.5	"
-10.0	21.5	"
-12.0	23.0	"
-14.0	24.7	"
-16.0	26.0	"
-18.0 Eutec.	27.0	$4BeSO_4.4H_2O$

t^0	d_4 sat. sol.	Gms. BeSO per 100 gms. sat. sol.		Solid Phase
0.	1.268	27.0	(27.0)	$BeSO_4.4H_2O$
15	1.287	27.5	(28.4)	"
25	1.301	28.7	(29.6)	"
40	1.320	31.4	(32.0)	"
60	1.350	34.7	(35.7)	"
80	1.401	(40.2)	(41.0)	"
100	1.448	45.3	(46.5)	"
110	—	47.0(?)	—	"
99	1.422	—	(43.8)	$BeSO_4.2H_2O$

The above results were read from curves plotted from the original data. The values in parentheses are the averages of Levi-Malvano and Schröder. The densities are by Schröder. Schreiner and Sieverts were unable to confirm the existence of the unstable hexa hydrate reported by Levi-Malvano.

SO BERYLLIUM SULFATE $BeSO_4.4H_2O$.

SOLUBILITY IN AQUEOUS SOLUTIONS CONTAINING BERYLLIUM OXIDE AT 25°.

(Sidgwick and Lewis, 1926.)

$d_{\frac{15}{4}}$ of sat. sol	Gms. per 100 gms. sat. sol. BeSO₄.	BeO.	Solid Phase
1.278	29.74	0.0	$BeSO_4.4H_2O$
1.318	31.73	2.16	"
1.327	32 12	2.62	"
--	33.86	4.03	"

$d_{\frac{15}{4}}$ of sat. sol	Gms. per 100 gms. sat. sol. BeSO₄.	BeO.	Solid Phase.
1.347	34.55	4.26	$BeSO_4.4H_2O$
--	34.87	5.02	"
--	36.46	6.10	"
1.416	37.48	7.73	"

SOLUBILITY OF BERYLLIUM SULFATE IN AQUEOUS SOLUTIONS OF COPPER SULFATE AND VICE VERSA.

(Novossjolova, Bodaljova and Querstein, 1938.)

Results at 30°

Gms. per 100 gms. sat. sol. $CuSO_4$	$BeSO_4$	Solid Phase
0.0	29.99	$BeSO_4.4H_2O$
1.18	29.07	"
1.89	28.50	"
3.37	27.76	"
3.97	27.58	"
5.17	26.39	" + $CuSO_4.5H_2O$
7.34	22.15	$CuSO_4.5H_2O$
8.48	20.60	"
13.94	10.81	"
16.81	4.67	"
18.04	2.54	"
18.92	1.08	"
19.86	0.0	"

Results at 80°

Gms. per 100 gms. sat. sol. $CuSO_4$	$BeSO_4$	Solid Phase
0.0	39.82	$BeSO_4.4H_2O$
1.6	39.80	"
8.13	34.73	"
10.15	33.65	"
14.20	31.05	"
15.47	30.40	" + $CuSO_4.5H_2O$
19.11	23.87	$CuSO_4.5H_2O$
23.05	18.52	"
27.48	11.63	"
31.63	5.84	"
33.81	3.79	"
34.26	2.25	"
35.54	0.0	"

SOLUBILITY OF BERYLLIUM SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID. AT 25°. (Britton, 1921.)

Aqueous H_2SO_4		Gms. $BeSO_4$ per 100 gms. sat. sol.	Aqueous H_2SO_4		Gms. $BeSO_4$ per 100 gms. sat. sol.
Normality.	Wt. % H_2SO_4		Normality.	Wt. % H_2SO_4	
0.0	0.0 (= H_2O)	29.94	11.10	40.34	5.25
3.39	12.91	20.51	13.23	46.59	3.54
5.01	19.17	15.91	16.70	55.50	2.04
5.89	22.36	13.65	19.23	62.02	0.98
8.66	32.04	8.61	20.70	66.10	0.86

The solid phase was $BeSO_4.4H_2O$ in all cases. The author failed to confirm the results of Wirth, 1913, who reported a solid phase containing $6H_2O$ and obtained values quite different from the above.

Data for the above system at 0°, 25°, 50° and 75° are given by L. Schreiner, Dissertation Jena, 1932, and the curves only are given by Schreiner and Sieverts, 1935, who state that their 25° isotherm agrees well with the previous determinations of Britton, 1921.

SOLUBILITY OF AMMONIUM SULFATE IN AQUEOUS SOLUTIONS OF BERYLLIUM SULFATE AT 25° AND VICE VERSA. (Britton, 1922a.)

SO

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
$BeSO_4$.	$(NH_4)_2SO_4$		$BeSO_4$.	$(NH_4)_2SO_4$.	
0.0	43.45	$(NH_4)_2SO_4$	24.04	32.20	1.1.2
8.62	38.60	»	26.79	28.09	» + $BeSO_4.4H_2O$
16.04	35.88	»	26.68	24.99	$BeSO_4.4H_2O$
19.72	37.56	» + 1.1.2	27.26	15.66	»
22.08	34.26	1.1.2	28.56	5.77	»
			29.94	0.0	»

1.1.2 = $(NH_4)_2SO_4.BeSO_4.2H_2O$

SOLUBILITY OF BERYLLIUM SULFATE IN AQUEOUS SOLUTIONS OF AMMONIUM SULFATE AT VARIOUS TEMPERATURES AND VICE VERSA.

(Schröder and Schwedt, 1938; Schröder, Beckmann and Ansel, 1939.)

Results at 0°			Results at 25°			Results at 50°		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$(NH_4)_2SO_4$	$BeSO_4$		$(NH_4)_2SO_4$	$BeSO_4$		$(NH_4)_2SO_4$	$BeSO_4$	
0.0	26.63	Be4	0.0	29.13	Be4	0.0	33.22	Be4
1.81	26.50	"	6.53	28.39	"	12.72	34.51	"
6.64	25.99	"	18.00	28.42	"	17.74	35.01	"
11.34	25.34	"	23.35	28.43	" + 1.1.2	19.83	35.38	" + 1.1.2
18.78	24.34	"	26.21	25.54	1.1.2	25.50	26.63	1.1.2
26.97	23.53	" + NH_4	28.18	23.63	"	31.10	23.03	"
27.63	22.11	NH_4	31.92	22.27	" + NH_4	36.94	20.91	" + NH_4
31.97	13.96	"	35.51	18.74	NH_4	40.03	13.77	NH_4
37.60	5.09	"	39.64	5.92	"	43.33	5.48	"
41.39	0.0	"	43.42	0.0	"	45.72	0.0	"

Results at 60°

Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$	Gms. per 100 gms. sat. sol. $BeSO_4$	Solid Phase
0.0	35.05	Be4
3.38	35.41	"
14.61	36.92	"
17.78	37.13	" + 1.1.2
20.09	32.95	1.1.2
24.93	27.31	"
28.96	24.34	"
34.50	20.98	"
38.48	19.86	" + NH_4
41.70	11.43	NH_4
46.69	0.0	"

Results at 75°

Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$	Gms. per 100 gms. sat. sol. $BeSO_4$	Solid Phase
0.0	38.62	Be4
5.61	39.78	"
10.58	40.45	"
14.20	40.88	" + 1.1.2
20.90	31.29	1.1.2
23.23	28.57	"
29.25	23.92	"
36.54	20.01	"
41.88	17.77	" + NH_4
44.78	9.96	NH_4
48.30	0.0	"

Results at 99.5°

Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$	Gms. per 100 gms. sat. sol. $BeSO_4$	Solid Phase
0.0	43.70	Be2
10.77	42.34	"
13.17	41.80	" + 1.1.0
18.93	33.78	1.1.0
25.98	26.21	"
31.01	22.68	"
35.91	19.61	"
41.14	16.69	"
46.69	13.80	" + NH_4
48.79	6.21	NH_4
50.79	0.0	"

Be4 = $BeSO_4.4H_2O$; Be2 = $BeSO_4.2H_2O$; 1.1.2 = $BeSO_4.(NH_4)_2SO_4.2H_2O$; 1.1.0 = $BeSO_4.(NH_4)_2SO_4$; NH_4 = $(NH_4)_2SO_4$. The authors also give results for 85° and the densities of the saturated solutions at all temperatures.

SOLUBILITY OF BERYLLIUM SULFATE IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE AND VICE VERSA, AT 25°. (Britton and Allmand, 1921.)

SO

The original results are given in terms of the percentage composition of the dissolved salts, and grams of water required to dissolve 100 grams of the two salts. They have been calculated to the following form.

Gms. per 100 gms. sat. sol. K_2SO_4.	Gms. per 100 gms. sat. sol. $BeSO_4$.	Solid Phase.	Gms. per 100 gms. sat. sol. K_2SO_4.	Gms. per 100 gms. sat. sol. $BeSO_4$.	Solid Phase
1.97	28.33	$BeSO_4.4H_2O$	15.77	10.34	1.1.2
3.06	28.19	"	16.78	13.45	"
4.78	26.67	" + 1.1.2	17.75	10.74	"
4.64	24.01	1.1.2	18.42	10.91	" + K_2SO_4
6.14	13.78	"	16.51	8.93	K_2SO_4
7.77	11.09	"	13.39	5.20	"
10.60	9.40	"	12.31	3.08	"
11.69	8.93	"	10.75	0.00	"

1.1.2 = $K_2SO_4.BeSO_4.2H_2O$.

SOLUBILITY OF BERYLLIUM SULFATE IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE AT SEVERAL TEMPERATURES AND VICE VERSA.

(Schröder, 1929.)

Results at 0°

Gms. per 100 gms. sat. sol. K_2SO_4	Gms. per 100 gms. sat. sol. $BeSO_4$	Solid Phase
0.0	26.63	Be4
1.05	26.13	"
1.52	25.81	" + 1.1.2
1.60	25.77	1.1.2
2.29	21.90	"
3.22	17.99	"
4.74	12.08	"
6.75	8.11	"
7.78	13.68*	" + K
7.83	8.55*	K
7.79	7.60*	"
7.72	6.59	" + 1.1.2
7.62	6.20	K
7.32	3.53	"
7.16	1.37	"

Results at 25°

Gms. per 100 gms. sat. sol. K_2SO_4	Gms. per 100 gms. sat. sol. $BeSO_4$	Solid Phase
0.0	29.13	Be4
1.58	28.44	"
1.92	28.10	" + 1.1.2
2.82	22.94	1.1.2
3.34	20.51	"
5.55	15.45	"
6.33	12.84	"
7.38	10.95	"
8.74	8.76	"
9.91	7.41	"
10.88	6.38	"
11.50	5.89	" + K
11.46	5.12	K
10.95	1.42	"
10.71	0.0	"

Results at 50°

Gms. per 100 gms. sat. sol. K_2SO_4	Gms. per 100 gms. sat. sol. $BeSO_4$	Solid Solid Phase
0.0	33.22	Be4
0.80	32.81	"
2.21	32.20	" + 1.1.2
3.16	27.94	1.1.2
4.84	22.16	"
6.98	15.94	"
8.46	12.89	"
10.45	9.70	"
11.39	8.50	"
13.49	6.54	"
14.76	5.67	"
14.93	5.54	" + K
14.87	5.427	K
14.45	1.898	"
14.16	0.0	"

Results at 75°

Gms. per 100 gms. sat. sol.		Solid Phase
K_2SO_4	$BeSO_4$	
0.0	38.62	Be4
2.63	37.08	"
3.52	36.73	"+1.1.2
3.89	33.46	1.1.2
5.34	27.33	"
7.20	21.94	"
10.58	14.11	"
13.41	10.03	"
15.43	7.99	"
18.41	5.71	"+K
18.25	4.96	K
17.95	3.56	"
17.46	1.20	"
17.17	0.0	"

Results at 99.5°

Gms. per 100 gms. sat. sol.		Solid Phase
K_2SO_4	$BeSO_4$	
0.0	43.51	Be2
2.57	42.26	"
5.12	41.28	"+1.1.2
5.32	39.61	1.1.2
6.98	33.60	"
8.55	26.97	"
10.92	21.31	"
13.66	15.61	"
16.71	10.91	"
19.42	8.38	"
22.17	8.48*	K
21.68	6.52	K+1.1.2
20.71	3.65	"
19.35	0.0	"

* = Metastable

Be4 = $BeSO_4.4H_2O$; Be2 = $BeSO_4.2H_2O$; K = K_2SO_4; 1.1.2 = $BeSO_4.K_2SO_4 + 2H_2O$.

Results for the densities of the saturated solutions are also given.

SO

Freezing-point data for mixtures of beryllium sulfate and potassium sulfate are given by Grahmann (1913).

SOLUBILITY OF BERYLLIUM SULFATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE AT VARIOUS TEMPERATURES AND VICE VERSA.

(Schröder, 1938; Schröder, Kombesch and Hirbach, 1938.)

Results at 0°

Gms. per 100 gms. sat. sol.		Solid Phase
Na_2SO_4	$BeSO_4$	
0.0	26.72	Be4
0.31	26.88	"
0.87	26.67	"
2.41	26.34	"
2.93	26.03	" + Na10
3.11	23.75	Na10
3.41	21.60	"
3.81	12.47	"
4.07	7.39	"
4.20	2.42	"
4.21	1.21	"
4.30	0.0	"

Results at 25°

Gms. per 100 gms. sat. sol.		Solid Phase
Na_2SO_4	$BeSO_4$	
0.0	29.29	Be4
4.30	27.63	"
9.42	25.64	"
13.90	23.90	"
19.38	22.09*	"
18.40	22.21	" + Na
19.42	20.27	Na
20.58	17.00	"
21.53	15.55	" + Na10
21.21	11.64	Na10
21.32	4.61	"
21.68	0.0	"

Results at 50°

Gms. per 100 gms. sat. sol.		Solid Phase
Na_2SO_4	$BeSO_4$	
0.0	33.31	Be4
6.83	31.07	"
10.33	30.09	"
15.77	28.46	" + 1.3
16.39	27.18	1.3
18.04	25.28	"
20.04	23.41	" + Na
20.58	22.35	Na
21.67	19.48	"
24.02	14.81	"
28.86	5.68	"
31.71	0.0	"

Results at 75°			Results at 86°			Results at 90.5°		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
Na_2SO_4	$BeSO_4$		Na_2SO_4	$BeSO_4$		Na_2SO_4	$BeSO_4$	
0.0	38.96	Be4	0.0	42.14	Be4	0.0	43.70	Be2
4.11	38.01	"	2.62	41.88	"	3.48	42.71	"
8.00	36.94	"	5.72	41.11	"	6.79	41.85	"
10.29	36.42	"	10.21	40.13	"	10.87	40.58	"
13.38	35.87	" + 1.3	13.32	39.65	" + 1.3	14.82	39.59	" + 1.3
15.45	32.47	1.3	16.94	31.93	1.3	16.97	34.51	1.3
18.75	26.63	"	18.42	28.87	"	19.53	29.32	"
20.59	23.31	"	21.95	22.36	"	21.76	24.82	"
22.13	21.01	"	25.02	17.30	"	23.98	20.71	"
24.75	18.07	" + Na	26.43	15.54	" + Na	26.51	15.78	"
25.82	14.40	Na	25.96	18.53*	Na	27.71	13.69	" + Na
27.81	7.54	"	28.01	8.61	"	28.18	10.29	Na
30.36	0.0	"	30.01	0.0	"	29.68	0.0	"

* = Unstable

Be4 = $BeSO_4.4H_2O$; Be2 = $BeSO_4.2H_2O$; Na10 = $Na_2SO_4.10H_2O$; Na = Na_2SO_4; 1.3 = $BeSO_4.3Na_2SO_4$. The authors also give results for the temperatures 16.5° and 60° and the densities of the saturated solutions in all cases.

SO

SOLUBILITY OF BERYLLIUM SULFATE IN AQUEOUS SOLUTIONS OF ZINC SULFATE AND VICE VERSA AT 25°.

(Schröder, 1936.)

d_4 of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$ZnSO_4$	$BeSO_4$	
1.3020	0.0	29.83	$BeSO_4.4H_2O$
1.3288	4.93	26.50	"
1.3642	10.46	22.83	"
1.4198	17.75	18.32	"
1.4560	21.31	16.49	" + $ZnSO_4.7H_2O$
1.4550	21.51	16.29	" "
1.4555	21.68	16.03	$ZnSO_4.7H_2O$
1.4571	23.09	14.27	"
1.4578	23.79	13.34	"
1.4671	28.09	8.66	"
1.4765	31.83	4.58	"
1.4860	34.98	1.64	"
1.4921	36.67	0.0	"

Similar results are also given for the isotherms 0°, 33°, 37°, 50°, 86° and 99°.

SeO **BERYLLIUM SELENATE** $BeSeO_4.4H_2O$.

SOLUBILITY OF BERYLLIUM SELENATE IN AQUEOUS SOLUTIONS CONTAINING BERYLLIUM OXIDE AT 25°.

(Sidgwick and Lewis, 1926.)

Gms. per 100 gms. sat. solution.		
$BeSeO_4$	BeO.	Solid Phase.
36.22	0.046	$BeSeO_4.4H_2O$
37.05	0.60	"
38.84	1.98	"
40.23	2.98	"
42.11	3.71	"

BERYLLIUM Meta**VANADATE** $Be(VO_3)_2.4H_2O$.

100 gms. H_2O dissolve 0.1 gm. of the salt at 25°. (Brinton, 1916.)

BISMUTH Bi.

RECIPROCAL SOLUBILITIES, DETERMINED BY THE METHOD OF LOWERING OF FUSION-POINT, ARE GIVEN FOR THE FOLLOWING MIXTURES:

Bismuth + Bromine	(Eggink, 1908.)
" + Chlorine	"
" + Iodine	(Amadori and Becarelli, 1912.)
" + Sulfur	(Aten, 1905; Palabon, 1904.)

MUTUAL SOLUBILITY OF BISMUTH AND ZINC. (Spring and Romanoff, 1906.)

t°.	Upper Layer		Lower Layer.		t°.	Upper Layer.		Lower Layer.	
	%Bi.	%Zn.	%Bi.	%Zn.		%Bi.	%Zn.	%Bi.	%Zn.
266	86	14	..	..	584	80	20	10	90
419	..	..	3	97	650	77	23	15	85
475	84	16	5	95	750	70	30	27	73
					810-820 (crit. temp.)				

BISMUTH BROMIDE $BiBr_3$

Br

Fusion point data for mixtures of $BiBr_3$ + $SbBr_3$ are given by Pušin and Makuc, 1938.

BISMUTH CITRATE $(CH_2)_2C(OH)(COO)_3Bi$. **BISMUTH** Ammonium **CITRATE.**

SOLUBILITY OF EACH IN WATER AND IN AQUEOUS ETHYL ALCOHOL AT 25°. (Seidell, '10.)

Gms. C_2H_5OH per 100 Gms Solvent	Gms $C_6H_5O_7Bi$ per 100 Gms Sat. Sol.	Gms C_2H_5OH per 100 Gms. Solvent.	Gms. Bi.NH_4 Citrate per 100 Gms. Sat. Sol.	d_{25} Sat. Sol.
0	0.011	0	22.25	1.25
51	0.041	51	1.34	0.92
91.4	0.065	91.4	None	0.81

·CH

BISMUTH Nitroso B Phenyl **HYDROXYLAMINE.** $Bi[C_6H_5N(NO)O]_3$

100 gms. H_2O dissolve $0.40.10^{-4}$ gm. bismuth nitroso phenyl hydroxylamine at 18°. (Martin.)

The solubility in water of the precipitated salt of nitroso phenyl hydroxylamine, obtained by adding a solution of "cupferron" $(C_6H_5N(NO)O.NH_4)$ to a solution of a soluble bismuth salt, was determined at 18° by a colorimetric method. The result corresponded to a solubility of 4.10×10^{-5} gm. atoms Bi per liter, equivalent to 0.0084 gm. $Bi[C_6H_5.N(NO)O]_3$. (Martin and Pinkus, 1927.)

BISMUTH LACTATE $C_6H_9O_6Bi.7H_2O$.

The solubility of the hydrate in water at 25°, is 12.6 gms. per 100 gms sat. solution. The solubility of the anhydrous salt is 1.6 gms. per 100 gms. sat. sol. (Moles and Portillo, 1924.)

BISMUTH Tri**PHENYL** $Bi(C_6H_5)_3$.

Fusion-point data are given for mixtures of bismuth triphenyl and mercury diphenyl by Cambi (1912).

BISMUTH SALICYLATE (basic, 64% Bi_2O_3).

SOLUBILITY IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 25°.

(Seidell, 1910.)

Gms. C_2H_5OH per 100 Gms. Solvent.	Gms. Salt per 100 Gms. Sat. Sol.	Gms C_2H_5OH per 100 Gms. Solvent.	Gms. Salt per 100 Gms. Sat. Sol.
0	0.010	80	0.065
20	0.015	90	0.095
40	0.022	92.3	0.105
60	0.036	100	0.160

BISMUTH OXALATES Neutral = $Bi_2(C_2O_4)_3$, Basic = $Bi(OH)C_2O_4$.

CO

SOLUBILITY IN AQUEOUS SOLUTIONS OF NITRIC ACID. (Koschan, 1925.)

A hot saturated solution of bismuth oxalate in 5.0 *n* H NO_3 was diluted with H_2O to desired concentrations. A very slow crystalization occurs. After 3 days the saturated solutions were analyzed and the following results obtained.

Milligrams Equivalents per liter of solution made with :

Normality of the aq. HNO_3.	$Bi_2(C_2O_4)_3$.		$Bi(OH)C_2O_4$.	
	C_2O_4''.	Bi'''.	C_2O_4''.	Bi'''.
4.0	25.8	24.7	21.3	46.2
3.0	13.5	12.7	8.5	22.5
2.0	6.0	5.4	3.8	14.2
1.0	1.9	1.5	1.2	3.7
0.5	0.7	0.5	0.4	0.7

BISMUTH CHLORIDE. $BiCl_3$. **BSMUTH OxyCHLORIDE** $BiOCl.H_2O$.

SOLUBILITY IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID.

Cl

d_{4}^{25} of Sat. Sol.	Results at 25°. (Noyes and Hall, 1917.) Gms. Atoms per 1000 Gms. H_2O.			Results at 30°. (Jacobs, 1917.) Gms. per 100 Gms. Sat. Solution.		Solid Phase.
	Cl.	Bi.	H(=Cl−3Bi).	Bi_2O_3.	HCl.	
1.002	0.3477	0.00130	0.3438	0.60	2.40	$BiOCl.H_2O$
1.007	0.4350	0.00376	0.4237	5.35	5.69	"
1.010	0.5221	0.00869	0.4960	8.17	8.47	"
1.013	0.6244	0.01767	0.5714	8.70	8.93	"
1.018	0.7375	0.03138	0.6434	14.52	13.02	"
1.025	0.8824	0.05338	0.7223	18.60	15.80	"
1.036	1.0760	0.08937	0.8079	30.10	21.7	"
1.044	1.2277	0.1177	0.8746	36.95	25.4	"
1.061	1.5321	0.1810	0.9891	54.70	31.5	"
1.083	1.9021	0.2657	1.105	56	32.8	BiOCl
1.157	3.1865	0.5685	1.481	58.5	33	$BiCl_3.2H_2O$
1.237	4.5056	0.9022	1.799	56.6	33.8	" $+BiCl_3$
1.288	5.325	1.100	2.025	56.25	34.9	$BiCl_3$
1.329	6.066	1.317	2.115	55.9	35.9	$BiCl_3.HCl$

BISMUTH OxyCHLORIDE BiOCl.

EQUILIBRIUM IN THE SYSTEM BISMUTH OXIDE, HYDROCHLORIC ACID AND WATER.

Results at 18° (Jellinek and Kuhn, 1923.) Results at 25° (Waris, 1925.

Mols. per 100 mols H_2O			Gms. per 100 gms. sat. sol		
HCl.	Bi_2O_3.	Solid Phase.	HCl.	Bi_2O_3.	Solid phase
0.71	0.0018	BiOCl	2.50	0.6	BiOCl
0.74	0.0021	"	4.22	2.60	"
0.89	0.0056	"	10.68	11.40	"
1.18	0.0165	"	13.43	16.41	"
1.28	0.0247	"	18.47	26.42	"
1.36	0.0315	"	30.23	50.74	"
2.20	0.1185	"	33.67	58.72	$BiCl_3$
3.81	0.2835	"	35.14	58.59	"

In the case of the results at 18°, the saturated solutions were prepared by adding sufficient H_2O to solutions of Bi_2O_3 in 0.1 *n* HCl untill BiOCl precipitated, and the mixtures were shaken repeatedly for 18-20 hours. For the results at 25° the constituents were constantly shaken in sealed tubes.

Cl

Data for the systems $BiCl_3 + NaCl + H_2O$ and $Bi_2O_3 + HCl + H_2O$ at room temperature are given by Kern and Jones, 1930.

SOLUBILITY OF BISMUTH CHLORIDE IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms. $BiCl_3$ per 100. cc. Solvent.	Gms. $BiCl_3$ per 100. Gms. Solvent.	Authority.
Acetone	18°	...	17.9 (d_{18} = 0.9194)	(Naumann, 1904, '05.)
Ethyl Acetate	18°	...	1.66 (d_{18} = 0.9106)	(Naumann, 1910).
Anhydrous Hydrazine	ord. temp.	32	...	(Welsh and Broderson, 1915.)

100 gms. 95% formic acid dissolve 0.05 gm. bismuth oxychloride (BiOCl) at 19.8°. (Aschan, 1913.)

Freezing-point data are given for $BiCl_3+CuCl$, $BiCl_3+FeCl_3$, $BiCl_3+PbCl_2$, $BiCl_3+PbBr_2$ and $BiCl_3+ZnCl_2$ by Herrmann (1911) and for $BiCl_3+TlCl$ by Scarpa (1912).

Fusion-point data are given for $BiCl_3 + CuCl$, $BiCl_3 + FeCl_3$, $BiCl_3 + PbCl_2$, $BiCl_3 + PbBr_2$ and $BiCl_3 + ZnCl_2$ by Herrmann, (1911), for $BiCl_3 + TlCl$ by Scarpa, (1912), and for $BiCl_3 + ZnCl_2$ by Jänecke, 1933.

Fusion-point data for mixtures of $BiCl_3 + SbCl_3$ are given by Starokadomskaja, 1939.

BISMUTH IODIDE BiI_3.

I

Data for the following systems are presented by the authors in the form of diagrams but the analytical results from which the diagrams were drawn are not given.

$BiI_3 + KI + H_2O$ at 15°, 35° and 55°. There are four branches of the solubility curve at each of the three temperatures, corresponding respectively to the solid phases, BiI_3, $BiI_3.KI.H_2O$, $BiI_3.2KI.H_2O$ and KI. (Delwaulle, 1934; Francois and Delwaulle, 1936.)

$BiI_3 + LiI + H_2O$ at 12°, 35° and 60°. There are three branches of the solubility curve at each of the three temperatures corresponding respectively to the solid phases, BiI_3, $BiI_3LiI\ 6H_2O$ and LiI. (Francois and Delwaulle, 1936.)

$BiI_3 + NH_4I + H_2O$ at 11°, 35° and 50°. There are five branches of the solubility curve at each of the three temperatures corresponding respectively to the solid phases. BiI_3, $BiI_3.NH_4I.2H_2O$, $BiI_3.2NH_4I.2H_2O$, BiI_3 $4NH_4I.2H_2O$ and NH_4I. (Delwaulle, 1935; Francois and Delwaulle, 1936.)

$BiI_3 + NaI + H_2O$ at 12°, 32° and 60°. There are four branches of the solubility curve at each of the three temperatures corresponding respectively to the solid phases. BiI_3, $BiI_3.NaI.6H_2O$, $BiI_3.2NaI.8H_2O$, and NaI. (Francois and Delwaulle, 1936.)

$BiI_3 + RbI + H_2O$ at 12°. There are four branches of the solubility curve corresponding respectively to the solid phases BiI_3, $BiI_3.1\frac{1}{2}RbI$, $BiI_3.3RbI$ and RbI. (Delwaulle, 1936.)

BISMUTH IODIDE BiI_3.

100 gms. absolute alcohol dissolve 3.5 gms. BiI_3 at 20°. (Gott and Muir, 1888)
100 gms. methylene iodide, CH_2I_2, dissolve 0.15 gm. BiI_3 at 12°. (Retgers, 1893)

BISMUTH Quinine IODIDE (Quinine Iodo bismuthate) $(BiI_3)_2C_{20}H_{24}N_2O_2.2HI$.

SOLUBILITY OF COMPLETELY DRIED QUININE IODO BISMUTHATE IN HIGHLY PURIFIED ACETONE.

(Picon, 1934.)

Very small quantities of water increase considerably the amount of the compound dissolved. Furthermore, even with perfectly dried constituents two liquid layers are formed. The lighter one contains very little quinine iodo bismuthate, while the more dense one corresponds to a liquid combination of the solvent and solid. The compound has the composition $(BiI_3)_2C_{20}H_{24}N_2O_2.2HI.6CH_3COCH_3$. The failure of the compound to crystallize increases the difficulty of the experiment. The solubility decreases in the lighter layer with increase of temperature.

I

	Lighter Layer		Heavier Layer	
t°	d	Gms. $(BiI_3)_2C_{20}H_{24}N_2O_2.2HI$ per 100 cc. sat. sol.	d	Gms. $(BiI_3)_2C_{20}H_{24}N_2O_2.2HI$ per 100 cc. sat. sol.
9	0.8159	2.64	1.473	94.2
19	0.8063	1.97	1.544	104.9
29	0.7981	1.54	1.609	115.3
39	0.7882	1.11	1.673	123.2
49	0.7793	0.80	1.732	130.2

The following results were obtained with commercial samples of quinine iodo bismuthate.

19	0.809	3.31	—	—
19	0.818	4.7	—	—
19	0.842	6.52	1.534	103.6
*19	0.939	20.08	1.314	72.64

*In this case 0.5% H_2O was present in the acetone.

NO

BISMUTH NITRATE $Bi(NO_3)_3.5H_2O$.

100 gms. acetone dissolve 48.66 gms. $Bi(NO_3)_3.5H_2O$ at 0°, and 41.7 gms. at 19°. (von Laszczynski, 1894)

SOLUBILITY OF BISMUTH NITRATE IN AQUEOUS NITRIC ACID AND IN AQUEOUS NITRIC ACID CONTAINING ACETONE, AT ORDINARY TEMPERATURE.

(Dubrissay, 1911.)

Solvent.	Gms. $Bi(NO_3)_3$ per per 100 cc. sat. Sol.	Solid Phase.
0.922 *n* HNO_3	86.86	$Bi(NO_3)_3.5H_2O$
0.922 " " + 6.66% Acetone	85.51	"
0.922 " " +13.33% "	81.96	"
2.3 " "	80.37	"
2.3 " " +16.66% "	74.47	"

SOLUBILITY OF DOUBLE NITRATES OF BISMUTH AND MAGNESIUM, NICKEL, COBALT, ZINC AND MANGANESE IN CONC. HNO_3 AT 16°.

(Jantsch, 1912.)

(d_{16} of HNO_3 = 1.325, 100 cc. of this acid contained 51.59 gms. HNO_3.)

Double Salt.	Gms. Hydrated Salt per 100 cc. Sat. Solution.	Double Salt.	Gms. Hydrated Salt per 100 cc. Sat. Solution.
$Bi_2Mg_3(NO_3)_{12}.24H_2O$	41.69	$Bi_2Zn_3(NO_3)_{12}.24H_2O$	57.51
$Bi_2Ni_3(NO_3)_{12}.24H_2O$	46.20	$Bi_2Mn_3(NO_3)_{12}.24H_2O$	65.77
$Bi_2Co_3(NO_3)_{12}.24H_2O$	54.67		

NO

BISMUTH Oxy NITRATE $BiO.NO_3.H_2O$.

SOLUBILITY OF BISMUTH OXYNITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 25°. (Smith, 1923 *a*.)

d_{25} of sat. sol.	Gm. mols. per liter sat. sol. Bi.	NO_3.	d_{25} of sat. sol.	Gm. mols. per liter sat. sol. Bi.	NO_3.
1.0005	0.002713	0.1027	1.0422	0.09956	0.6969
1.0067	0.01449	0.2168	1.0643	0.1592	0.9537
1.0228	0.04944	0.4485	1.0912	0.2351	1.2547

BISMUTH OXIDE Bi_2O_3.

O

SOLUBILITY OF BISMUTH OXIDE IN AQUEOUS NITRIC ACID AT 20°.

(Rutten and van Bemmelen, 1902.)

Present in Shaker Flask. Per 1 part $Bi_2O_3.3N_2O_5.10H_2O$.	Gms. per 100 Gms. Solution. Bi_2O_3	N_2O_5	Mols. per 100 Mols. H_2O. Bi_2O_3	N_2O_5	Ratio $Bi_2O_3 : N_2O_5$.	Solid Phase.
24.4 parts H_2O	0.321	0.963	0 126	1.61	1:12.8	$Bi_2O_3.N_2O_5.2H_2O$
3.2 parts H_2O	6.37	7.17	2.844	13.82.	1: 4.8	
Dilute HNO_3	18.74	15.9	10.50	38.65	1: 3.6	$Bi_2O_3N_2O_5.H_2O$
Dilute HNO_3	31.48	23.7	27.2	83.8	1: 3.0	
Dilute HNO_3 — 6.13% N_2O_5	32.93	24.83	30.15	97.97	1: 3.2	$Bi_2O_3.N_2O_5.H_2O$ and $Bi_2O_3.3N_2O_5.10H_2O$
6.816% N_2O_5	32.67	24.70	29.70	96.57	1: 3.2	$Bi_2O_3\ 3N_2O_5.10H_2O$
24.0% N_2O_5	24.16	28.25	19.65	98.76	1: 5.0	
51.0% N_2O_5	11.66	46.62	10.81	186.23	1:17.2	
70.0% N_2O_5	20.76	53.75	33.51	355.87	1:10.6	
	27.85	51.02	51.0	403.0	1: 7.9	$Bi_2O_3.3N_2O_5.10H_2O$ and $Bi_2O_3.3N_2O_5.3H_2O$
Anyhdrous HNO_3	8.56	68.28	14.35	492.0	1:34.3	$Bi_2O_3.3N_2O_5.3H_2O$
Bi_2O_3+ "	4.05	74.90	7.45	592.9	1:79.5	

Results are also given for 9°, 30°, and 65°.

BISMUTH HYDROXIDE $BiO(OH)$.

SOLUBILITY OF BISMUTH HYDROXIDE IN WATER. (Almkvist, 1918.)

Ordinary distilled water containing a little CO_2 was used. The Bi O (OH) was, therefore, probably converted to basic carbonate. Two liters of the saturated solution were used for the analysis. After constant stirring at approximately 20°, there was found 0.00144 gms. Bi O (OH) per liter.

BISMUTH HYDROXIDE $Bi(OH)_3$.

SOLUBILITY OF BISMUTH HYDROXIDE IN AQUEOUS SOLUTIONS OF SODIUM AND POTASSIUM HYDROXIDES AT 20° AND AT 100°.

(Moser, 1909.)

Gms. KOH per Liter.	Gms. Dissolved $Bi(OH)_3$ per Liter at:		Gms. NaOH per Liter.	Gms. Dissolved $Bi(OH)_3$ per Liter at:	
	20°.	100°.		20°.	100°.
28	0	0.188	20	0	0.188
50	trace	0.249	40	trace (0.0014)*	0.249
112	0.037	0.373	80	0.050 (0.0029)*	0.436
168	0.074	...	120	0.087 (0.0054)*	0.622
224	0.100	0.622	160	0.100	...
280	0.124	0.622	200	0.124	0.622
336	0.137	...	240	0.137	...
448	0.137	1.494	320	0.137	1.494
560	0.174	2.054	400	0.199	2.120

* Results at 25° by Knox (1909).

At 100° some $Bi(OH)_3$ was converted into BiO(OH).

SOLUBILITY OF BISMUTH HYDROXIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AND OF POTASSIUM BROMIDE AT 30°.

(Herz and Bulla, 1909.)

(An excess of bismuth hydroxide, prepared according to Moses and having the composition corresponding to BiO.OH, was shaken 2-3 weeks at 30° with aqueous KCl and KBr. The analyses of the sat. solutions are expressed in terms of millimols KOH and KCl or KBr. They have been calculated for the following table to gms. BiO.OH and KCl or KBr.)

Solvent.	Gms. per 100 cc. Sat. Sol.		Solvent.	Gms. per 100 cc. Sat. Sol.	
	BiO.OH.	KCl.		BiO.OH.	KBr.
2 *n* KCl	3.759	13.75	1 *n* KBr	8.555	7.67
3 *n* KCl	5.745	20.71	2 *n* KBr	17.785	15.02

PO BISMUTH PHOSPHATE $BiPO_4$

THE SOLUBILITY OF BISMUTH PHOSPHATE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 25°.

(Jansen, 1934.)

The $BiPO_4$ was prepared by adding a hot solution of Na_2HPO_4 to a ho nitric acid solution of $BiONO_3$. The precipitated $BiPO_4$ was washed with dilute HNO_3 and water and dried at 100°. It is very slightly soluble in aqueous NaCl, but upon the addition of very small amounts of free acid the solubility is extraordinarily increased.

A series of determinations were made of the solubility of $BiPO_4$ in aqueous solutions containing fixed amounts of HNO_3 and H_3PO_4 with increasing amounts of NaCl. In one case fixed amounts of HNO_3 and NaCl and increasing amounts of H_3PO_4 were employed. The results show that a solubility of $BiPO_4$ is approximately proportional to the third power of the chloride ion concentration and the second power of the hydrogen ion and independant of the phosphoric acid concentration. It therefore, follows that the reaction occuring in the solution of bismuth phosphate in hydrochloric acid is primarily, $BiPO_4 + 2H^+ + 3Cl^- \rightarrow Bi\begin{bmatrix}Cl_3\\H_2PO_4\end{bmatrix}^-$.

BISMUTH SULFIDE Bi_2S_3.

1 liter H_2O dissolves 0.00018 gm. Bi_2S_3 at 18°.

(Weigel, 1906; see also Bruner and Zawadski, 1912.)

A critical survey of the literature on the solubilities of metal sulfides lead Kolthoff, 1931 to the conclusion that the results of Weigel are unreliable.

SOLUBILITY OF BISMUTH SULFIDE IN AQUEOUS ALKALI SULFIDE SOLUTIONS AT 25°.

(Knox, 1909)

Solvent.	Gms. Bi_2S_3 per 100 cc. Sat. Solution.	Solvent.	Gms. Bi_2S_3 per 100 cc. Sat. Solution.
0.5 *n* Na_2S	0.0040	0.5 *n* Na_2S + 1 *n* NaOH	0.0185
1.0 *n* "	0.0238	1 *n* Na_2S + 1 *n* NaOH	0.0838
1.5 *n* "	0.1023	0.5 *n* K_2S + 1 *n* KOH	0.0240
0.5 *n* K_2S	0.0043	1 *n* K_2S + 1 *n* KOH	0.1230
1 *n* "	0.0337	1.25 *n* K_2S + 1.25 *n* KOH	0.2354
1.5 *n* "	0.0639		

BISMUTH SULFIDE, TELLURIDE, MOLYBDATE, etc.

Fusion-point data are given for the following systems.

$Bi_2S_3 + Bi_2Te_3$.	(Amadori, 1915, 1918.)
» » + Bi.	»
$Bi_2(MoO_4)_3 + PbMoO_4$.	(Zambonini, 1920.)
$Bi_2(WO_4)_3 + PbWO_4$.	»
$Bi_2O_3 + PbO$.	(Belladen, 1922.)

BISMUTH SULFATE $Bi_2(SO_4)_3$

EQUILIBRIUM IN THE SYSTEM $Bi_2(SO_4)_3 + K_2SO_4 + H_2O$ AT 25°.

(Cagliotl and Stolfi, 1927.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$Bi_2(SO_4)_3$	K_2SO_4		$Bi_2(SO_4)_3$	K_2SO_4	
—	2.69	?	—	7.62	$Bi_2(SO_4)_3.3K_2SO_4$
—	4.47	?	—	9.29	"
—	4.50	$Bi_2(SO_4)_3.3K_2SO_4$	—	12.01	"
—	5.32	"	—	12.86	" + K_2SO_4
—	6.34	"			

EQUILIBRIUM IN THE SYSTEM $Bi_2(SO_4)_3 + Li_2SO_4 + H_2O$ AT 25°.

(Malossi, 1931.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$Bi_2(SO_4)_3$	Li_2SO_4		$Bi_2(SO_4)_3$	Li_2SO_4	
0.16	36.20	$Li_3Bi(SO_4)_3.2H_2O$	0.13	19.52	$Bi_2O_3SO_3.Li_2SO_3.2H_2O$
0.15	26.10	"	0.11	16.79	"
0.15	25.75	$Bi_2O_3SO_3.Li_2SO_4.2H_2O$	0.09	14.92	"

EQUILIBRIUM IN THE SYSTEM $Bi_2(SO_4)_3 + (NH_4)_2SO_4 + H_2O$ AT 25°.

(Cagliotl and Malossi, 1929.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$Bi_2(SO_4)_3$	$(NH_4)_2SO_4$		$Bi_2(SO_4)_3$	$(NH_4)_2SO_4$	
0.10	23.50	$Bi_2(OH)_4SO_4$	0.125	32.52	$Bi(NH_4)_3(SO_4)_3$
0.103	25.27	"	0.13	36.37	"
0.107	25.40	" + $Bi(NH_4)_3(SO_4)_3$	0.14	40.36	"
0.115	25.50	$Bi(NH_4)_3(SO_4)_3$	0.14	41.13	" + $(NH_4)_2SO_4$

BROMINE Br_2

SOLUBILITY IN WATER.

(Winkler — Chem. Ztg. 23, 687, '99; Roozeboom — Rec. trav. chim. 3, 29, 59, 73, 84, '84; Dancer — J. Chem. Soc. 15, 477, '62; at 15°, Dietze — Pharm. Ztg, 43, 290, '98.)

t°.	Grams Bromine per 100 Grams. Water. (W.)	Water. (R. D. & D.)	Solution (W.)	Solution (R. D. & D.)	"Absorption Coefficient." * a.	"Solubility." * q.
0	4.17	4.22	3.98	4.05	60.5	43.1
5	3.92	3.7	3.77	3.57	45.8	32.4
10	3.74	3.4	3.61	3.29	35.1	24.8
15	3.65	3.25	3.52	3.15	27.0	19.0
20	3.58	3.20	3.46	3.10	21.3	14.8
25	3.48	3.17	3.36	3.07	17.0	11.7
30	3.44	3.13	3.32	3.03	13.8	9.4
40	3.45	...	3.33	...	9.4	6.2
50	3.52	...	3.40	...	6.5	4.0
60	...	...	...	...	4.9	2.8
80	...	...	...	...	3.0	1.1

* a "Absorption Coefficient" = the volume of gas (reduced to 0° and 760mm pressure) taken up by one volume of liquid at the given temperature when the partial pressure of the gas equals 760mm mercury.

* q "Solubility" = the amount of gas in grams dissolved by 100 gms. pure solvent at the given temperature if the total pressure, that is the partial pressure of the gas plus the vapor pressure of the liquid at the absorption temperature, is 760mm of mercury.

ADDITIONAL DETERMINATIONS OF THE SOLUBILITY OF BROMINE IN WATER.

t°	Gms. Br per 100 gms. sat. sol.	Solid Phase	t°	Gms. Br per 100 gms. sat. sol.	Solid phase
-0.3(Eutec.)	2.23(1)	Ice + $Br_2.8H_2O$	20.5	3.46 (5)	Br_2
0.0	2.25(1)	$Br_2.8H_2O$	25.0	3.42 (3)†	"
0.0	2.31(2)	$Br_2.10H_2O$	25.0	3.36 (4)†	"
+3.0	3.08(1)	$Br_2.8H_2O$	25.0	3.39 (6)	"
5.84	3.73(1)	" +Br_2	30.1	3.341(7)	"
-0.58	4.12(1)*	Ice +Br_2	36.0	3.357(7)	"
0.0	4.05(1)*	Br_2	41.0	3.387(7)	"
+3.0	3.85(1)*	"	44.8	3.414(7)	"
10.0	3.60(1)	"	48.8	3.447(7)	"
20.0	3.41(1)	"	52.8	3.496(7)	"
			53.6(b.pt.)	3.50 (7)	"

* Unstable † gms. per 100cc. sat. solution.

(1) D'Ans and Höfer, 1934; (2) Harris, 1932; (3) Jones and Baeckstrom, 1934; (4) Bray and Connolly, 1910; (5) Oliveri-Mandala, 1920; Pearce and O'Leary, 1923; (7) Rhodes and Bascomb, 1927.

At the b. pt. of 53.6°, the pressure is 748.8mm Hg. and the vapor that is given off contains 98.85 gms. Br per 100 gms. vapor.

In addition to the result for the solubility of Bromine in water at 25° the paper of Jones and Baeckstrom, 1934, contains results for the solubility of Bromine in aqueous KBr solutions of 0.01 to 0.10 normality. The equilibrium constant of the reaction $Br_2 + Br \rightleftarrows Br_3$ was found to be 16.0 and that for the reaction $2Br_2 + Br \rightleftarrows Br_5$ was calculated to be 40.0. Determinations are also given of the hydrolysis constant of bromine in water and the activity coefficient of bromine in aqueous solutions of KNO_3.

The density of a saturated solution of bromine in water at 0° is $d^{0}_{4} = 1.0286$, and it has the composition Br_2, 0.2539 mols. per liter; H^+, 0.001085; Br, 0.000126; Br_3, 0.000628; Br_5, 0.000331. (Jones and Hartmann, 1916.)

The coefficient of solubility of bromine in water at 15°, determined by an aspiration method, is given as 33 by Jones (1911). This investigator also gives the figure 56 for the solubility coefficient in 25 vol. % acetic acid and 551 for 90 vol. % acetic acid at 15°.

Data for the distribution of bromine between water and air at 25°, are given by Hantzsch and Vagt (1901).

EQUILIBRIUM IN THE SYSTEM $Br_2 + CsBr + H_2O$ AT 0° AND AT 25°.

(Harris, 1932.)

Results at 0°			Results at 25°		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
Br_2	CsBr		Br_2	CsBr	
4.25	2.73	$Br_2 \cdot 10H_2O$	3.48	0.0	Liquid Br present
5.72	4.46	" +CsBr	11.70	13.53	Two liquids
4.80	5.07	$CsBr_3$	12.13	14.56	Solid + two liquids
2.97	6.55	"	59.20	34.77	" " "
1.12	20.80	"	4.26	20.14	$CsBr_3$
0.81	43.35	" + CsBr	2.15	55.51	" + CsBr
—	45.00	"	—	55.23	CsBr
86.20	13.80	$CsBr_3$	64.42	32.08	$CsBr_3$
77.43	20.75	"	81.06	18.94	—
73.70	23.54	"+ $Br_2 \cdot 10H_2O$	16.35	18.90	In variant at 30.6°
78.91	19.14	$Br_2 \cdot 10H_2O$			
85.61	13.18	"			
92.63	6.71	"			

SOLUBILITY OF BROMINE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID, HYDROBROMIC ACID AND SODIUM CHLORIDE. (Oliveri-Mandala, 1920.)

In Aq. NaCl at 20°.6.		In Aq. HCl at 20°.8.		In Aq. HBr at 20°.8.	
Gm. mols. per liter		Gm. mols. per liter		Gm. mols. per liter	
NaCl	Br.	HCl.	Br.	HBr.	Br.
0.7010	0.3211	1.070	0.4959	0.052	0.2744
1.0891	0.3861	1.605	0.6532	0.104	0.3331
1.3867	0.4246	2.140	0.8159	0.208	0.4538
1.7680	0.4925	2.463	0.928	0.416	0.6809
2.0260	0.5408	3.106	1.164	0.832	1.1735
2.313	0.6122			1.664	2.1293

SOLUBILITY OF BROMINE IN AQUEOUS SOLUTIONS OF MERCURIC BROMIDE AT 25° AND VICE VERSA.

(Herz and Paul, 1914.)

Gms per 100 cc. Sat. Sol.		Solid Phase.	Gms. per 100 cc. Sat. Sol.		Solid Phase.
$HgBr_2$.	Br.		$HgBr_2$.	Br.	
0	3.40	Br_2	0.763	3.57	Br_2+HgBr_2
0.202	3.53	"	0.701	2.88	$HgBr_2$
0.285	3.55	"	0.664	1.20	"
0.462	3.56	"			

SOLUBILITY OF BROMINE IN AQUEOUS SOLUTIONS OF POTASSIUM BROMIDE.

(Results at 0° and 25°, Boericke, 1905; at 0°, Jones and Hartmann, 1916; at 18.5° and 26.5°, Worley, 1905.)

Gm. Mols KBr per Liter.	Gms. KBr per Liter.	Gms. Bromine Dissolved per Liter of Sat. Solution at:			
		0°.	18.5°.	25°.	26.5°.
0	0	41.6 (24.2)	35.56	34	34.23
0.005	0.59	41.7 (25.5)	36.1	34.3	35.1
0.010	1.19	42.6 (26.2)	37	35	36
0.020	2.38	44.4 (27.5)	38.56	36.5	37.35
0.050	5.95	50.2 (31.5)	43.8	41	42.5
0.100	11.90	59.7 (40)	52.23	49.3	51.87
0.20	23.80	79.1 (57.1)	69.69	67.3	68.69
0.50	59.51	138.6 (111.9)	123	119	116
0.80	92.22	200 (174)	178.70	176	168.10
1	119.02	243.1 (217.5)	216	216.5	204
1.725	205.2	402.3 (395.9)	...	...	...
1.82	216.6	423.8 (423)	...	...	...
2.17	258.2	511.7 (511.7)	...	...	...
3.033	360.8	736.7 ...	...	632.4	...

Br

Very accurate determinations at 0°, at concentrations of KBr below 0.01 normal, are given by Jones and Hartmann. Liquid bromine in contact with aqueous solutions at 0° is slowly converted to the hydrate, $Br_2.10H_2O$, with a reduction in amount of dissolved bromine. At this temperature there are, consequently, two saturation concentrations. The unstable one being for solutions in contact with liquid bromine and the stable one being for solutions in contact with $Br_2.10H_2O$. The results for the latter are shown in parentheses in the above table.

SOLUBILITY OF BROMINE IN AQUEOUS SOLUTIONS OF SODIUM BROMIDE AT 25°.

(Bell and Buckley, 1912.)

Grams per Liter Sat. Sol.		d_{25} of Sat. Sol.	Gms. per Liter Sat. Sol.		d_{25} of Sat. Sol.
NaBr.	Br.		NaBr.	Br.	
92.6	99.2	1.213	319.7	546	1.997
160.5	176.7	1.372	359	641.6	2.137
205.8	247.8	1.515	...	769.2	2.327
255.8	343	1.678	408.3	834	2.420

EQUILIBRIUM IN THE SYSTEM $Br_2 + KBr + H_2O$ AT 0°.

(Harris, 1932.)

Results for low concentrations of KBr

Gms. per 100 gms. sat. sol. Br_2	Gms. per 100 gms. sat. sol. KBr	Solid Phase
2.31	0.0	$Br_2.10H_2O$
9.73	5.39	"
12.15	6.85	"
13.22	7.25	"
14.54	8.20	"
24.77	12.33	"
26.71	13.07	"
32.76	14.70	"
34.12	14.79	"+2 liquid layers
35.36	15.09	2 liquid layers
41.95	16.14	" "

Results for high concentrations of KBr

Gms. per 100 gms. sat. sol. Br_2	Gms. per 100 gms. sat. sol. KBr	Solid Phase
53.84	17.13	2 liquid layers
61.60	16.77	" "
68.87	15.54	" "
76.26	13.81	"+$2KBr_6.3H_2O$
75.28	13.85	$2KBr_6.3H_2O$
71.06	16.25	"
67.61	18.18	"
58.51	22.87	"
54.87	26.01	"
52.85	29.02	" + KBr
50.30	29.50	KBr
34.46	31.54	"

In order to insure the separation of $Br_2.10H_2O$ it was necessary initially to cool the mixture to about -15°. An ingenious apparatus was used for the determination of all the constituents of the saturated solutions.

SOLUBILITY OF BROMINE IN AQUEOUS SOLUTIONS OF POTASSIUM SULPHATE, SODIUM SULPHATE, AND OF SODIUM NITRATE AT 25°.

(Jakowkin — Z. physik. Chem. 20, 38, '96.)

Normality of Salt Solution.	In K_2SO_4 Gms. per Liter. K_2SO_4.	In K_2SO_4 Gms. per Liter. Br.	In Na_2SO_4 Gms. per Liter. Na_2SO_4.	In Na_2SO_4 Gms. per Liter. Br.	In $NaNO_3$ Gms. per Liter. $NaNO_3$.	In $NaNO_3$ Gms. per Liter. Br.
$\frac{1}{1}$	91.18	25.14	63.55	25.07	85.09	28.80
$\frac{1}{2}$	45.59	29.44	31.77	29.20	42.54	31.35
$\frac{1}{4}$	22.79	31.46	15.88	31.33	21.27	32.62
$\frac{1}{8}$	11.39	32.70	7.94	32.94	10.63	33.33
$\frac{1}{16}$	5.69	33.10	3.97	33.26	5.31	33.74

SOLUBILITY OF BROMINE IN AQUEOUS SALT SOLUTIONS AT 25°.

(McLauchlan, 1903.)

Salt.	Gms. Salt per Liter.	Normality of Dissolved Br.	Gms. Br. per Liter.	Salt.	Gms. Salt per Liter.	Normality of Dissolved Br.	Gms. Br. per Liter
Water	0.0	0.424	33.95	NH_4NO_3	80.11	0.688	55.15
Na_2SO_4	63.55	0.286	23.9	NaCl	58.50	0.701	55.90
K_2SO_4	91.18	0.310	24.8	KCl	74.60	0.718	57.40
$(NH_4)_2SO_4$	70.04	0.971	77.7	NH_4Cl	53.52	1.028	82.2
$NaNO_3$	85.09	0.3495	28.0	CH_3COONH_4	77.09	4.26	340.5
KNO_3	101.19	0.362	28 95	H_2SO_4*	49.03	0.366	29.26

* Wildeman.

SOLUBILITY OF BROMINE IN AQUEOUS SOLUTIONS OF STRONTIUM BROMIDE AT 25°.

(Pearce and O'Leary, 1923.)

Mols. per 1000 gms. H_2O $SrBr_2$.	Mols. per 1000 gms. H_2O Br_2.	Mols. per 1000 gms. H_2O $SrBr_2$.	Mols. per 1000 gms. H_2O Br_2	Mols. per 1000 gms. H_2O $SrBr_2$.	Mols. per 1000 gms. H_2O Br_2.
0.000	0.21966	0.06183	0.34871	0.25015	0.87806
0.01229	0.23862	0.12361	0.47838	0.30555	1.09510
0.02455	0.26533	0.19916	0.73592	0.39113	1.25960
0.05683	0.31524	0.22293	0.80449		

DISTRIBUTION OF BROMINE BETWEEN WATER AND CARBON TETRACHLORIDE AT 0°.

(Jones and Hartmann, 1916.)

Gm. Br_2 per gm. CCl_4 solution.	Density CCl_4-Br_2.	Mols. Br_2 per liter in CCl_4.	Mols. Br_2 per liter in H_2O.	Gm. Br_2 per gm. CCl_4 solution.	Density CCl_4-Br_2.	Mols. Br_2 per liter in CCl_4.	Mols. Br_2 per liter in H_2O.
0.1646	1.7667	1.8194	0.07015	0.06126	1.6809	0.6442	0.02870
0.08661	1.7012	0.9218	0.03937	0.05433	1.6755	0.5695	0.02572
0.08162	1.6972	0.8666	0.03771	0.01847	1.6470	0.1903	0.00901
0.07261	1.6896	0.7676	0.03344	0.01640	1.6454	0.1687	0.008007

Data are also given for the distribution of bromine between aqueous KBr solutions and carbon tetrachloride at 0°.

DISTRIBUTION OF BROMINE AT 25° BETWEEN :

(Pearce and O'Leary, 1923.)

Water and Carbon tetrachloride.

Gm. mols. Br_2 per 1000 gms. H_2O of the H_2O layer (W)	Gm. mols. Br_2 per 1000 gms. CCl_4 of the CCl_4 layer (C).	$\frac{C}{W}$.
0.01529	0.28224	18.46
0.02984	0.58550	19.62
0.03561	0.76320	21.43
0.04163	0.89829	21.58
0.04613	1.0152	22.01
0.04889	1.0686	22.88
0.06600	1.6553	25.08
0.06805	1.7714	26.03
0.08648	2.3842	27.57
0.08475	2.4207	28.56
0.08779	2.5854	29.45
0.09249	2.7498	29.73

Aq. $SrBr_2$ solutions and Carbon tetrachloride.

Gm. mols $SrBr_2$ per 1000 gms. H_2O.	Gm. mols. Br_2 per 1000 gms. CCl_4.	Gm. mols. Br_2 per 1000 gms. H_2O. Total Br_2.	Gm. mols. Br_2 per 1000 gms. H_2O. Free Br_2.
0.05386	Not given	0.05401	0.02262
0.15161	"	0.16689	0.03886
0.15615	"	0.11407	0.02328
0.29435	"	0.21511	0.02451
0.29851	"	0.29596	0.03828
0.34560	"	0.29380	0.03268
0.36740	"	0.23785	0.02447
0.39582	"	0.18796	0.01528
0.43315	"	0.32753	0.02689
0.59546	"	0.56390	0.04287
0.72234	"	0.46989	0.02629

Data for the distribution of Bromine between water and benzene and aqueous solutions of KBr and benzene are given by Lichaejova and Lucinskij, 1938.

DISTRIBUTION OF BROMINE BETWEEN WATER AND CARBON TETRACHLORIDE.

(Griffith, McKeown and Winn, 1932.)

Aqueous layer pure H_2O

t°	Mols. Br_2 per liter Aq. layer (W)	Mols. Br_2 per liter CCl_4 layer (C)	$\frac{C}{W}$
16.5	0.000698	0.01653	23.7
"	0.000985	0.02360	24.0
"	0.001490	0.03755	25.2
"	0.002939	0.0748	25.5
"	0.004950	0.1272	25.8

Aqueous layer 0.001 normal H_2SO_4

t°	Mols. Br_2 per liter Aq. layer (W)	Mols. Br_2 per liter CCl_4 layer (C)	$\frac{C}{W}$
16.5	0.00700	0.1843	26.3
21.5	0.00646	0.1775	27.5
"	0.00682	0.1881	27.6
"	0.01328	0.370	27.8

The purpose of the 0.001 normal H_2SO_4 was to limit the hydrolysis of the bromine in the aqueous layer. These authors also give results for the distribution of bromine between carbon tetrachloride and aqueous solutions of HBr, KBr, LiBr and NaBr. Results for the distribution of bromine between carbon tetrachloride and aqueous solutions of HBr are also given by Lewis and Storch, 1917, Sherrill and Izard, 1928, and Wilke and Martin, 1927. These latter authors also give results for CCl_4 + aq. KBr solutions.

DISTRIBUTION OF BROMINE AT 25° BETWEEN WATER AND:

(Calculated from results of Jakowkin, 1895. Those in parentheses from Herz and Kurzer, 1910.)

Carbon Disulfide.

Gms. Br. per Liter of: Aq. Layer.	Gms. Br. per Liter of: CS_2 Layer.
0.5	36 (35)
1	80 (75)
2	163 (155)
3	240 (230)
4	330 (310)
5	420 (395)
6	515 (480)
7	620 (565)

Bromoform.

Gms. Br. per Liter of: Aq. Layer.	Gms. Br. per Liter of: $CHBr_3$ Layer.
0.5	33
1	66
2	136
3	206
4	276
5	346
6	415
....	...

Carbon Tetrachloride.

Gms. Br. per Liter of: Aq. Layer.	Gms. Br. per Liter of: CCl_4 Layer.
0.5	15 (13)
1	28 (23)
2	60 (45)
3	90 (70)
4	123 (95)
5	156 (122)
6	190 (150)
8	260 (220)
10	340 (300)
12	430 (400)
14	520 (550?)

Lewis and Storch (1917) point out that Jakowkin (1896) failed to take into consideration, the hydrolysis of the bromine in the aqueous phase in the very dilute solutions. They used 0.001 *n* HCl which prevents the hydrolysis but is presumably too dilute to affect the true solubility. The distribution coefficient found in this way, given in terms of mols. Br per 1000 gms. H_2O, divided by the mol. fraction of Br in the CCl_4, is 0.3705 at 25°. These authors also give a series of determinations of the distribution of bromine between 0.1 *n* HBr and CCl_4 at 25°.

Br

DISTRIBUTION OF BROMINE BETWEEN WATER AND MIXTURES OF CARBON DISULFIDE AND CARBON TETRACHLORIDE AT 25°.

(Herz and Kurzer, 1910)

25 Vol. % CS_2 + 75 Vol. % CCl_4.

Gms. Bromine per Liter. Aq. Layer.	Gms. Bromine per Liter. CS_2+CCl_4 Layer.
0.79	28.4
1.53	58.4
2.32	86.6
2.98	111.3
3.66	137.8
5.26	205.1
7.95	324.9
9.66	432.2

50 Vol. % CS_2+50 Vol. % CCl_4.

Gms. Bromine per Liter. Aq. Layer.	Gms. Bromine per Liter. CS_2+CCl_4 Layer.
0.63	28.7
1.19	54.5
1.76	81.1
2.45	110.9
2.95	132.9
6.47	343.8
7.97	447.7

75 Vol. % CS_2+25 Vol. % CCl_4.

Gms. Bromine per Liter. Aq. Layer.	Gms. Bromine per Liter. CS_2+CCl_4 Layer.
0.71	46
1.34	87.2
3.98	213.8
5.06	330.5
6.82	444.2

DISTRIBUTION OF BROMINE AT 25° (Herz and Rathmann, 1913) BETWEEN:

Water and Tetrachlorethane.

Grams Bromine per Liter. Aq. Layer.	Grams Bromine per Liter. $C_2H_2Cl_4$ Layer.
0.216	6.47
0.592	18.20
0.944	29.46
1.348	41.65
2.444	74.57

Water and Pentachlorethane.

Gms. Bromine per Liter. Aq. Layer.	Gms. Bromine per Liter. $C_2H.Cl_5$ Layer.
0.402	10.70
0.670	18.29
0.864	23.49
1.300	35.46
2.408	67.44

DATA FOR THE DISTRIBUTION OF BROMINE BETWEEN AQUEOUS SALT SOLUTIONS AND ORGANIC SOLVENTS ARE GIVEN BY THE FOLLOWING INVESTIGATORS:

Immiscible Solvents.	t°.	Authority.
Aqueous $CdBr_2+CCl_4$	25	(Van Name and Brown, 1917.)
Aqueous $CdBr_2.2KBr+CCl_4$	25	" "
Aqueous $HBr+CCl_4$	25	(Lewis and Storch, 1917.)
Aqueous $HgBr_2+CCl_4$	25	(Herz and Paul, 1914; Van Name and Brown, 1917.)
Aqueous $HgBr_2.2KBr+CCl_4$	25	(Van Name and Brown, 1917.)
Aqueous $KBr+CCl_4$	0	(Jones and Hartmann, 1916.)
Aqueous $KBr+CS_2$	32.6	(Roloff, 1894.)

DISTRIBUTION OF BROMINE BETWEEN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AND CARBON TETRACHLORIDE AT 30°. (Ray and Sarkar, 1922.)

Normality of the aq. HCl.	Concentration of Bromine in		Normality of the aq. HCl.	Concentration of Bromine in	
	Aq. layer.	CCl_4 layer.		Aq. layer.	CCl_4 layer.
0.25......	1.584	36.36	1.0......	1.291	16.92
0.25......	2.246	51.87	1.0......	1.541	19.46
0.5.......	0.6852	12.69	1.0......	1.881	24.00
0.5......	0.9210	16.48	1.0......	2.989	38.38
0.5.......	2.1520	38.54			

DISTRIBUTION OF BROMINE BETWEEN GLACIAL ACETIC ACID AND AIR.

(Dancaster, 1932.)

t°	Gm. Mols. Br_2 per liter		$\frac{L}{A}$	t°	Gm. Mols Br_2 per liter		$\frac{L}{A}$
	CH_3COOH layer(L)	Air layer(A)			CH_3COOH layer(L)	Air layer(A)	
15	0.04712	0.00005945	792.6	25	0.89242	0.001707	522.8
"	0.59393	0.0007480	794.0	30	0.04017	0.00009589	418.9
20	0.04605	0.00007210	638.7	"	0.29630	0.0007056	419.9
"	0.58243	0.0009129	638.0	40	0.04696	0.0001706	275.3
25	0.04272	0.00008228	519.2	"	0.39274	0.001422	276.2

Results are also given for the distribution of bromine between air and glacial acetic acid solutions of CH_3COONa, CH_3COOK and Na_2HPO_4 which do not form per halides and for LiCl, NaCl, KCl and $AlCl_3$, which normally form the tri halide and $HgCl_2$, $FeCl_3$, $SnCl_4$ and $SbCl_5$ which give higher values than the normal halides. Results are also given for glacial acetic acid solutions of KBr which forms principally the penta instead of the tri halide as in the case of the normal chloride salts.

This author also gives a series of determinations of the distribution of bromine between water and CCl_4 at 15°, 20°, 30° and 40°.

Reciprocal Solubility of Bromine and Chlorine, Bromine and Hydrobromic Acid and Bromine and Sulfur Dioxide, Determined by Method of Lowering of the Freezing-point

Results for Bromine + Chlorine.

(Lebeau, 1906; see also Karsten, 1907.)

t° of Melting.	Gms. Br per 100 Gms. Mixture.
−102.5	0
−100	6.5
− 90	31
− 80	48.6
− 70	60.4
− 60	70
− 50	79
− 40	86.3
− 30	91.1
− 20	95.2
− 10	89
− 7.3	100

Bromine + Hydrobromic Acid.

(Büchner and Karsten, 1908–09.)

t° of Melting.	Gms. Br per 100 Gms. Mixture	Mol. % Br. in Mixture.
−87.3	0	0
−90	6	2.5
−95*	11.2	4.8
−90	11.8	5
−80	15.2	6.8
−70	22	11.5
−60	31.7	19
−50	43	30
−40	54.5	43.5
−30	66.2	60
−20	79.5	76.5
−12.5	90	90

* Eutec..

Bromine + Sulfur Dioxide.

(van der Goot, 1913.)

t° of Melting.	Gms. Br per 100 Gms. Mixture.
−75.1	0
−75.3*	1.73
−60	4
−40	12.5
−30	21
−20	35.5
−18	40.5
−16	48
−14	72
−13	90
−10	96.5
− 7.1	100

Reciprocal Solubility of Bromine and Chloroform Determined by the Lowering of the Freezing-Point.

(Sameshima and Hiramatsu, 1934; Wheat II and Browne, 1936.)

The results were plotted on cross section paper and the following average values read from the curves. The lower figures in parentheses are by Sameshima and Hiramatsu.

t^o	Mols. Br_2 per 100 mols. $Br_2 + CHCl_3$	Solid Phase	t^o	Mols Br_2 per 100 mols. $Br + CHCl_3$	Solid Phase
-63.5(m.pt.)	0	$CHCl_3$	-50	36.0 (24.0)	Br_2
-65	3.0	"	-45	42.5 (29.0)	"
-67.5	6.7	"	-40	49.5 (34.5)	"
-70.0	10.0	"	-35	56.0 (41.0)	"
-71.5(Eutec)	12.5	" $+Br_2$	-30	63.5 (48.5)	"
-70	14.0(13.0)	Br_2	-25	70.5 (58.0)	"
-65	19.0(15.0	"	-20	78.0 (69.0)	"
-60	24.0(17.0)	"	-15	85.5 (80.5)	"
-55	30.0(20.0)	"	-10	94.0 (93.0)	"
			-7.3	100.0 (100)	"

Reciprocal Solubility of Bromine and Carbon Tetrachloride Determined by the Lowering of the Freezing Point.

(Sameshima and Hiramatsu, 1934.)

t^o	Mols. Br_2 per 100 mols. $Br_2 + CCl_4$	Solid Phase	t^o	Mols. Br_2 per 100 mols. $Br_2 + CCl_4$	Solid Phase
-22.9	0.0	CCl_4	-38.5	32.08	Br_2
-30.0	4.8	"	-32.1	40.60	"
-36.4	8.68	"	-25.0	55.32	"
-42.0	10.99	"	-20.0	67.49	"
-47.5	15.10	"	-15.2	79.78	"
-47.6	17.26	Br_2	-10.0	92.20	"
-46.7	20.00	"	- 7.3	100.00	"

100 grams saturated solution of bromine in carbon disulfide contain 45.4 grams Br at −95°, 39 grams at −110.5°, and 36.9 grams at −116°.
(Arctowski, 1895 — 1896.)

SOLUBILITY DATA, DETERMINED BY THE FREEZING-POINT METHOD
ARE GIVEN FOR THE FOLLOWING MIXTURES:

Bromine + Methyl alcohol (Maass and McIntosh, 1912.)
" + Ethyl alcohol " "
" + Ethyl ether (McIntosh, 1911.)
" + Ethyl acetate (Maass and McIntosh, 1912.)
" + Acetone " "
" + Ethyl bromide (Wroczynski and Guye, 1910.)
" + Iodine (Meerum-Terwogt, 1905; Kruyt and Heldermann, 1918.)
" + Sulfur (Ruff and Winterfeld, 1903.)
" + Ethylene oxide (Maass and Boomer, 1922.)
" + Carbon tetrabromide (Biltz and Meinecke, 1923.)
" + Nitric oxide (Trautz and Dalai, 1920.)
" + Tellurium (Damiens, 1921a; 1923.)
" + Titanium tetrachloride (Lutschinsky, 1935.)

CBr CARBON TETRABROMIDE CBr_4

SOLUBILITY OF CARBON TETRABROMIDE IN CARBON DISULFIDE.
(Korvezee, 1934.)

The temperature was determined at which the last crystal just disappeared from a mixture of weighed amounts of the two components.

t°	Gms. CBr_4	Gms. CS_2	Gms. CBr_4 per 100 gms. mixture	Mols. CBr per 100 mols. CBr_4 + CS_2
38.6	1.573	0.1149	93.17	75.97
42.05	1.770	0.1091	94.21	78.94
54.25	2.048	0.0746	96.51	86.42
65.0	1.851	0.0476	97.45	90.06

CCl **CARBON TETRACHLORIDE** CCl_4

SOLUBILITY IN WATER. (Rex, 1906.)

t°.	0°.	10°	20°	30°
Gms. CCl_4 per 100 gms. H_2O	0.097	0.083	0.080	0.085

RECIPROCAL SOLUBILITY OF CARBON TETRACHLORIDE, ALCOHOL AND WATER.
(Curtis and Titus, 1915.)

Alcohol was added from a weight buret to mixtures of weighed amounts of CCl_4 and H_2O, stirred vigorously at 19.75°, until the mixture became homogeneous.

Per cent CCl_4.	Per cent C_2H_5OH.	Per cent H_2O.
41.94	43.19	14.89
33.07	47.68	19.25
25.46	50.50	24.04
17.00	51.95	31.05
14.02	51.56	34.42
10.53	50.97	38.50

In order to determine the effect of temperature upon the mutual solubility, one component was added to a known mixture of the other two, and the critical solubility temperature determined by raising and lowering the temp. through the critical point several times. A further amount of the third component was then added and the critical solubility temperature again determined.

Ratio $\frac{CCl_4}{C_2H_5OH}$ = 0.5048.		Ratio $\frac{CCl_4}{C_2H_5OH}$ = 1.064.		Ratio $\frac{CCl_4}{C_2H_5OH}$ = 2.1012.		Ratio $\frac{CCl_4}{H_2O}$ = 1.0922.	
Per cent H_2O.	Crit. Sol. t°.	Per cent H_2O.	Crit. Sol. t°.	Per cent H_2O.	Crit. Sol. t°.	Per cent C_2H_5OH.	Crit. Sol. t°.
24.25	−1.8	12.47	2.03	6.84	12.7	47.43	44.5
24.61	+3.6	13.95	23.9	7.16	21.55	47.83	39.5
25.13	10.6	14.45	29.8	7.35	27.2	48.6	30.6
25.64	17	14.85	35.4	7.54	31.3	49.61	19.9
26.14	24.5	15.3	39.55	7.84	36.8	50.07	14.6
27.15	31.45	15.67	42.75	8.02	39.75	50.50	9.15
28.52	35.5(?)	16.02	45.5	8.28	44.1	51.06	1.6

The results show that temperature has very little effect on the mutual solubility of the three components. Extensive series of determinations of refractive indices and densities of the mixtures are also given.

C1

RECIPROCAL SOLUBILITY OF CARBON TETRACHLORIDE, METHYL ALCOHOL AND WATER AT 30°.

(Showalter, 1933.)

The binodal curve for this system was determined by the titration method.

Composition in gms. of Homogenous Mixtures			Composition in gms. of Homogenous Mixtures		
CCl_4	CH_3OH	H_2O	CCl_4	CH_3OH	H_2O
0.9292	0.0664	0.0044	0.2331	0.5927	0.1742
0.8627	0.1265	0.0108	0.1829	0.6036	0.2135
0.7950	0.187	0.018*	0.1218	0.6109	0.2673
0.7697	0.2085	0.0218	0.1153	0.6030	0.2817
0.7272	0.2542	0.0286	0.0537	0.5715	0.3748
0.5876	0.3629	0.0495	0.0452	0.5526	0.4022
0.4637	0.4566	0.0797	0.0237	0.5157	0.4606
0.4330	0.4773	0.0897	0.0164	0.4678	0.5158
0.3873	0.5101	0.1026	0.0122	0.4671	0.5207
0.2409	0.5396	0.1195			

* plait point

Additional data for this system will be found under Methyl Alcohol.

CARBON TETRACHLORIDE CCl_4.

SOLUBILITY OF CARBON TETRACHLORIDE AT 20° IN AQUEOUS 50 PER CENT ETHYL ALCOHOL SATURATED WITH VARIOUS SALTS. (Wright, 1926.)

Salt present.	None	NaCl.	$NaNO_3$	KCl	KNO_3	KBr
Gms. CCl_4 per 100 gms. solvent.....	6.4	13.4	8.2	9.9	7.1	9.9

Data for the reciprocal Solubility, determined by the titration method at 25°, of Carbon Tetrachloride, Water and each of the following compounds; n Valeric Acid, Iso Valeric Acid, Methyl Ethyl Acetic Acid and Tri Methyl Acetic Acid, are given by Smith and Taylor, 1938.

SOLUBILITY OF CARBON TETRACHLORIDE IN LIQUID SULFUR DIOXIDE.

(Bond and Beach, 1926.)

The synthetic method was used and special precautions were taken to prevent contact with moisture.

t°.	Gms. CCl_4 per 100 gms. sat. sol	Solid Phase	t°.	Gms. CCl per 100 gms. sat. sol.	Solid Phase.
−26.76	98.77	C Cl	−29.37 (Crit. sol.)	58.19	(liquid layer)
−30.58	97.81	"	−29.68	49.93	"
−34.90	97.44	"	−35.2	31.66	"
−44.63	95.43	"	−37.2	28.36	"
−39.80	88.44	(liquid layer)	−47.2	16.44	SO_2
−34.9	82.56	"	−47.5	15.31	"
−33.57	80.83	"	−50.9	13.33	"
−29.8	66.26	"	−57.9	8.42	"
−29.37	58.98	"	−66.1	5.24	"

100 gms. anhydrous formic acid dissolve 6.95 gms. CCl_4 at 25°. (Gordon and Reid, 1922.

Freezing-point lowering data are given for mixtures of:

Carbon tetra chloride + Chlorine (Waentig and McIntosh, 1916; Biltz and Meinecke, 1923.)
" " " + Chloroform (Sameshima and Hiramatsu, 1934)
" " " + Ethylene dibromide (Linard, 1925.)
" " " + Nitrogen peroxide (Pascal, 1923.)
" " " + $TiCl_4$ (Nasu, 1933.)

N **CYANOGEN** $(CN)_2$.

SOLUBILITY IN WATER AND OTHER SOLVENTS.

(Berthelot, 1901.)

The determinations were made over mercury with exclusion of air. The mercury was not attacked by the $(CN)_2$. On account of polymerization, the solubility increased with time of contact and amount of agitation of the mixture.

One volume of H_2O at 30° dissolves 3.5 vols. $(CN)_2$ after 2 hours, and 9.7 vols. after 97 hours.

One volume of abs. alcohol at 20° dissolves 26 vols. $(CN)_2$ immediately; 39 vols. after 4 hours; 89 vols. after 48 hrs. and 223 vols. after 4 days.

One volume glacial acetic acid dissolves 42 vols. of $(CN)_2$ immediately and 50.5 vols. after 3 days.

One volume of chloroform dissolves about 19 vols. $(CN)_2$ immediately and 29–30 vols. with time.

One volume of benzine finally dissolves 28 vols. $(CN)_2$.

One volume of rectified turpentine dissolves 9–10 vols. of $(CN)_2$.

One volume of ether dissolves 5 vols. $(CN)_2$ at 20°. (Gay Lussac)

CYANAMIDE $CN.NH_2$.

SOLUBILITY IN WATER, DETERMINED BY FREEZING-POINT METHOD.

(Pratolongo, 1913)
4

t° of Congealing.	Gms. $CN.NH_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t° of Congealing.	Gms. $CN.NH_2$ per 100 Gms. Sat. Sol.	Solid Phase.
− 0.62	2.58	Ice	−14.39	40.19	$CN.NH_2$
− 3.96	9.42	"	− 2.49	56.80	"
− 7.58	18.40	"	+14.50	77.20	"
−12.72	30.9	"	25.6	87.15	"
−16.6 Eutec.	37.8	" + $CN.NH_2$	37.90	96.77	"
−15.6	38.75	$CN.NH_2$	42.9	100	"

Similar data for $CN.NH_2$ + urea and $CN.NH_2$ + dicyandiamide are also given.

DiCYANDIAMIDINE Perchlorate $C_2H_6N_4OHClO_4$.

100 gms. H_2O dissolve 0.07 gms. of the salt at 17° (*d* sat. sol. = 1.039). (Carlson, 1910)

RECIPROCAL SOLUBILITY OF CARBON TETRACHLORIDE AND ETHYL ALCOHOL AT LOW TEMPERATURES.

(Wieth, 1920.)

t°	-58.5	-52.5	-39	-38	-35	-30
Gms. CCl_4 per 100 gms. sat. sol.	26.4	31.7	49.1	50.8	57.7	70.8

CARBON MONOXIDE CO.

SOLUBILITY IN WATER. (Winkler, 1901.)

t°.	β, "Absorp. Coef."	β', "Solubility."	q.	t°.	β, "Absorp. Coef."	β', "Solubility."	q.
0	0.03537	0.03516	0.0044	40	0.01775	0.01647	0.0021
5	0.03149	0.03122	0.0039	50	0.01615	0.01420	0.0018
10	0,02816	0.02782	0.0035	60	0.01488	0.01197	0.0015
15	0.02543	0.02501	0.0031	70	0.01440	0.00998	0.0013
20	0.02319	0.02266	0.0028	80	0.01430	0.00762	0.0010
25	0.02142	0.02076	0.0026	90	0.01420	0.00438	0.0006
30	0.01998	0.01915	0.0024	100	0.01410	0.00000	0.0000

β = vol. of CO absorbed by 1 volume of the liquid at a partial pressure of 760 mm. See p. 227.

β' = vol. of CO (reduced to 0° and 760 mm.) absorbed by 1 volume of the liquid under a total pressure of 760 mm.

q = grams of CO dissolved by 100 grams H_2O at a total pressure of 760 mm.

l = the Ostwald Solubility Expression which represents the ratio of the volume (v) of gas absorbed at any pressure and temperature, to the volume (V) of the absorbing liquid, that is $l = \frac{v}{V}$. This expression differs from the Bunsen Absorption Coefficient B^V in that the volume (v) of the dissolved gas is not reduced to 0° and 760 mm. The solubility l is, therefore, the volume of gas dissolved by unit volume of solvent at the temperature of the experiment.

The solubility of Carbon Monoxide in water, in terms of the Ostwald solubility expression, was found by Findlay and Creighton (1911) to be $l_{25} = 0.0154$.

Data for the solubility of CO in water at high pressures are given by Cassuto, 1913.

Data for the solubility of CO in aq. NaOH solutions are given by Fonda, 1910.

Results for the solubility of CO in aq. H_2SO_4 at 20° are given in terms of the Ostwald solubility expression *l* by Christoff (1906) as follows: l_{20} for H_2O = 0.02482, l_{20} for 35.82% H_2SO_4 = 0.0114, l_{25} for 61.62% H_2SO_4 = 0.00958, l_{20} for 95.6% H_2SO_4 = 0.02327 and 0.02164.

Data for the solubility of CO in ox blood and ox serum at 25° are given by Findlay and Creighton, 1910–11.

Data for the influence of time on the absorption of CO by blood are given by Grehaut (1894). The author passed air containing from one part CO per 1000 to one part CO per 60,000, through 100 cc. portions of blood and found that the maximum absorption, 18.3 cc. CO per 100 cc. of blood (for the 1 : 1000 mixture) occurred in three hours.

Data for the solubility of CO in aqueous hemoglobin solutions are given by Hüfner (1895) and Hüfner and Kulz (1895).

SOLUBILITY OF PURE CARBON MONOXIDE IN SERUM AND IN PLASMA.

(O'Brien and Parker, 1922.)

t°.	Cc. of CO absorbed per 1.0 cc. of Beef serum.	Sheep serum.	Human serum.	Beef plasma.
15	0.203	0.0206	–	0.0198
20	0.181	0.0187	0.0180	0.0181
25	0.161	0.0156	0.0183	0.0169
30	0.145	0.0153	0.0158	0.0147
37	0.129	0.0144	0.0142	0.0134

As a check upon the above determinations the authors also determined the solubility of carbon monoxide in water and obtained results in good agreement with those of Winkler.

100 cc. of RUBBER saturated with carbon monoxide at 21°, dissolve 6.2 cc. CO (at 0° and 760 mm.). The determination was made by pumping out the gas with a Töpler pump and measuring it over mercury. Results for the effect of temperature and pressure upon the solubility are also given. (Venable and Fuwa, 1922.)

SOLUBILITY OF CARBON MONOXIDE IN AQUEOUS ALCOHOL SOLUTIONS AT 20° AND 760 MM. PRESSURE.

(Lubarsch, 1889.)

Wt. % Alcohol.	Vol. % Absorbed CO.	Wt. % Alcohol.	Vol. % Absorbed CO.
0	2.41	28.57	1.50
9.09	1.87	33.33	1.94
16.67	1.75	50	3.20
23.08	1.68		

SOLUBILITY OF CARBON MONOXIDE IN ORGANIC SOLVENTS.

(Just, 1901; Skirrow, 1902.)

Results in terms of the Ostwald Solubility Expression

Solvent	l_{25}.	l_{20}.	Solvent.	l_{25}.	l_{20}.
Water	0.02404	0.02586	Toluene	0.1808	0.1742
Aniline	0.05358	0.05055	Ethyl Alcohol	0.1921	0.1901
Carbon Disulfide	0.08314	0.08112	Chloroform	0.1954	0.1897
Nitrobenzene	0.09366	0.09105	Methyl Alcohol	0.1955	0.1830
Benzene	0.1707	0.1645	Amyl Acetate	0.2140	0.2108
Acetic Acid	0.1714	0.1689	Acetone	0.2225	0.2128
Amyl Alcohol	0.1714	0.1706	Isobutyl Acetate	0.2365	0.2314
Xylene	0.1781	0.1744	Ethyl Acetate	0.2516	0.2419

100 volumes of petroleum absorb 12.3 vols. CO at 20°, and 13.4 vols. at 10°. (Gniewosz and Walfisz, 1887.)

SOLUBILITY OF CARBON MONOXIDE IN ETHYL ETHER.

(Christoff, 1912.)

Results in terms of the Ostwald Solubility Expression.

$l_0 = 0.3618$. $l_{10} = 0.3842$.

SOLUBILITY OF CARBON MONOXIDE IN ORGANIC SOLVENTS AT DIFFERENT TEMPERATURES.

(Horiuti, 1931.)

Results in terms of the Ostwald Solubility Expression.

Solvent:

Carbon Tetrachloride		Chlorobenzene		Benzene	
t°	l	t°	l	t°	l
-19.9	0.1837	-40.45	0.1201	12.	0.1702
0.0	0.1977	-21.3	0.1273	20.	0.1771
20.0	0.2142	0.0	0.1375	40.05	0.1972
40.1	0.2314	20.0	0.1483	60.3	0.2201
60.1	0.2528	40.0	0.1600		
		60.0	0.1735		
		80.35	0.1898		

Acetone		Methyl Acetate		Ethyl Ether	
t°	l	t°	l	t°	l
-79.8	0.1917	-78.8	0.1812	-78.8	0.3820
-59.7	0.1961	-60.4	0.1897	-59.5	0.3660
-40.3	0.2053	-40.9	0.2023	-40.1	0.3627
-20.5	0.2178	-20.3	0.2182	-20.1	0.3651
0.0	0.2336	0.0	0.2363	0.0	0.3790
20.0	0.2538	20.0	0.2549	20.0	0.3907
40.0	0.2732	40.1	0.2761		

The above determinations were made with great care using highly perfected apparatus and materials of the greatest purity.

SOLUBILITY OF CARBON MONOXIDE IN MIXTURES OF ACETIC ACID AND OTHER SOLVENTS AT 25°.

(Skirrow, 1902.)

Results in terms of the Ostwald solubility expression.

Mixture of Acetic Ac. and:	Wt. % CH_3COOH in Mixture.	CO. l_{25}	Mixture of Acetic Ac. and:	Wt. % CH_3COOH in Mixture.	CO. l_{25}
Aniline	100	0.173	Chloroform	56.4	0.196
"	86.5	0.110	"	0	0.206
"	58.3	0.070	Nitrobenzene	78.4	0.156
"	17.8	0.058	"	49	0.130
"	0	0.053	"	0	0.093
Benzene	67.5	0.199	Toluene	74.7	0.191
"	33.5	0.198	"	56.9	0.195
"	19.2	0.190	"	20.5	0.190
"	0	0.174	"	0	0.182

SOLUBILITY OF CARBON MONOXIDE IN MIXTURES OF ACETONE AND OTHER SOLVENTS AT 25°.

(Skirrow.)

Mixture of Acetone and:	% $(CH_3)_2CO$ in Mixture. By Wt.	CO. l_{25}.	Mixture of Acetone and:	% $(CH_3)_2CO$ in Mixture. By Wt.	CO. l_{25}.
Aniline	100	0.238	Chloroform	66.6	0.226
"	79.2	0.179	"	26.5	0.212
"	44.9	0.110	"	0	0.207
"	0	0.053	β Naphthol	86	0.190
Carbon Disulfide	82	0.236	"	73.1	0.169
"	50.5	0.227	Nitrobenzene	78.4	0.207
"	26	0.187	"	46.8	0.157
"	14.5	0.144	"	0	0.093
"	0	0.096	Phenanthrene	87.2	0.205
Naphthalene	86.7	0.199	"	75	0.183
"	72.6	0.187			

SOLUBILITY OF CARBON MONOXIDE IN MIXTURES OF BENZENE AND OTHER SOLVENTS AT 25°.

(Skirrow, 1902.)

The solubility of the CO given in terms of the Ostwald expression, see p. 217.

Mixture of Benzene and:	% C_6H_6 in Mixture. By Wt.	CO. l_{25}.	Mixture of Benzene and:	% C_6H_6 in Mixture. By Wt.	CO. l_{25}.
Naphthalene	100	0.174	Aniline	87.3	0.156
"	88.5	0.164	"	71.7	0.131
"	66.2	0.141	"	42.6	0.095
Phenanthrene	89.5	0.144	"	21.2	0.068
"	72.6	0.127	"	0	0.053
α Naphthol	96.5	0.149	Nitrobenzene	71.8	0.152
"	87.9	0.139	"	45.1	0.127
β Naphthol	97.9	0.158	"	0	0.093
"	95.6	0.149	Ethyl Alconol	47.7	0.181
			"	0	0.192

SOLUBILITY OF CARBON MONOXIDE IN MIXTURES OF TOLUENE AND OTHER SOLVENTS AT 25°.

(Skirrow, 1902.)

Mixture of Toluene and:	$C_6H_5CH_3$ in Mixture.		CO.	Mixture of Toluene and:	$C_6H_5CH_3$ in Mixture.		CO.
	Wt. %.	Mol. %.	l_{25}.		Wt. %.	Mol. %.	l_{25}.
Aniline	100	100	0.182	α Naphthol	95.5	97.1	0.171
"	93.4	93.5	0.169	"	91.2	94.2	0.162
"	80.1	80.3	0.148	Nitrobenzene	81.7	85.7	0.160
"	55.4	55.6	0.115	"	50.8	58.1	0.131
"	25.4	25.6	0.077	"	23.7	29.3	0.108
"	0	0	0.053	"	0	0	0.093
Naphthalene	92.9	94.8	0.169	Phenanthrene	94.4	97	0.170
"	84.9	88.7	0.161	"	88.8	93.9	0.161
"	77.3	82.5	0.153	"	78.4	87.5	0.147

SOLUBILITY OF CARBON MONOXIDE IN MIXTURES OF ORGANIC SOLVENTS AT 25°.

(Skirrow.)

Mixture Composed of:	% of Latter in Mixture. By Wt.	% of Latter in Mixture. By Mol.	CO l_{25}
Chloroform and Methyl Alcohol	0.0		0.207
" "	13.0		0.202
" "	100		0.196
Carbon Bisulphide and Ethyl Di Chloride		100	0.147
" "		75	0.157
" "		51	0.160
" "		18.4	0.140
" "		0.0	0.083
Methyl Alcohol and Glycerine	0.0	0.0	0.196
" "	39.6	30.1	0.096
" "	60.5	50.1	0.052
" "	77.1	68.9	0.025
" "	100.0	100.0	very small

NOTE. — From the results shown in the preceding five tables, it is concluded that the solubility of carbon monoxide in various mixtures of organic solvents is, in general, an additive function.

One liter of Cyclohexanol ($CH_2:(CH_2CH_2)_2:CHOH$) dissolve 894.73 cc. CO at 26° and 766 mm. pressure. (Cauquil, 1927.)

CARBON DIOXIDE CO_2.

SOLUBILITY IN WATER.

(Bohr, 1899; Geffcken, 1904; Just, 1901.)

t°	Solubility in Water. q.	Solubility in Water. β.	Solubility in Water. l.	In 6.53% NaCl. β.	In 17.62% NaCl. β.
0	0.335	1.713	...	1.234	0.678
5	0.277	1.424	...	1.024	0.577
10	0.231	1.194	...	0.875	0.503
15	0.197	1.019	1.070	0.755	0.442
20	0.169	0.878	...	0.664	0.393
25	0.145	0.759	0.826	0.583	0.352
30	0.126	0.665	...	0.517	0.319
40	0.097	0.530	...	0.414	0.263
50	0.076	0.436	...	0.370	0.235
60	0.058	0.359	...	0.305	0.183

q = wt. of gas dissolved by 100 grams of solvent at a total pressure of 760 mm.

β = the **Bunsen Absorption Coefficient** which signifies the volume (v) of the gas (reduced to 0° and 760 mm.) taken up by unit volume (V) of the liquid when the pressure of the gas itself minus the vapor tension of the solvent is 760 mm.

$$\beta = \frac{v}{V(1 + 0.00367\,t)}.$$

l = the **Ostwald Solubility Expression** which represents the ratio of the volume (v) of gas absorbed at any pressure and temperature, to the volume (V) of the absorbing liquid, i.e. $l = \frac{v}{V}$. This expression differs from the Bunsen Absorption Coefficient, β, in that the volume (v) of the dissolved gas is not reduced to 0° and 760 mm. The solubility l is therefore the volume of gas dissolved by unit volume of the solvent at the temperature of the experiment. The two expressions are related thus:

$$l = \beta\,(1 + 0.00367\,t), \quad \beta = \frac{l}{(1 + 0.00367\,t)}.$$

CARBON DIOXIDE CO_2.

SOLUBILITY OF CARBON DIOXIDE IN WATER AT LOW CONCENTRATIONS.

(Buch, 1925.)

Cc. CO_2 per 10 liters of the gas phase.	Absorption Coef. of CO_2.	Cc. CO_2 per 10 liters of the gas phase.	Absorption Coef. of CO_2.
1.07	0.156	11.4	0.102
2.0	0.150	12.3	0.096
2.7	0.110	12.8	0.0985
3.6	0.097	19.5	0.090
8.43	0.095	50.4	0.093

A discussion of the equilibrium reactions in aqueous solutions of carbonates and their application to the titrametric determination of free and combined carbonic acid is given by Johnston, 1916.

ADDITIONAL DETERMINATIONS OF THE SOLUBILITY OF CARBON DIOXIDE IN WATER.

0

t°	Results in terms of the: Bunsen Absorp. Coef. B	Ostwald Solubility Expression l	Authority
0.05	—	1.713	(v. Kiss, Lajtai and Thury, 1937.)
12.5	—	1.159	" " " "
15.0	1.022	—	(Showalter and Ferguson, 1936.)
25.0	0.753	—	(Orcutt and Seevers, 1936.)
25.0	0.7572	0.8267	(Morgan and Pyne, 1930.)
25.0	—	0.8190	(v. Kiss, Lajtai and Thury, 1937.)
38.0	0.5455*	—	(Van Slyke, Sendroy, Jr. Hastings and Neill, 1928.)

In order to overcome the effect of the trace of alkali usually present in ordinary distilled water, aq. 0.01 normal HCl was used for this determination.

SOLUBILITY OF CARBON DIOXIDE IN WATER AT PRESSURES ABOVE ONE ATMOSPHERE.

(Wroblewski — Compt. rend. 94, 1335, '82.)

Pressure in Atmospheres.	Coefficient of Saturation * at: 0°.	12.4°.	Pressure in Atmospheres.	Coefficient of Saturation * at: 0°.	12.4°.
1	1.797	1.086	20	26.65	17.11
5	8.65	5.15	25	30.55	20.31
10	16.03	9.65	30	33.74	23.25

* Coefficient of absorption is no doubt intended.

SOLUBILITY OF CARBON DIOXIDE IN WATER AT HIGH PRESSURES.

(Haehnel, 1920.)

Water was saturated with carbon dioxide in an autoclave of about 1.5 liters capacity. The autoclave was shaken frequently during six hours. Of the saturated solution thus obtained, 75 to 100 cc. were removed and brought to atmospheric pressure, and the excess of CO_2 which was given off was measured in a eudiometer.

Pressure in atmospheres.	Vol. of CO_2 (at 0° and 760 mm.) dissolved by 1 vol. of H_2O at			Gms. CO_2 per 100 gms. of the sat. solution at		
	0°.	12.43°.	15°.	0°.	12.43°.	15°.
1......	1.80	1.09	1.00	0.35	0.21	0.20
5......	8.71	5.15	4.59	1.71	1.01	0.90
10......	15.89	9.65	8.39	3.12	1.90	1.65
15......	21.82	13.63	11.85	4.28	2.68	2.33
20......	26.53	17.11	15.21	5.21	3.36	2.99
25......	30.46	20.34	17.64	5.98	3.99	3.47
30......	33.65	23.25	20.31	6.61	4.57	3.99
35......	36.73	–	22.52	7.21	–	4.42
38......	37.87	–	–	7.44	–	–
40......	–	–	24.44	–	–	4.79
45......	–	–	25.59	–	–	5.03
50......	–	–	27.06	–	–	5.31
52......	–	–	27.67	–	–	5.44

The results at 12.°43 are those of v. Wroblewski (*Ann. phys. chem.*, 18, 290, 1883). The results at 1 atmosphere pressure are taken from Bunsen.

SOLUBILITY OF CARBON DIOXIDE IN WATER AT 50°, 75° AND 100° AT PRESSURES ABOVE 25 ATMOSPHERES.

(Wiebe and Gaddy, 1939.)

Total Pressure in atmospheres	cc CO_2 reduced to 0° and 760mm.) dissolved by 1 gm. H_2O at:		
	50°	75°	100°
25	9.71	6.815	5.365
50	17.246	12.590	10.179
75	22.534	17.044	14.289
100	25.628	20.61	17.67
150	27.643	24.58	22.725
200	29.143	26.66	25.694
300	31.34	29.51	29.53
400	33.29	31.88	32.39
700	38.34	37.59	38.50

The solubility l (Ostwald coefficient) of Carbon Dioxide in Deuterium Oxide (D_2O) at 25 , was found by Curry and Hazelton, 1938, to be 0.819 cc CO_2 per 1 cc of D_2O. The value for the solubility of CO_2 in H_2O under identical experimental conditions was 0.821. In terms of the Ostwald coefficient the solubilities are the same within less than 1%. On a molal basis CO_2 is 0.902 times as soluble in D_2O as in H_2O.

Data for the supersaturation of water and other solvents with carbon dioxide, hydrogen, oxygen, nitrogen and air are given by Metschl, 1924.

Determinations of the Solubility of Carbon Dioxide mixed with Hydrogen, in Water at 20° and 30° and under total pressures up to 30 Kgs. per sq. cm. are given by Kritschewsky, Showoronkoff and Aepelbaum, 1935.

Data for the distribution of CO_2 between air and H_2O, air and aq. H_2SO_4 and air and toluene at various temperatures, are given by Hantzsch and Vagt (1901).

Solubility of Carbon Dioxide in Water at High Pressures. (Sander, 1911–12.)

Note. — The pressures varied from 25 to 170 kilograms per square centimeter. The results are expressed in terms of the volume of CO_2, reduced to 1 kg. per sq. centimeter, dissolved by unit volume of liquid at the temperature and pressure of the experiment. A Caillet apparatus, provided with the well-known Caillet tube, was used. The experiments were made with very great care. In general, the procedure consisted in compressing CO_2 above mercury in the closed millimeter graduated end of the Caillet tube and taking many readings on the scale at various pressures and temperatures. The volumes thus found were compared with similar readings made after a known amount of solvent had been introduced above the layer of mercury, by means of a graduated pipet with turned-up end. The differences show the volume of CO_2 dissolved at given temperatures and pressures.

Two series of determinations were made. In the case of the results marked (*a*) the used volume of water was 0.210 cc. and for those marked (*b*) the volume was 0.102 cc. The volumes of CO_2 used, varied from 60 to 76 cc.

t°.	Pressure in Kg. per Sq. Cm.	cc. of CO_2 (Reduced to 1 Kg. per Sq. Cm.) Dissolved by 1 cc. H_2O.		t°.	Pressure in Kg. per Sq. Cm.	cc. CO_2 (Reduced to 1 Kg. per Sq. Cm.) Dissolved by 1 cc H_2O.	
		(*a*)	(*b*)			(*a*)	(*b*)
20	25	...	17.77	60	90	22.74	21.16
“	30	...	19.77	“	100	26.22	27.85
“	40	...	21.52	“	110	28.92	28.79
“	50	...	28.09	“	120	30.20	33.90
“	55	...	29.75	100	60	8.97	...
35	30	11.77	13.57	“	70	10.11	6.40
“	40	14.82	20	“	80	11.05	9.59
“	50	18.96	24.64	“	90	12.62	10.85
“	60	22.90	22.50	“	100	13.63	12.40
“	70	27.18	27.62	“	110	14.88	16.31
“	80	...	32.85	“	120	16.40	15.78
60	40	10.88	9.80	“	130	17.93	16.89
“	50	12.24	13.72	“	140	19.56	17.71
“	60	14.46	15.28	“	150	20.58	17.49
“	70	16.80	17.46	“	160	22.07	...
“	80	19.74	22.67	“	170	22.78	...

Solubility of Carbon Dioxide in Water Expressed in Terms of the Fahrenheit Scale of Temperature and Pounds per Square Inch Pressure.

(Heath, 1915; Anthony, 1916, see also Riley, 1911.)

(The existing data were calculated to this form, particularly for use in the bottling industry.)

Pounds per Sq. Inch Pressure	Volumes of CO_2 Gas Dissolved by One Volume of Water at:												
	32°.	36°.	40°	44°.	48°.	55°.	60°.	65°.	70°.	75°.	80°.	85°.	90°.
15	3.46	3.19	2.93	2.70	2.50	2.20	2.02	1.86	1.71	1.58	1.44	1.37	1.27
20	4.04	3.73	3.42	3.15	2.92	2.57.	2.36	2.17	2	1.84	1.69	1.58	1.48
25	4.58	4.27	3.92	3.61	3.35	2.04	2.69	2.48	2.29	2.10	1.93	1.80	1.70
30	5.21	4.81	4.41	4.06	3.77	3.31	3.03	2.80	2.58	2.37	2.18	2.03	1.91
35	5.80	5.35	4.91	4.52	4.19	3.69	3.37	3.11	2.86	2.63	2.42	2.26	2.13
40	6.37	5.89	5.39	4.97	4.61	4.05	3.71	3.42	3.15	2.89	2.67	2.49	2.34
45	6.95	6.43	5.88	5.43	5.03	4.43	4.06	3.74	3.44	3.16	2.91	2.72	2.56
50	7.53	6.95	6.36	5.89	5.45	4.80	4.40	4.05	3.73	3.42	3.16	2.94	2.77
55	8.11	7.48	6.86	6.34	5.87	5.17	4.74	4.37	4.02	3.69	3.40	3.17	2.99
60	8.71	8.02	7.35	6.79	6.29	5.53	5.08	4.68	4.31	3.95	3.64	3.39	3.20
70	9.86	9.09	8.33	7.70	7.13	6.27	5.76	5.30	4.89	4.49	4.14	3.86	3.63
80	11.02	10.17	9.31	8.61	7.98	7	6.43	5.92	5.46	5.02	4.62	4.31	4.06
90	12.18	11.25	10.30	9.52	8.82	7.74	7.11	6.54	6.04	5.55	5.12	4.77	4.49
100	13.34	12.33	11.29	10.43	9.66	8.4	7.79	7.18	6.62	6.08	5.60	5.22	4.91

SOLUBILITY OF CO_2 IN AQUEOUS SOLUTIONS OF ACIDS AND SALTS.

(Geffcken.)

Aq. Solvent.	Gms. Acid per Liter.	CO_2 Dissolved, l at:		Aq. Solvent	Gms. Salt per Liter.	CO_2 Dissolved, l at:	
		15°.	25°.			15°.	25°.
HCl	18.23	1.043	0.806	CsCl	84.17	1.006	0.781
"	36.46	1.028	0.799	KCl	37.30	0.976	0.759
"	72.92	1.000	0.795	KCl	74.60	0.897	0.700
HNO_3	31.52	1.078	0.840	KI	83.06	0.992	0.775
"	63.05	1.086	0.853	KI	166.12	0.923	0.727
"	126.10	1.100	0.877	KBr	59.55	0.986	0.768
H_2SO_4	24.52	1.018	0.794	KBr	119.11	0.914	0.713
"	49.04	0.978	0.770	KNO_3	50.59	1.005	0.784
"	98.08	0.917	0.730	KNO_3	101.19	0.946	0.749
"	147.11	0.870	0.698	RbCl	60.47	0.989	0.769
"	196.15	0.828	0.667	RbCl	120.95	0.921	0.788

SOLUBILITY IN AQUEOUS SOLUTIONS OF SALTS. (Mackenzie, 1877.)

Salt in Solution.	Gms. Salt per 100 Gms. Solution.	Density of Solution 15°.	Absorption Coefficient α at:			
			8°.		15°	22°
KCl	6.05	1.021	0.988		0.777	0.670
"	8.646	1.053	0.918		0.777	0.649
"	11.974	1.080	0.864		0.720	0.597
"	22.506	1.549	0.688		0.571	0.480
NaCl	7.062	1.038	0.899 (6.4°)		0.735	...
"	12.995	1.080	0.633 (6.4°)		0.557	0.482
"	17.42	1.123	0.518 (6.4°)		0.431	0.389
"	26.00	1.195	0.347 (6.4°)		0.297	0.263
NH_4Cl	6.465	1.021	1.023		0.825	0.718
"	8.723	1.047	1.000		0.791	0.702
"	12.727	1.053	0.922		0.798	0.684
"	24.233	1.072	0.813 (10°)		0.738	0.600
			8°.	16.5°.	22°.	30°.
$BaCl_2$	7.316	1.068	0.969	0.744	0.680	0.566
"	9.753	1.092	1.021	0.645	0.607	0.543
"	14.030	1.137	...	0.618	0.524	0.467
"	25.215	1.273	0.495	0.618	0.383	0.315
$SrCl_2$	9.511	1.087	0.779	0.663	0.581	0.508
"	12.325	1.1159	0.737	0.586	0.507	0.539
"	17.713	1.173	0.606	0.473	0.444	0.367
"	31.194	1.343	0.285	0.245	0.247	0.223
$CaCl_2$	4.365	1.036	0.942	0.759	0.673	0.596
"	5.739	1.049	0.855	0.726	0.616	0.527
"	8.045	1.068	0.838	0.674	0.581	0.500
"	15.793	1.139	0.632	0.520	0.471	0.400

Data for the solubility of CO_2 in sea water are given by Hamberg (1885).

According to Fox (1909a), analyses of sea water all show an excess of base over acid, that is, when CO_2 is left out of account. This CO_2 (about 50 cc. per liter) is, of course, in equilibrium with the excess of base, which is actually equal to about 40 mgs. OH per liter. The partial pressure of CO_2 very seldom, if ever, exceeds 6 in 10,000. For the determination of the absorption coefficient of CO_2 there are, consequently, four independent variables to be considered; influence of alkalinity, a chemical influence in addition to the purely physical influences of temperature, pressure and salinity. For convenience, the dissolved CO_2 may be considered as made up of two parts, about 1% dependent upon physical influences alone and a far larger part dependent upon the alkalinity, pressure and temperature, but independent of salinity. Extensive experimental determinations are described.

A critical review of the literature on the solubility of carbon dioxide in water and in sea water is given by Coste (1917).

SOLUBILITY OF CARBON DIOXIDE IN AQUEOUS SOLUTIONS OF SALTS AT 15.2°.

(Setschenow, 1892)

(Results expressed in terms of cc. CO_2 (at 0° and 760 mm.) dissolved per 1 cc. sat. solution.)

Salt.	Gms. Salt per Liter.	Dissolved CO_2.	Salt.	Gms. Salt per Liter.	Dissolved CO_2.	Salt.	Gms. Salt per Liter.	Dissolved CO_2.
NH_4Cl	1	1.005	LiCl	16.72	1.035	NaCl	12.9	0.978
"	10	0.985	"	50.15	0.808	"	64	0.760
"	51.6	0.941	"	125.4	0.596	"	128	0.580
"	172	0.819	"	250.8	0.497	"	192	0.466
"	258	0.770	"	501.5	0.120	NaBr	115.1	0.775
NH_4NO_3	2.8	1.013	$MgSO_4$	26.5	0.901	"	400.3	0.364
"	11.2	1.002	"	79.5	0.669	"	690.4	0.221
"	55	0.989	"	159	0.441	$NaNO_3$	89.3	0.835
"	101	0.962	"	318	0.188	"	125	0.762
"	202.1	0.911	KBr	83.9	0.908	"	208.4	0.621
"	404.3	0.807	"	167.7	0.819	"	416.8	0.385
"	810.4	0.612	"	251.5	0.748	"	625.2	0.244
$(NH_4)_2SO_4$	72.2	0.712	"	503.1	0.579	$NaClO_3$	233.3	0.625
"	144.4	0.575	KI	319.1	0.777	"	349.9	0.506
$Ba(NO_3)$	62.7	0.922	"	478.6	0.688	"	699.8	0.257
$Ca(NO_3)_2$	41	0.923	"	957.3	0.506	Na_2SO_4	14.2	0.950
Citric Acid	12	1.007	KSCN	326	0.691	"	94.8	0.620
"	49	0.975	"	489	0.590	"	284.4	0.234
"	99	0.950	"	978	0.387	$ZnSO_4$	38.3	0.903
"	198	0.893	KNO_3	58.8	0.959	"	76.7	0.783
"	298	0.841	"	117.5	0.890	"	230	0.474
"	595	0.719	"	235.1	0.781	"	460	0.209

Several determinations at other temperatures are also given.

SOLUBILITY OF CARBON DIOXIDE IN AQUEOUS SALT SOLUTIONS AT 25°.

(Findlay and Shen, 1912.)

Salt.	Gms. Salt per 100 cc. Solution.	d of Sat. Sol.	Solubility of CO_2, Ostwald Expression l_{25}.	Salt.	Gms. Salt per 100 cc. Solution.	d of Sat. Sol.	Solubility of CO_2, Ostwald Expression l_{25}.
Water alone	...	...	0.825	$Fe(SO_4)(NH_4)_2SO_4.6H_2O$	9.51	1.052	0.641
NH_4Cl	2.35	1.005	0.791	"	10.26	1.057	0.629
"	5.05	1.013	0.754	"	22.47	1.124	0.460
"	10.02	1.022	0.732	KCl	1.84	1.008	0.792
"	17.09	1.045	0.665	"	3.05	1.017	0.764
$BaCl_2$	2.80	1.018	0.789	"	4.58	1.026	0.749
"	5.81	1.040	0.741	"	7.46	1.044	0.701
"	8.15	1.054	0.710	Sucrose	2.63	1.009	0.813
"	9.97	1.070	0.676	"	5.16	1.018	0.798
Chloral Hydrate	5.08	1.019	0.815	"	9.68	1.038	0.767
	10.12	1.041	0.795	"	12.33	1.051	0.744

Data for KCl solutions at higher pressures are given by Findlay and Creighton, 1910.

Data for the influence of colloids and fine suspensions upon the solubility of carbon dioxide in water at 25° and at various pressures are given by Findlay, 1908; Findlay and Creighton, 1910, 1911; Findlay and Shen, 1911, 1912; Findlay and Williams, 1913; Findlay and Howell, 1915.

The solubility of CO_2 increases slightly with increasing concentrations of $Fe(OH)_3$, gelatine, silicic acid, aniline (chem. combination occurs), methyl orange, blood, serum, peptone, protopeptone, and commercial hemoglobin. The solubility diminishes slightly with increasing concentrations of arsenious sulfide, dextrine, soluble starch, glycogen (?), egg albumen and serum albumen. No appreciable effect is produced by suspensions of charcoal or silica.

When the solubility is increased by a given substance, the solubility curve falls with increase of pressure; when it is lessened, the curve rises with increasing pressure. In the case of starch and other neutral colloids, the solubility passes through a minimum with increase of pressure.

Data for the influence of colloids and suspensions on the evolution of CO_2 from supersaturated solutions, are given by Findlay and King, 1913–14.

SOLUBILITY OF CARBON DIOXIDE IN AQUEOUS SALT SOLUTIONS AT 15.5° AND 760 MM. PRESSURE.

(Christoff, 1905.)

A gravimetric method was used. A stream of CO_2 was passed through the weighed salt solution and, after saturation, the solution again weighed and the difference taken to represent absorbed CO_2. The loss of water from the solution was prevented by first passing the CO_2 through a series of U-tubes containing some of the same solution. Constant temp. was not employed, but corrections of the results were made for the slight variations in temp. which occurred. Absorption flasks of special shape, graduated to hold 75 cc., were used.

Salt in Aq. Solution.	Conc. of Aq. Sol.	Gms. CO_2 Absorbed per 75 cc. Solvent.	Salt in Aq. Solution.	Conc. of Aq. Sol.	Gms. CO_2 Absorbed per 75 cc. Solvent.
Water Alone	...	0.1382	$K_4P_4O_{12}$	1 normal	0.1237
$(NH_4)_2SO_4$	1 normal	0.1093	$KHSO_4$	0.66 "	0.1020
$(NH_4)_2Fe_2(SO_4)_4.24H_2O$	1 "	0.0991	"	2. "	0.1000
$K_2Al_2(SO_4)_4.24H_2O$	1 "	0.1054	K_2SO_4	0.66 "	0.1140
$NH_4HB_2O_4$	0.25 "	0.7672	"	1	0.1002
$CuSO_4$	2 "	0.0751	$Na_4B_4O_7$	0.025 "	0.2205
LiCl	1 "	0.1087	"	0.125 "	0.5317
$MgSO_4$	0.5 "	0.1209	"	0.25 "	0.8511
"	1 "	0.1020	"	sat. sol.	1.8285
"	2 "	0.0662	"	" +crysts.	3.2240
"	4 "	0.0527	$NaBO_2$	0.25 normal	0.8122
KBr	1 "	0.1280	NaCl	1 "	0.1050
KCl	1 "	0.1213	$Na_3PO_4.12H_2O$	1 "	0.5828
KI	1 "	0.1204	$Na_4P_2O_7.10H_2O$	1 "	0.8463
KNO_3	1 "	0.1231	$Na_4P_4O_{12}$	1 "	0.0700
K_2HAsO_4	0.5 "	0.1110	$ZnSO_4$	2 "	0.0720
$KH_2As_2O_4$	1 "	0.0812	Sugar	0.1 "	0.1225
KH_2PO_4	1 "	0.0860	"	0.5 "	0.1089
K_2HPO_4	0.5 "	0.4900(?)	"	1 "	0.0931

SOLUBILITY OF CARBON DIOXIDE IN AQUEOUS SOLUTIONS OF SULFURIC ACID.

Results at 15.5°. (Christoff, 1905.)				Results at 20°. (Christoff, 1906.)	
Per cent H_2SO_4 in Solvent.	Gms. CO_2 Absorbed per 75 cc. Solvent.	Per cent H_2SO_4 in Solvent.	Gms. CO_2 Absorbed per 75 cc. Solvent.	Per cent H_2SO_4 in Solvent.	Solubility of CO_2, Ostwald Expression l_{20}.
2.5	0.1282	40	0.0713	0	0.9674
5	0.1079	45	0.0725	35.82	0.6521
10	0.0833	70	0.0918	61.62	0.7191
20	0.0755	90	0.1433	95.6	0.9924
30	0.0751			96	$\beta = 0.926$ (Bohr, 1910.)

SOLUBILITY OF CARBON DIOXIDE IN AQUEOUS SOLUTIONS OF PRUSSIAN BLUE.

(Gatterer, 1926.)

The Prussian Blue solution (Ferri ferrocyanide) was prepared from sodium ferrocyanide and ferric chloride. The gram equivalent was taken as $\frac{1}{4}Fe_4[Fe(CN)_6]_3 = 71.603$ for purposes of calculation. The solubility of CO_2 is given in terms of the Ostwald Solubility Expression, l.

Normality of Prussian Blue solution.	Solubility l of CO_2 at 25°.	20°.	15°.	10°.	5°
0.896	0.8421	0.9512	1.087	1.255	1.453
0.51	0.8505	0.9613	1.093	1.264	1.464
0.37	0.8577	0.9684	1.106	1.277	1.478
0.178	0.853	0.9633	1.098	1.268	1.472
0.126	0.8443	0.9549	1.089	1.258	1.465

SOLUBILITY OF CARBON DIOXIDE IN AQUEOUS SOLUTIONS OF FERRIC HYDROXIDE.

(Gatterer, 1926.)

An apparatus designed to eliminate the disadvantages of the Ostwald apparatus was used.

Normality of Ferric hydroxide solution.	Solubility *l* of CO_2 at 25°.	20°.	15°.	10°.	5°.
0.000 (= H_2O).	0.826	0.936	1.070	1.240	1.446
0.071	0.8533	0.9610	1.095	1.267	1.471
0.144	0.8764	0.9870	1.123	1.297	1.503
0.293	0.9063	1.016	1.154	1.326	1.534
0.513	0.9526	1.066	1.204	1.379	1.584
0.967	1.032	1.149	1.291	1.470	1.680

The results for H_2O are the mean of the author's determinations. They agree well with the results of Bohr and Bock and of Geffcken.

THE SOLUBILITY OF CARBON DIOXIDE IN AQUEOUS SOLUTIONS OF OF POTASSIUM AND SODIUM SALTS OF VARIOUS ACIDS.

(Bhagwat and Dhar, 1929.)

These determinations were made for the purpose of calculating the dissociation constants of the several acids. The authors also give results in terms of gm. mols. per liter, for the solubility of CO_2 in water alone, but these results, when recalculated to the weight basis, agree so closely with the results of Bohr, Geffcken and Just, given in a preceding table, that they are not repeated here.

In Aq. Potassium Fluoride

t°	Gm. mols. per liter	
	KF	CO_2
25	0.619	0.1295
"	1.238	0.1504
30	0.7428	0.1156
"	0.9904	0.1320

In Aq. Potassium Dichromate

t°	Gm. mols. per liter	
	$K_2Cr_2O_7$	CO_2
30	0.1250	0.1500
"	0.2154	0.1760
"	0.2396	0.2143
"	0.2500	0.1973
"	0.3482	0.2460
"	0.3962	0.2541
"	0.4309	0.2637
"	0.500	0.2601
"	1.000	0.3684

In Aq. Sodium Borate

t°	Gm. mols. per liter	
	$Na_2B_4O_7$	CO_2
16	0.0924	0.2664
17	0.1540	0.3470
16	0.2156	0.4213
18	0.3080	0.5288

In Aq. Potassium Molybdate

t°	Gm. mols. per liter	
	K_2MoO_4	CO_2
25	0.04096	0.0802
"	0.1024	0.0951
"	0.2048	0.1200
"	0.4096	0.1686

In Aq. Potassium Iodate

t°	Gm. mols. per liter	
	KIO_3	CO_2
19	0.1375	0.08164
"	0.3437	0.08373
18	0.6879	0.09505

In Aq. Potassium Titanate

t°	Gm. mols. per liter	
	K_2TiO_3	CO_2
17	0.0015	0.08854
"	0.0035	0.09585
"	0.0050	0.1149

In Aq. Potassium Hypophosphite

t°	Gm. mols. per liter	
	NaH_2PO_2	CO_2
27	0.1407	0.0703
25	0.2424	0.0745
"	0.4849	0.0786
"	0.9698	0.08554

In Aq. Sodium Phosphite

t°	Gm. mols. per liter Na_2HPO_3	Gm. mols. per liter CO_2
24	0.3846	0.2055
21	0.4615	0.1945
"	0.6153	0.2295
24	0.7692	0.2337
26.5	2.2015	0.2322

In Aq. Ammonium Molybdate

	Gm. mols. per liter $(NH_4)_2MoO_4$	Gm. mols. per liter CO_2
23.	0.0841	0.0700
20.5	0.0854	0.07581
22.0	0.0893	0.07213

In Aq. Sodium Vanadate

t°	Gm. mols. per liter Na_3VO_4	Gm. mols. per liter CO_2
21	0.3117	0.5944
"	0.4646	0.7177

SOLUBILITY OF CARBON DIOXIDE IN AQUEOUS SOLUTIONS OF ACIDS AND OF MIXTURES OF ACIDS AND SALTS AT 38°.

(Van Slyke, Sendroy, Hastings and Neill, 1928.)

Comp. of aq. solvent Gm. mols. per liter	Mm. CO_2 tension at 38°	Bunsen abs. coef. α, of CO_2
Water alone	715	0.5455
0.256 HCl	721	0.5384
0.300 "	723	0.5364
0.100 lactic ac.	711	0.5470
0.150 " "	713	0.5436
0.150 " "	714	0.5473
0.300 " "	713	0.5434
0.150 H_3PO_4	724	0.5396
0.300 "	724	0.5317
0.01 HCl + 0.150 NaCl	721	0.5300
" " + " "	715	0.5276
" " + 0.300 NaCl	721	0.5116
" " + 0.150 KCl	700	0.5325
" " + " "	709	0.5314
" " + 0.300 KCl	700	0.5207
" " + " "	709	0.5187
0.1 lactic + 0.15 Na lactate	700	0.5214
0.15 " + " " "	707	0.5220
0.10 " + 0.30 " "	700	0.5023
0.30 " + 0.30 " "	707	0.4980
0.10 " + 0.15 K "	721	0.5278
0.15 " + 0.15 " "	720	0.5288
0.10 " + 0.30 " "	721	0.5106
0.30 " + 0.30 " "	720	0.5103
0.011 H_3PO_4 + 0.037 NaH_3PO_4	710	0.5360
0.019 " + 0.075 "	710	0.5272
0.024 " + 0.120 "	710	0.5175
0.015 " + 0.150 "	712	0.5109
0.030 " + 0.300 "	718	0.4791
0.030 " + 0.300 "	712	0.4823
0.015 " + 0.15 KH_3PO_4	720	0.5163
0.030 " + 0.30 "	720	0.4906
0.030 " + 0.30 "	712	0.4915
None + 0.30 KHC_2O_4	718	0.5211
" + 0.60 "	718	0.4969

SOLUBILITY OF CARBON DIOXIDE AT 38° IN NORMAL PLASMA AND SERUM ACIDIFIED WITH 0.1 GM. MOL. LACTIC ACID PER LITER.

(Van Slyke, Sendroy, Hastings and Neill, 1928.)

Solvent	Mm.CO_2 tension at 38°	Bunsen Absorp. Coef. B of CO_2
Ox Serum	706	0.509
" "	709	0.511
Normal Human Serum	709	0.506
" " Oxalate Plasma	700	0.511

The authors also give results for the effect of lipoids upon the Solubility of CO_2 in plasma and serum. They also give results for the Solubility of CO_2 in acidified aqueous solutions of ox cells at 38°.*

On the basis of calculations from their experimental determinations the authors state that "The measurable deviations of the solubility of CO_2 in serum from its solubility in water have been found due to the following factors: <u>Salts</u>, depressing the solubility about 3 percent by lowering the solvent power of the water for CO_2, and to a lesser extent by displacing a small amount of water; <u>proteins</u>, depressing the solubility of CO_2 per cc. of serum several percent by displacing water; <u>lipoids</u>, raising the solubility (by about 4 percent in normal serum) because of their own high solvent power for CO_2. The combined effect is to reduce the solubility in normal serum to 93 to 94 percent of its solubility in water."

O Data for the absorption of CO_2 by hemoglobin are given by Jolin, 1889.

Data for the solubility of CO_2 in blood and plasma, quoted from Bohr, are given by O'Brien and Parker, 1922.

SOLUBILITY OF CARBON DIOXIDE IN URINE.

(Mainzer and Bruhn, 1931.)

In 20 samples of urine measured under a variation of pressure of CO_2 between 13.3 and 242.4 mm. Hg the absorption coefficient of CO_2 at 38° varied between 0.441 and 0.514.

SOLUBILITY OF CARBON DIOXIDE IN ALCOHOL.

(Bohr — Wied. Ann. Physik. [4] 1, 247, '00)

	In 99 per cent Alcohol.		In 98.7 per cent Alcohol.	
t°.	cc. CO_2 (at 0° and 760 mm) per 1 cc.		cc. CO_2 (at 0° and 760 mm) per 1 cc	
	Alcohol.	Sat. Solution.	Alcohol.	Sat. Solution.
−65	38·41	35·93	39·89	37·22
−20	7·51	7·41	7·25	7·16
−10	5·75	5·69	5·43	5·38
0	4·44	4·40	4·35	4·31
+10	3·57	3·55	...	...
20	2·98	2·96	...	...
25	2·76	2·74	...	...
30	2·57	2·56	...	...
40	2·20	2·19	...	...
45	2·01	2·00	...	...

SOLUBILITY IN AQUEOUS ALCOHOL AT 20°.

(Müller, 1889; Lubarsch, 1889.)

Density of Alcohol.	Per cent Alcohol by Wt.	Abs. Coef. of CO_2, α.	Density of Alcohol.	Per cent Alcohol by Wt.	Abs. Coef. of CO_2, α.
0.998	1.07	0.861	0.922	49.0	0.982
0.969	22.76	0.841	0.870 (18.8°)	71.1	1.293
0.960 (22.4°)	28.46	0.792	0.835 (16°)	85.3	1.974
0.956	31.17	0.801	0.795 (19°)	99.7	2.719
0.935 (17°)	42.15	0.877			

SOLUBILITY IN AQUEOUS ALCOHOL AT 25°.

(Findlay and Shen, 1911.)

Results for alcohol, of $d_{\frac{25}{25}}$ = 0.9931 (2.95 gms. per 100 cc.).		Results for alcohol, of $d_{\frac{25}{25}}$ = 0.9929 (3.01 gms. per 100 cc.).		Results for alcohol, of $d_{\frac{25}{25}}$ = 0.9834 (8.83 gms. per 100 cc.).	
Pressure m.m. Hg.	Solubility of CO_2, Ostwald Expression l_{25}.	Pressure m.m. Hg.	Solubility of CO_2, Ostwald Expression l_{25}.	Pressure m.m. Hg.	Solubility of CO_2, Ostwald Expression l_{25}.
737	0.812	745	0.814	747	0.786
836	0.813	937	0.815	942	0.784
1073	0.811	1083	0.813	1090	0.785
1338	0.811	1357	0.812	1360	0.788

These authors also showed that the solubility of CO_2 in wort containing 13 gms. solids per 100 cc. is less than in water; also that the solubility of CO_2 in beer is less than in aqueous alcohol solutions of alcohol content equal to that of the beer.

SOLUBILITY OF CARBON DIOXIDE IN AQUEOUS SOLUTIONS OF NON-ELECTROLYTES AT 20°.

Results in terms of the Bunsen Absorption Coefficient β, see p. 221. (Usher, 1910.)

Aqueous Solution of:	Gm. Mols. per Liter.	d_{20} of Aq. Sol.	Absorption Coef. β.	Aqueous Solution of:	Gm. Mols. per Liter.	d_{20} of Aq. Sol.	Absorption Coef. β.
Water Alone	...	...	0.877	Resorcinol	0.5	1 0096	0.901
Sucrose	0.125	1.0152	0.846	Catechol	0.5	1.0107	0 868
"	0.25	1.0313	0.815	Urethan	0.5	1.0037	0.869
"	0.50	1.0637	0 756	Carbamide	0.5	1 0072	0 864
"	1	1.1281	0.649	Thiocarbamide	0 5	1.0092	0.859
Dextrose	0.5	1.0328	0.792	Antipyrine	0.5	1.0134	0.859
Mannitol	0.5	1.0303	0.782	Acetamide	0.5	1.0005	0.879
Glycine	0 5	1.0141	0.843	Acetic Acid	0.5	1.0026	0.868
Pyrogallol	0.5	1.0172	0.853	*n* Propyl Alcohol	0.5	0.9939	0.869
Quinol	0.5	1.0095	0.887				

SOLUBILITY OF CARBON DIOXIDE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL, GLYCEROL, ACETONE AND UREA. (CARBAMIDE)

(Kiss, Lajtai and Thury, 1937.)

Composition of aqueous solvent in gm. mols. per liter		Ostwald Sol. Expression l for CO_2 dissolved at:			Gm. mols. CO_2 dissolved per liter sat. sol. at:		
		0.05°	12.5°	25°	0.05°	12.5°	25°
Results for aq. solutions of Ethyl Alcohol							
0.0	C_2H_5OH	0.07640	0.04944	0.03385	1.713	1.159	0.8190
2.0	"	0.06616	0.04534	0.03255	1.484	1.063	0.7960
4.0	"	0.05423	0.04094	0.03100	1.216	0.960	0.7500
6.0	"	0.04516	0.03573	0.02900	1.013	0.838	0.7016
8.0	"	0.04556	0.03800	0.03310	1.022	0.891	0.8008
10.0	"	0.05123	0.04401	0.03893	1.149	1.032	0.9418
12.0	"	0.06754	0.05709	0.04932	1.515	1.339	1.193
14.0	"	0.09001	0.07351	0.06290	2.019	1.724	1.522
16.0	"	0.1239	0.1002	0.08435	2.778	2.350	2.041

Results for aq. solutions of Glycerol

2.0	$C_3H_8O_3$	0.05086	0.03690	0.02723	1.140	0.8653	0.6664
4.0	"	0.03570	0.02696	0.02110	0.8006	0.6322	0.5164
6.0	"	0.02776	0.02214	0.01850	0.6225	0.5192	0.4528
8.0	"	0.02202	0.01865	0.01570	0.4938	0.4374	0.3842

Results for aq. solutions of Acetone

2.0	CH_3COCH_3	0.06751	0.04790	0.03562	1.514	1.123	0.8718
4.0	"	0.06510	0.04984	0.03990	1.460	1.169	0.9765
6.0	"	0.07194	0.05809	0.04825	1.613	1.362	1.181
8.0	"	0.09596	0.08050	0.06987	2.152	1.639	1.710
10.0	"	0.1505	0.1308	0.1135	3.375	3.067	2.778
12.0	"	0.2595	0.2158	0.1826	5.820	5.062	4.469

Results for aq. solutions of Urea (Carbamide)

2.0	NH_2CONH_2	0.06665	0.04571	0.03290	1.495	1.072	0.8052
4.0	"	0.06061	0.04326	0.03230	1.359	1.015	0.7905
6.0	"	0.05560	0.04131	0.03190	1.247	0.9687	0.7807
8.0	"	—	0.03819	0.03060	—	0.8956	0.7589

SOLUBILITY OF CARBON DIOXIDE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 15°.

(Showalter and Ferguson, 1936.)

O

Wt. percent C_2H_5OH in solvent	Vapor pressure of the pure solution in mm. Hg	Bunsen abs. coef. B of CO_2	Wt. percent C_2H_5OH in solvent	Vapor pressure of the pure solution in mm. Hg	Bunsen abs. coef. B of CO_2
0.0 (= H_2O)	12.7	1.022	34.5	25.0	0.8550
7.7	15.5	0.991	52.6	29.0	1.139
12.2	17.5	0.9545	90.8	31.2	2.546
24.0	21.5	0.8427	91.8	31.8	2.556

SOLUBILITY OF CARBON DIOXIDE IN AQUEOUS SOLUTIONS OF SUGARS AT 15°.

(Showalter and Ferguson, 1936.)

Results for Aq. Solutions of:

Sucrose		Dextrose (D Glucose)		Levulose (D Fructose)	
Wt. percent $C_{12}H_{22}O_{11}$ in solvent	Bunsen Abs. coef. B of CO_2	Wt. percent $C_6H_{12}O_6$ in solvent	Bunsen Abs. coef. B of CO_2	Wt. percent $C_6H_{12}O_6$ in solvent	Bunsen Abs. coef. B of CO_2
8.4	0.945	4.5	0.9714	6.2*	0.9529
15.7	0.8952	9.25	0.9284	10.7	0.9061
25.5	0.8026	11.2	0.8986	12.0*	0.8768
		15.0	0.8526	13.6	0.8670
		21.9	0.7772	14.1	0.8676
		22.4	0.7636	21.2	0.7866
		26.9	0.7157	23.1*	0.7452
		27.9	0.7050		

* Kahlbaum's levulose "Aus Inulin" was used in these experiments. The authors also give results for the solubility of carbon dioxide in aqueous solutions of mixtures of Alcohol and Dextrose and Alcohol and Sucrose. They used a new type of solubility apparatus.

Data for the solubility of CO_2 in Sugar solutions and its combination with amino acids are given by Majer, 1928.

SOLUBILITY OF CARBON DIOXIDE IN AQUEOUS SOLUTIONS OF CHLORAL HYDRATE AND OF GLYCEROL AT 15°.

Results in terms of the Bunsen absorption coefficient β, and also the Ostwald solubility expression l (see p. 221). (von Hammel, 1915.)

In Aq. Chloral Hydrate.			In Aq. Glycerol.		
Gms. $CCl_3.CH(OH)_2$ per 100 Gms. Aq. Sol.	Abs. Coef., β_{15}.	Solubility, l_{15}.	Gms. $(CH_2OH)_2CHOH$ per 100 Gms. Aq. Sol.	Abs. Coef., β_{15}.	Solubility, l_{15}.
17.7	0.885	0.935	0	1.008	1.064
31.6	0.803	0.848	26.11	0.785	0.829
38.3	0.781	0.825	43.72	0.639	0.675
49.8	0.760	0.802	62.14	0.511	0.540
57.1	0.765	0.808	77.75	0.430	0.454
68.8	0.797	0.842	90.74	0.404	0.427
79.4	0.903	0.953	99.26	0.410	0.438

SOLUBILITY OF CARBON DIOXIDE IN WATER AND IN ORGANIC SOLVENTS.

(Kunerth, 1922.)

Solvent.	Cc. CO_2 dissolved per 1 cc. of solvent at									
	18°.	20°.	22°.	24°.	26°.	28°.	30°.	32°.	34°.	36°.
Water...........		0.900	0.872	0.834	0.800	0.765	0.729	0.693	0.656	–
Acetone.........		6.98	6.76	6.55	6.22	5.88	5.49	5.08	4.66	
Acetic acid.......	5.40	5.23	5.07	4.91	4.73	4.57	4.41	4.25	4.12	4.00
Pyridine..........	3.95	3.85	3.75	3.63	3.53	3.45	3.33	3.25	3.13	3.03
Methyl alcohol...	3.63	3.57	3.51	3.44	3.37	3.28	3.19	3.09	2.97	–
Ethyl » ...	2.95	2.87	2.80	2.73	2.66	2.58	2.48	2.41	2.51	
Benzaldehyde.....	3.06	2.98	2.90	2.80	2.73	2.66	2.58	2.52	2.46	2.39
Aniline..........	–	1.38	1.35	1.32	1.29	1.25	1.22	1.21	1.19	1.17
Amyl acetate.....	4.79	4.65	4.55	4.44	4.35	4.29	4.14	4.10	4.02	–
Ethylene bromide.	2.32	2.27	2.22	2.16	2.12	2.07	2.03	1.97	1.92	1.86
Iso amyl alcohol...	–	1.91	1.88	1.85	1.81	1.76	1.72	1.69	1.67	–
Chloroform.......	3.83	3.71	3.60	3.50	3.39	3.26	3.11	2.94	2.81	2.68

The CO_2 and solvent were measured at the same temperature and barometric pressure. The CO_2 was saturated with the vapor of the solvent before the solubility determination was made and thus no allowance for the vapor pressure of the solvent was necessary. The CO_2 was prepared by heating $NaHCO_3$ and passing the gas over $CaCl_2$ to remove H_2O.

SOLUBILITY OF CARBON DIOXIDE IN ORGANIC SOLVENTS AT LOW TEMPERATURES AND PRESSURES. (Stern, 1912-13.)

Very accurate determinations with an elaborate apparatus. The results are expressed in terms of K' = the number of cc. of CO_2, reduced to 0°, absorbed at the indicated pressure by 1 gram of liquid. This number differs from the Bunsen absorption coefficient only by a constant factor which is the density d of the liquid. Therefore Bunsen coef. $\beta = K'd$. The results are also expressed in terms of the Ostwald solubility expression l (see p. 221).

t°.	Pressure in m.m. Hg.	Solvent, C_2H_5OH.		Solvent, CH_3OH.		Solvent, $(CH_3)_2CO$.		Solvent, $CH_3CO_2.C_2H_5$.		Solvent, $CH_3CO_2CH_3$.	
		$d_{\frac{-78}{4}} = 0.872$. $d_{\frac{-59}{4}} = 0.856$.		$d_{\frac{-78}{4}} = 0.884$. $d_{\frac{-59}{4}} = 0.866$.		$d_{\frac{-78}{4}} = 0.900$. $d_{\frac{-59}{4}} = 0.879$.		$d_{\frac{-78}{4}} = 1.017$. $d_{\frac{-59}{4}} = 0.994$		$d_{\frac{-78}{4}} = 1.056$. $d_{\frac{-59}{4}} = 1.012$.	
		K'.	l.	K'.	l.	K'.	l.	K'.	l.	K'.	l.
−78	50	107	...	194	120.5	311	196.6	250.2	177.5	304.9	224.1
"	100	111.8	68.4	195	119.6	322	198.1	255.6	177.1	315	224.3
"	200	115.7	69.5	202.9	120.1	344.5	201.5	271.8	179.2	337.4	223.1
"	400	123.8	71.4	221.5	122.2	400	208.8	310.9	183.2	389.3	225.6
"	700	138.6	74.7	260	126.8	545.5	...	...	...	...	...
−59	100	40.85	27.27	63	42.5	97.8	67.2	85.3	65.6	94.3	75.8
"	200	41	27.16	64.2	42.7	101.2	68	86.3	65.3	98.45	77.1
"	400	42.35	27.65	66.3	43.1	106.6	72.8	91.6	66.7	103.6	77.6
"	700	44.15	28.10	69	43.35	118.8	72.8	101.5	69.7	112.9	79

SOLUBILITY OF CARBON DIOXIDE IN ORGANIC SOLVENTS AT HIGH PRESSURES.

(See Note, p. 224.)

(Sander, 1911–12.)

Pressure in Kg. per Sq. Cm.	Cc. of CO_2 (Reduced to 1 Kg per Sq. Cm.) Dissolved at the Temp. and Pressure of Experiment by 1 cc. of Sat. Solution in:								
	C_2H_5OH (0.093 cc.)	C_3H_7OH (0.103 cc.)	$(C_2H_5)_2O$ (0.131 cc.)	$CH_3COOC_2H_5$ (0.155 cc.)	C_6H_6 (0.08 cc.)	C_6H_5Cl (0.106 cc.)	C_6H_5Br (0.113 cc.)	$C_6H_5NO_2$ (0.164 cc.)	$C_6H_5CH_3$ (0.114 cc.)
Results at 20°.									
20	...	56.16	...	...	71.16	62.61	50.83	57.12	57.91
30	104.8	86.62	...	188.2	125.3	95.22	82.29	92.50	103.3
40	149.7	122.1	...	227.9	192.4	137.3	121.1	115.9	155.9
50	188.8	174.6	...	...	264.3	187.5	160	155.9	235.8
Results at 35°.									
20	...	40	...	...	48.65	46.66	43.38	44.48	49.6
40	113.1	98.16	...	188.4	138.3	101.5	90.43	94.39	118.8
60	173	159.9	241.3	219.8	243.1	168.3	146	145.1	192.1
80	...	269.6	...	...	...	...	233.9	227	...
Results at 60°.									
20	...	24.73	...	...	34.57	35.86	30.58	31.38	...
40	72.82	64.65	...	140.5	88.71	73.69	62.64	52.26	78.67
60	122.5	111.5	195.4	186.7	156.6	118.1	98.73	72.15	128.1
80	167.9	159.2	221.4	223.4	215	149.3	131.4	85.03	171.9
100	195.7	213.9	248.7	...	284.4	...	169.7	...	210
Results at 100°.									
30	...	...	...	...	...	33.65	30.56	41.09	28.68
40	...	26.5	...	80.70	46.52	48.16	41.49	50.36	49.25
60	66.05	74.51	101	132	91.27	77.24	72.64	70.85	85.98
80	111.2	107.7	142.8	162.3	155.8	103	92.86	86.86	117.6
100	145.7	144.7	175.4	191.5	212.9	121.5	118	...	149
120	174.6	175.4	...	...	258.2	140.7	140.7	...	171.8
130	182.6	...	...	...	...	146.8	...	...	178.2

The figures in parentheses immediately below the formulas of the solvents in the above table, show the volumes of solvent used for the series of determinations in each case. The volumes of CO_2 varied from about 55 to 77 cc. in the several cases. The increasing content of CO_2 in the solvents at increasing pressures caused a considerable increase in volume of the solvent. This was determined and the proper calculation of the readings to the saturated solution were made. All necessary figures to show the extent of the applicability of Henry's Law in the present case, are given.

SOLUBILITY OF CARBON DIOXIDE IN PURE METHYL ALCOHOL AND IN METHYL ALCOHOL CONTAINING INCREASING AMOUNTS OF SALTS AT 15°.

(Kosakewitsch, 1929.)

Gm. mols. salt per 100 Gm. mols. CH_3OH	Gm. mols. CO_2 per 100 Gm. mols. CH_3OH (reduced to 760mm. pressure) in CH_3OH solution of:			
	LiBr	LiCl	LiI	NaI
0.0 (= pure CH_3OH)	0.825	0.825	0.825	0.825
1.0	0.764	0.762	0.756	0.758
2.0	0.710	0.708	0.693	0.698
4.0	0.618	0.611	—	0.598
6.0	0.540	0.526	—	0.518
8.0	0.470	0.450	—	0.457
10.0	0.410	—	—	—

SOLUBILITY OF CARBON DIOXIDE IN ORGANIC SOLVENTS.

(Just, 1901.)

The determinations are described in great detail. Results are given in terms of the Ostwald solubility expression *l* (see p. 221).

Solvent.	l_{15}.	l_{20}.	l_{25}.	Solvent.	l_{15}.	l_{20}.	l_{25}.
Water	0.8256	...	...	Benzene	2.425	2.540	2.710
Glycerol	0.0302	...	...	Amylbromide	2.455	2.638	2.803
Carbon Disulfide	0.8699	0.8888	0.9446	Nitrobenzene	2.456	2.655	2.845
Iodobenzene	1.301	1.371	1.440	Propyl Alcohol	2.498	...	...
Aniline	1.324	1.434	1.531	Carvol	2.498	2.690	2.914
o Toluidine	1.381	1.473	1.539	Ethyl Alcohol (97%)	2.706	2.923	3.130
m "	1.436	1.581	1.730	Benzaldehyde	2.841	3.057	3.304
Eugenol	1.539	1.653	1.762	Amylchloride	2.910	3.127	3.363
Benzene Trichloride	1.643	...	...	Isobutylchloride	3.105	3.388	3.659
Cumol	1.782	1.879	1.978	Chloroform	3.430	3.681	3.956
Carven	1.802	1.921	2.030	Butyric Acid	3.478	3.767	4.084
Dichlorhydrine	1.810	1.917	2.034	Ethylene Chloride	3.525	3.795	4.061
Amyl Alcohol	1.831	1.941	2.058	Pyridine	3.656	3.862	4.291
Bromobenzene	1.842	1.964	2.092	Methyl Alcohol	3.837	4.205	4.606
Isobutyl Alcohol	1.849	1.964	2.088	Amylformate	4.026	4.329	4.646
Benzylchloride	1.938	2.072	2.180	Propionic Acid	4.078	4.407	4.787
Metoxylol	2.090	2.216	2.346	Amyl Acetate	4.119	4.411	4.850
Ethylenebromide	2.157	2.294	2.424	Acetic Acid (glacial)	4.679	5.129	5.614
Chlorobenzene	2.265	2.420	2.581	Isobutyl Acetate	4.691	4.968	...
Carbontetrachloride	2.294	2.502	2.603	Acetic Anhydride	5.206	5.720	6.218
Propylenebromide	2.301	2.453	2.586	Acetone	6.295	6.921	...
Toluene	2.305	2.426	2.557	Methyl Acetate	6.494	...	...

SOLUBILITY OF CARBON DIOXIDE IN PURE ETHYL ALCOHOL AND IN ETHYL ALCOHOL CONTAINING INCREASING AMOUNTS OF SALTS AT 20°.

(Kosakewitsch, 1929.)

Gm. mols. salt per 100 gm. mols. C_2H_5OH	Gm. mols. CO_2 per 100 Gm. mols. C_2H_5OH (reduced to 760mm. pressure) in C_2H_5OH solution of:			
	LiBr	LiCl	LiI	NaI
0.0 (= pure C_2H_5OH)	0.768	0.768	0.768	0.768
1.0	0.712	0.720	0.702	0.720
2.0	0.670	0.682	0.650	0.675
4.0	0.602	0.617	0.554	0.601
6.0	0.547	0.564	0.476	0.550
8.0	—	0.514	0.421	0.517
10.0	—	0.470	0.388	—
12.0	—	0.432	—	—

In studying the effect of CHLOROPHYLL upon the solubility of carbon dioxide, Kremann and Schinderschitsch, 1916, found the solubility coefficient in 95 % alcohol to be $l_{16} = 2.44$, 2.48 and 2.53. The corresponding figure for a 95 % alcoholic solution of chlorophyll was $l_{16} = 2.37$ (in the light) and 2.44 (in the dark). These values all agree with the data of Winkler and show no appreciable effect on the solubility of CO_2, resulting from the presence of chlorophyll.

SOLUBILITY OF CARBON DIOXIDE IN ETHYL ETHER. RESULTS IN TERMS OF THE OSTWALD SOLUBILITY EXPRESSION *l*.

(Christoff, 1912.)

$l_0 = 7.330$. $l_{10} = 6.044$. $l_{15} = 5.465$.

EQUILIBRIUM IN THE SYSTEM CARBON DIOXIDE AND ETHER.

(Thiel and Schulte, 1920.)

t°.	Mol per cent Ether in the Vapor Phase.	Mol per cent Ether in the Liquid Phase.
−78.6	0.065	52.6
−63.7	0.25	72.9
−23.8	6.1	93.3
± 0	23.8	97.7
+15	45.4	98.6

Solubility of Solid CO_2 in Ether.

t°.	Mol. per cent in sat sol. Ether.	Mol. per cent in sat sol. CO_2.
−83.5	54.6	45.4
−92.5	63.4	36.6
−98.0	69.4	30.6

The authors also give results for the composition of the vapor phase and in some cases, the liquid phase, in systems composed of carbon dioxide and each of the following compounds : ethyl chloride, sulfur dioxide, methyl ether, chlorine and hydrogen sulfide.

SOLUBILITY OF CARBON DIOXIDE IN ACETONE.

(Felsing and Durban, 1926.)

t°	cc CO_2 (at 0° & 760mm.) dissolved by 1.0 gm. $CH_3.CO.CH_3$ at p.p. 760mm.	t°	cc CO_2 (at 0° & 760mm.) dissolved by 1.0 gm. $CH_3.CO.CH_3$ at p.p. 760mm.
−73.1	313	−13.6	20.2
−60.1	133	− 2.5	13.9
−45.1	62.7	+20.0	7.97
−29.2	33.1		

O Data for the reciprocal solubility of CO_2 (also air, SO_2, NH_3 and HCl) and the vapors of ethyl ether, methyl alcohol, acetone and chloroform, as determined by measuring at 25° the change in pressure produced by adding a weighed amount of the volatile liquid to a given volume of carbon dioxide, are given by Mac Farlane and Wright, 1934.

Data for the adsorption of CO_2 by *p* azoxyphenetol at temperatures below and above its melting point, show that no adsorption or solution occurs while the material is in the solid (unmelted) condition, but after the first melting, absorption takes place and as soon as the isotropic liquid phase is reached, a second very well-marked increase in absorption is observed. After this, expansion and decrease of solubility proceed regularly with rise of temp. (Homfray, 1910.)

The absorption coefficient β of CO_2 in Russian petroleum was found by Gniewosz and Walfisz (1887) to be 1.17 at 20° and 1.31 at 10°.

By a more recent determination, the Solubility of Carbon Dioxide in purified white mineral oil of d_{27} = 0.868, viscosity (Saybolt) 285 at 37.8°C and f. pt. of about −37°, was found to be 0.841 ± 0.011 cc. CO_2 (at 0° and 760 mm. pressure per 1.0cc. of oil (neglecting the change in volume of the oil) under one atmosphere pressure of the gas (neglecting the partial pressure of water and oil vapor over the oil). Determinations were also made of the rate of diffusion of CO_2 from the oil go the air. (Kubie, 1927.)

Data for the absorption of CO_2 by rubber and carbon are given by Reychler (1910).

100 cc. of RUBBER saturated with carbon dioxide at 21°, dissolve 99 cc. CO_2 (0° and 760 mm.). The determination was made by pumping out the gas with a Töpler pump and measuring it over mercury. Results for the effect of pressure and temperature upon the solubility are also given. (Venable and Fuwa, 1922.)

Determinations by Northrop, 1929 show that the solubility of carbon dioxide in Collodion is proportional to the pressure between 0 and 800 mm. Hg at room temperature.

The solubility of Carbon Dioxide in Carbon Tetrachloride in terms of the Ostwald Solubility Expression l is 2.668 at 25°. (Horiuti, 1931,[illegible].)

Data for the solubility of carbon dioxide in mixtures of acetic acid and carbon tetrachloride and of ethylene chloride and carbon disulfide are given by Christoff, 1905.

The solubility of Carbon Dioxide in Cyclohexanol $(CH_2:(CH_2CH_2)_2.CHOH)$ is 677cc. CO_2 per liter at 26° and 766mm pressure, Cauquil, (1927).

By means of density determinations of co-existing gaseous and liquid carbon dioxide, both in the presence and absence of water, it was estimated that the solubility of H_2O in liquid CO_2 is less than 0.05 percent by weight. (Lowery and Erickson, 1927.)

Vapor pressure - temperature data are given for the following systems:-

CO_2 + Hydrogen Sulfide (Klemenc and Bankowski, 1932.)
" + Methyl Alcohol (Baume and Perrot, 1911, 1914.)
" + Methyl Ether " " " "
" + as. o Xylidine (Scheffer and Smittenberg, 1932.)
" + o Nitro Phenol " " " 1933)
" + o Chloro Nitro Phenol " " "
" + m " " " " " "

Determinations of the melting points, defining the liquid areas in the system Carbon Dioxide, Urea, and Ammonia, are given by Davis and Black, 1931.

CARBON OXY CHLORIDE $COCl_2$. (PHOSGENE, CARBONYL CHLORIDE) OC1

SOLUBILITY OF CARBONYL CHLORIDE IN SEVERAL SOLVENTS.

(Atkinson, Heycock and Pope, 1920.)

Two or three cc. quantities of the several solvents were saturated by passing a stream of carbonyl chloride through them while they were kept in a constant temperature bath untill no further absorption occurred. About 3 hours were required. The bulb was then sealed and weighed. The quantity of carbonyl chloride was then determined by breaking the bulb in a closed bottle containing 50 or 100 cc. of standard Na OH solution and titrating back with acid.

Solvent.	t°.	Gms. $COCl_2$ per 100 gms. solvent.	Solvent.	t°.	Gms. $COCl_2$ per 100 gms. solvent.
Toluene	17	244.7	Chloro benzene	12.3	442.1
»	23.5	124.2	»	16.6	204.3
»	30.5	79.38	»	16.7	221.6
»	31.5	74.48	»	24.2	99.9
Xylene	12.3	457.3	»	29.7	81.7
»	16.4	225.6	Petroleum (b.pt. 180°-200°)	12.3	263.8
»	16.9	217.9	»	15.8	163.1
»	23.8	103.4	»	16.7	143.4
»	29.8	71.24	»	22.4	79.5
Creosote oil	16.2	77.42	»	23.7	71.2
Acetylene tetra chloride	16.8	149.7	»	29.9	49.2
» »	25.1	89.4	»	30.0	48.6
» »	29.9	74.9	Heavy lubricating oil	15.6	79.7
Nitro benzene	16.8	106.4	»	23.5	39.3
α Chloro naphthalene	17.0	104.5	»	31.0	24.5

Solubility of Phosgene (Carbonyl Chloride) in Several Solvents at 20.21°.

(Baskerville and Cohen, 1921.)

The $COCl_2$ gas was passed at atmospheric pressure thoungh a Bowen's absorption bulb containing the solvent and the increase in weight determined.

Solvent.	Gms. $COCl_2$ dissolved per 100 gms. solvent.	Solvent.	Gms. $COCl_2$ dissolved per 100 gms. solvent.
Carbon tetrachloride	27.67	Benzene	99.31
Chloroform	58.70*	Toluene	66.59*
Gasoline	81.08*	Glacial acetic acid	62.10*
Paraffine oil	0.0	Ethyl acetate	98.54
Russian mineral oil	35.88	Chlorocosane	30.95

* In these cases positive evidence was obtained that chemical reaction occurred.

CARBON OXYSULFIDE COS.

Solubility of Carbon Oxysulfide in Water.

(Winkler, 1906.)

t°.	β.	q.	t°.	β.	q.
0	1.333	0.356	20	0.561	0.147
5	1.056	0.281	25	0.468	0.122
10	0.836	0.221	30	0.403	0.104
15	0.677	0.179			

For β and q see Carbon Dioxide, p. 221.

OS

Solubility of Carbon Oxysulfide in Several Solvents.

Solvent.	t°.	cc. COS per 100 cc. Solvent.	Authority.
Water	13.5	80	(Hempel, 1901.)
"	20	54	(Stock and Kuss 1917.)
Alcohol	22	800	" "
Toluene	22	1500	" "
HCl solution of CuCl	13.5	20	(Hempel, 1901.)
1 gm. KOH + 2cc. H_2O + 2cc. C_2H_5OH	13.5	7200	"
Pyridine	...	4.4	"
Nitrobenzene	...	12.0	"

S

CARBON DISULFIDE CS_2.

Solubility in Water.

(Chancel and Parmentier, 1885; Rex, 1906.)

t°.	Grams CS_2 per 100 cc. Solution.	Grams CS_2 per 100 Gms. H_2O (Rex).	t°.	Grams CS_2 per 100 cc. Solution.	Grams CS_2 per 100 Gms. H_2O (Rex).
0	0.204	0.258	30	0.155	0.195
5	0.199	...	35	0.137	...
10	0.194	0.239	40	0.111	...
15	0.187	...	45	0.070	...
20	0.179	0.217	49	0.014	...
25	0.169	...			

100 cc. H_2O dissolve 0.174 cc. CS_2 at 22°; Vol. of solution = 100.208, Sp. Gr. = 0.9981.

100 cc. CS_2 dissolve 0.961 cc. H_2O at 22°; Vol. of solution = 100.961, Sp. Gr. = 1.253.

(Herz, 1898.)

SOLUBILITY OF CARBON DISULFIDE IN:

Aq. Solutions of Ethyl Alcohol at 17°.
(Tuchschmidt and Folleuins, 1871.)

Wt. per cent Alcohol.	cc. CS_2 per 100 cc. Solvent.	Wt. per cent Alcohol.	cc. CS_2 per 100 cc. Solvent.
100	∞	91.37	50
98.5	182	84.12	30
98.15	132	76.02	20
96.95	100	48.40	2
93.54	70	47.90	0

Methyl Alcohol.
(Rothmund, 1898.)

t°.	Wt. per CS_2 in: CH_3OH Layer.	Wt. per CS_2 in: CS_2 Layer.
10	45.1.	98.3
20	50.8	97.2
25	54.2	96.4
30	58.4	95.5
35	64	93.5
40.5 (crit. temp.) 80.5		

SOLUBILITY OF CARBON DISULFIDE IN ETHYL ALCOHOL. (Guthrie, 1884.)

Gms. CS_2 per 100 Gms. $CS_2+C_2H_5OH$.	Appearance on Cooling in Ice and Salt Mixture.
94.94	Remains clear down to −18.4
89.54	Becomes turbid at −14.4
84.89	" " " −15.9
79.96	" " " −16.1
65.11	" " " −17.7
59.58	Remains clear down to −20
29.92	" " " " "

CARBON DISULFIDE CS_2. S

EQUILIBRIUM IN THE SYSTEM CARBON DISULFIDE, ETHYL ALCOHOL AND WATER.

(Schoorl and Regenboger, 1922 *a*.)

Mixtures of known volumes of the three highly purified constituents were cooled to the appearance of milkiness, and the temperature determined by means of a thermometer immersed in the mixture. Open tubes were used in some cases and closed tubes in others. The determinations were plotted and the following values read from the curves.

Ratio in cc. of H_2O.	to C_2H_5OH.	Cc. of CS_2 per 100 cc. of $H_2O+C_2H_5OH$ mixture to cause clouding at 0°.	10°.	15°.	20°.	40°.	60°.	80°.
66.7	33.3	–	0.4	–	–	–	–	–
50.0	50.0	1.0	1.5	1.75	2.0	2.4	3.3	4.7
33.3	66.7	3.7	4.7	5.2	5.6	–	–	–
25.0	75.0	7.0	9.0	9.5	10.0	–	–	–
17.0	83.0	12.0	13.8	14.7	15.6	–	–	–

Ratio in cc. of CS_2.	to C_2H_5OH.	Cc. of H_2O per 100 cc. of $CS_2+C_2H_5OH$ mixture to cause clouding at 0°.	10°.	15°.	20°.	40°.	60°.	80°.
17.0	83.0	12	14	15	16	–	–	–
25.0	75.0	6	7.8	8.7	9.6	–	–	–
37.0	63.0	2.5	3.6	4.1	4.7	–	–	–
50.0	50.0	1.0	1.65	2.0	2.45	4.5	6.5	9.0
67.0	33.0	0.55	0.95	1.1	1.3	–	–	–
75.0	25.0	0.4	0.65	0.75	0.9	–	–	–

Ratio in cc. of H_2O.	to CS_2.	Cc. C_2H_5OH per 100 cc. of H_2O+CS_2 mixture to cause clouding at 0°.	10°.	15°.	20°.	40°.	60°.	80°.
50.0	50.0				-	66.5	63.0	59.0

100 gms. sat. sol. of carbon disulfide in 92.0 wt. % C_2H_5OH contain 34.6 gms. CS_2 at 15°. (Ormandy and Craven, 1921.)

Reciprocal Solubility of Carbon Disulfide and Ethyl Alcohol.

(Schoorl and Regenbogen, 1922a.) (Mc Kolvy and Simpson, 1922.)

t° of clouding.	Cc. CS_2 per 100 cc. of mixture.	t° of clouding.	Gms. CS_2 per 100 gms. mixture.	t° of clouding.	Gms. CS_2 per 100 gms. mixture.
—62.0	98.0	—108.04	99.09	— 24.31	82.71
—42.0	94.3	— 73.68	98.55	— 25.13	76.25
—35.0	90.9	— 43.71	96.78	— 26.88	70.39
—24.0	77.8	— 30.16	93.05	— 35.17	61.23
—24.0 (crit. temp).	71.5	— 25.76	89.57	— 54.58	49.46
—24.0	57.0	— 25.07	87.48	— 79.26	38.75
—45.0 (about)	43.0	— 24.4 (crit. t.	83.0	—100.07	31.96
—75.0 (less than)	29.0				

The determinations of Mc Kelvy and Simpson were made with exceptional car

Reciprocal Solubility of Carbon Disulfide and Methyl Alcohol.

(Mc Kelvy and Simpson, 1922.)

t° of clouding.	Gms. CS_2 per 100 gms. mixture.	t°. of clouding.	Gms. CS_2 per 100 gms. mixture.	t° of clouding.	Gms. CS^2 per 100 gms. mixture
—18.85	99.64	34.82	88.43	30.70	64.12
+ 6.46	98.47	35.7 (crit. t.	85.0	28.60	61.03
26.50	95.27	35.75	84.73	27.34	60.53
28.0	94.74	35.63	83.89	13.80	49.93
30.58	93.55	35.30	77.65	— 4.43	41.29
31.08	93.00	34.09	72.85	— 38.37	28.78
33.80	90.22	33 35	70.13	— 73.60	18.70
				— 100.7 (f. pt.)	6.39

100 gms. anhydrous formic acid dissolve 4.66 gms. CS_2 at 25°. (Gordon and Reid, 1922.)

CALCIUM Ca

Determinations of the solubility of mixtures of metallic Ca and Na in melted mixtures of $CaCl_2$ + NaCl at temperatures between 500° and 800° are given by Lorenz and Winzer, 1929.

CALCIUM ALUMINATES $3CaO.Al_2O_3$, $5CaO.3Al_2O_3$ etc.

The equilibrium between the calcium aluminates of Portland cement and water has been given considerable attention in recent years. Thorvaldson, Grace and Vigfussen, 1929, reported that 100cc sat. solution of $3CaO.Al_2O_3.6H_2O$, in water contain 0.0246 gm. at 21° and 0.0268 gm. at 90°. Travers and Seknoutka, (1930) made a series of determinations of the solubilities of three crystalline forms of $3CaO.Al_2O_3$, and $3CaO.Al_2O_3.xCaO$, both hydrated and calcined, in water and in aqueous solutions of $Ca(OH)_2$, KOH, $CaSO_4$, $CaCl_2$, NaCl and $MgCl_2$, at room temperature and at the boiling point. It is probable however, that equilibrium was not reached since the mixtures were agitated only two hours. Assarsson, 1930, studied the system CaO + Al_2O_3 + H_2O at 20° and allowed 3 to 5 days for attainment of equilibrium. He gives a diagram showing the approximate concentration areas corresponding to the solid phases $4CaO.Al_2O_3.13.5H_2O$, $3CaO.Al_2O_3.12.5H_2O$, $2CaO.Al_2O_3 8H_2O$ and $3CaO.Al_2O_3.6H_2O$. He also gives results for the solubility of the tetra calcium aluminate in aqueous solutions of calcium hydroxide. Nacker and Mosebach, 1936, agitated weighed amounts of $3CaO.Al_2O_3$ and $CaCl_2$ in 1000cc. portions of water in an air thermostat at 30° for long periods and analyzed the saturated solutions for Al_2O_3, CaO and $CaCl_2$. The analytical results and microscopic examinations showed that the solid phase tended to approach the composition, $Al_2O_3.3CaO.CaCl_2.10H_2O$. Additional data on calcium aluminates are given by Mlle. Foret, 1931.

CALCIUM ARSENATES $CaHAsO_4.H_2O$, $CaH_4(AsO_4)_2$ etc.

EQUILIBRIUM IN THE SYSTEM CALCIUM OXIDE, ARSENIC PENTOXIDE AND WATER AT 35° (ACID REGION). (Smith, 1920.)

An excess of Ca O was added to aqueous solutions containing increasing amounts of arsenic acid. The mixtures were rotated continuously at 35° and the solutions analyzed at the end of 10 days and 17 days.

Density of sat. sol.	Gms. per liter of sat. sol.		Solid Phase.	Density of sat. sol.	Gms. per liter of sat. sol.		Solid Phase.
	CaO.	As_2O_5.			CaO.	As_2O_5.	
0.996	0.956	1.372		1.480	79.0	518.4	$CaH_4(AsO_4)_2$
1.025	7.20	27.79	$CaHAsO_4.H_2O$	1.590	64.7	690.5	»
1.09	20.74	87.00	»	1.697	50.1	853.6	»
1.157	37.09	150.1	»	1.795	33.6	995.0	»
1.242	57.0	232.3	»	1.975	16.2	1230.0	»
1.261	58.2	252.1	»	2.167	2.93	1539.0	»
1.300	69.4	285.6	»	2.217	2.53	1599.0	» + $3As_2O_5.5H_2O$
1.413	92.5	405.4	$CaH_4(AsO_4)_2$				

Data for the system calcium oxide, arsenic trioxide and water at 0°, 25° and 99° are given by Story and Anderson, 1924.

1 liter of water sat. with $CaHAsO_4$ contains 3.10 gms. of the compound at 25°
1 » » with $Ca_3(AsO_4)_2$ » 0.13 » » » »
(Robinson, 1918.)

The author also gives a few determinations which show that the presence of calcium hydroxide greatly reduces the solubility of the above two compounds.

100 gms. H_2O dissolve 0.0048 gm. basic arsenate of calcium, $3Ca_3(AsO_4)_2$ $Ca(OH)_2$ at 25°. (Tartar, Wood and Hine, 1924)

AsO

EQUILIBRIUM IN THE BASIC REGION OF THE SYSTEM CALCIUM OXIDE, ARSENIC PENTOXIDE AND WATER.

This region has been intensively studied especially in regard to the composition of the compounds formed.

Pearce and Norton, 1936, 1937, developed a technique for the rapid attainment of equilibrium. They found that when solid brine was shaken with solutions of arsenic acid, equilibrium was not reached in six weeks, even at 90°. When, however, brine was added in solution in such proportion that a precipitate would be obtained at 90° but none at room temperature, it was found that no detectible change in the composition of the solution occurred after the first few hours. Such solutions were accordingly prepared on the basis of preliminary determinations to yield calculated amounts of precipitate varying from 50 to 500 milligrams, and analyzed after two to ten days. During this time most of the solids became definitely crystalline. The authors report the identification at 90° of dicalcium arsenate, $CaHAsO_4$, penta calcium arsenate, $Ca_5H_2(AsO_4)_4$, tri calcium arsenate, $Ca_3(AsO_4)_2$ and basic calcium arsenate $[Ca_3(AsO_4)_2]_3Ca(OH)_2$. The basic calcium arsenate was, however, not obtained at 35°.

Clifford and Cameron, 1929, upon mixing and stirring large volumes of saturated solutions of calcium hydroxide and varying quantities of solutions of arsenic acid obtained fluffy non crystalline precipitates in all cases. A period of 2 months at 25° was allowed for equilibrium. The ratios of Ag_2O_3 to CaO in the precipitates varied continuously from 1.08 to 1.60, thus indicating that they are members of a series of solid solutions.

CALCIUM ARSENATES (Con.)

Nelson and Haring, 1937, rotated constantly for nearly four months at 62°, mixtures of arsenic acid solutions and successively increasing amounts of calcium oxide in quantities to produce sufficient precipitates for analysis. Attainment of equilibrium was recognized by constancy in analytical results after successive intervals of time. No calcium arsenate more basic than $4CaO.As_2O_5.xH_2O$ was obtained, hence precipitates more basic than this must be solid solutions. The other calcium arsenates which were identified were, $CaHAsO_4$, $Ca_5H_2(AsO_4)_4.5H_2O$ and $Ca_3(AsO_4)_2.2H_2O$. In regard to the "Solubility" of calcium arsenates the authors state that "probably all the acid arsenates and the tri calcium salt react with water to form more basic solid phases while the tetra calcium arsenate hydrolyzes in the opposite direction. It is evident, therefore, that the solubility of an arsenate of calcium depends on the conditions under which the determinations are made. The ordinary usage of the term "Solubility" of a compound implies an equilibrium condition between the solid and the solution,,and also that the dissolved portion has the same chemical composition of the solid material after equilibrium is attained, depends upon the quantity of water used, that is, the extent to which the salt has been hydrolyzed."

Observations upon the relations between the composition of the several arsenates obtained in mixtures of arsenic pentoxide calcium oxide and water and the pH of the solutions at 17°, are given by Guerin, 1939. The solubility of crystalline tricalcium arsenate, containing 10 mols. H_2O of cryst., in water at 17°, is stated to be about 0.012 gm. of anhydrous salt per 100 gms. sat. solution.

BO **CALCIUM BORATES** $CaB_2O_4.4H_2O$, $CaB_2O_4.6H_2O$.

SOLUBILITY OF EACH SEPARATELY IN WATER.

(Mandelbaum, 1909.)

t°.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.	t°.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
	B_2O_3.	CaB_2O_4.			B_2O_3.	CaB_2O_4.	
30	0.0365	0.310	$CaB_2O_4.4H_2O$	30	0.0205	0.254	$CaB_2O_4.6H_2O$
50	0.036	0.307	" (amorphous)	50	0.032	0.353	" (cryst.)
70	0.048	0.392	"	70	0.068	0.457	"
90	0.0315	0.310	"	90	0.0675	0.359	"

SOLUBILITY OF CALCIUM BORATES IN AQUEOUS SOLUTIONS OF BORIC ACID AT 30°.

(Sborgi, 1913.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
B_2O_3.	CaO.		B_2O_3.	CaO.	
0.014	0.126	$Ca(OH)_2$	0.869	0.067	2.3.9
0.032	0.140	"	1.116	0.076	"
0.098	0.194	"	1.339	0.093	" +1.3.12
0.127	0.217	" +1.1.6	2.058	0.093	1.3.12
0.134	0.220	1.1.6	2.509	0.099	"
0.138	0.118	"	2.730	0.111	"
0.162	0.106	"	3.732	0.325	"
0.166	0.107	" +2.3.9	2.798	0.109	"
0.171	0.109	" "	3.313	0.143	"
0.290	0.052	2.3.9	3.841	0.152	"
0.610	0.054	"	4.250	0.155	" $+H_3BO_3$
0.767	0.059	"	4.179	0.137	H_3BO_3.

1.1.6 = $CaO.B_2O_3.6H_2O$, 2.3.9 = $2CaO.3B_2O_3.9H_2O$,
1.3.12 = $CaO.3B_2O_3.12H_2O$.

Many determinations, in addition to the above, are given in the original paper.

CALCIUM BROMIDE $CaBr_2.6H_2O$.

SOLUBILITY IN WATER.

(Kremers, 1858; Etard, 1894, gives results which yield an irregular curve and are evidently less accurate than those of Kremers.)

t°.	Gms. $CaBr_2$ per 100 Gms. Water.	Gms. $CaBr_2$ per 100 Gms. Solution.	Solid Phase.	t°.	Gms. $CaBr_2$ per 100 Gms. Water.	Gms. $CaBr_2$ per 100 Gms. Solution.	Solid Phase.
−22*	101	50.5	$CaBr_2.6H_2O$+Ice	34.2†	185	65.1	$CaBr_2.6H_2O+CaBr_2.4H_2O$
0	125	55.5	$CaBr_2.6H_2O$	40	213	68.1	$CaBr_2.4H_2O$
10	132	57	"	60	278	73.5	"
20	143	58.8	"	80	295	74.7	"
25	153	60.5	"	105	312	75.7	"

* Eutec. † tr. pt.

Density of saturated solution at 20° = 1.82.

EQUILIBRIUM IN THE SYSTEM CALCIUM BROMIDE, CALCIUM OXIDE AND WATER AT 25°. (Milikan, 1917-1918.)

Gms. per 100 gms. sat. sol. CaO.	Gms. per 100 gms. sat. sol. $CaBr_2$.	Solid Phase.	Gms. per 100 gms. sat. sol. CaO.	Gms. per 100 gms. sat. sol. $CaBr_2$.	Solid Phase.
0.0	60.07	$CaBr_2\,6H_2O$	0.080	32.92	$D_{1.3.16}$
0.209	60.09	» $+D_{3.4.16}$	0.080	32.50	»
0.192	59.48	$D_{3.4.16}$	0.089	28.21	»
0.199	58.90	»	0.089	25.15	»
0.235	56.94	»	0.092	22.39	»
0.271	55.29	»	0.103	21.80	»
0.358	54.22	» $+D_{1.3.16}$	0.097	20.75	» $+Ca(OH)_2$
0.267	53.39	$D_{1.3.16}$	0.115	19.18	$Ca(OH)_2$
0.132	50.04	»	0.101	13.75	»
0.098	44.21	»	0.119	9.28	»
0.077	41.36	»	0.118	0.0	»

$D_{3.4.16} = 3CaBr_2.4CaO.16H_2O$. $D_{1.3.16} = CaBr_2.3CaO.16H_2O$.

SOLUBILITY OF CALCIUM BROMIDE IN AQUEOUS SOLUTIONS OF HYDROBROMIC ACID AT 25°.

(Scott and Durham, 1930.)

Gms. per 100 gms. sat. sol. HBr	Gms. per 100 gms. sat. sol. $CaBr_2$
0.0	58.53
3.48	54.24
7.23	50.09
10.84	48.67

SOLUBILITY OF CALCIUM BROMIDE IN AQUEOUS SOLUTIONS OF UREA AT 11°.

(DeCarli, 1932.)

Gms. per 100 gms. sat. sol. $CO(NH_2)_2$	Gms. per 100 gms. sat. sol. $CaBr_2$	Solid Phase	Gms. per 100 gms. sat. sol. $CO(NH_2)_2$	Gms. per 100 gms. sat. sol. $CaBr_2$	Solid Phase
0.0	56.8	$CaBr_2.6H_2O$	31.02	31.60	$CaBr_2.4CO(NH_2)_2.H_2O$
3.50	56.18	"	41.77	26.11	"
7.25	55.58	"	49.30	22.20	"$+CO(NH_2)_2$
8.20	55.05	"$+CaBr_2.4CO(NH_2)_2.2H_2O$	47.94	17.70	$CO(NH_2)_2$
9.40	52.64	$CaBr_2.4CO(NH_2)_2.2H_2O$	47.76	11.44	"
13.74	47.70	"	40,84	0.0	"

SOLUBILITY OF CALCIUM BROMIDE IN ABSOLUTE ETHYL ALCOHOL.

(Bonnell and Jones, 1926.)

t	Gms. $CaBr_2$ per 100 gms. C_2H_5OH.	Solid Phase.	t°.	Gms. $CaBr_2$ per 100 gms. C_2H_5OH.	Solid Phase.
0.....	46.70	$CaBr_2.4C_2H_5OH$	50.......	65.64	$CaBr_2.3C_2H_5OH$
10.....	48.01	»	60... ...	76.02	»
15.....	50.51	»	70.......	93.81	»
17 (tr. pt.)		» + $CaBr_2.3C_2H_5OH$	73.9 (tr. pt.)		» + $CaBr_2.C_2H_5OH$
20.....	53.50	$CaBr_2.3C_2H_5OH$	75.......	102.20	$CaBr_2.C_2H_5OH$
25.....	53.95	»	80.......	103.10	»
30.....	55.52	»	85.......	106.10	»
40....	60.11	»			

SOLUBILITY OF CALCIUM BROMIDE IN METHYL, PROPYL, BUTYL, AMYL AND BENZYL ALCOHOLS.

(Lloyd, Brown, Glynwyn, Bonnell and Jones, 1928.)

Br

t°	Gms. $CaBr_2$ per 100 gms.: Methyl alcohol CH_3OH	n Propyl alcohol $CH_3CH_2CH_2OH$	n Butyl alcohol $CH_3(CH_2)_2CH_2OH$	n Amyl alcohol $CH_3(CH_2)_3CH_2OH$	iso Amyl alcohol $(CH_3)_2CH(CH_2)_2OH$	Benzyl alcohol $C_6H_5CH_2OH$
0	50.4	6.6	18.3	—	—	—
10	52.0	13.0	25.3	17.4	21.7	12.9
20	56.2	22.5	33.9	25.3	25.6	15.0
30	62.9	35.0	43.7	34.0	29.9	17.0
40	71.9	49.2	54.3	43.0	36.9	17.7
50	83.2	63.4	64.8	51.5	43.4	17.4
60	97.8	76.8	75.2	62.3	50.0	17.2
70	105.6 (65°)			74.5	56.2	17.0

In each case except in methyl alcohol the solid phase in contact with the saturated solution is the tri alcoholate of calcium bromide.

SOLUBILITY OF CALCIUM BROMIDE IN ABSOLUTE ACETONE.

(Bell, Rowlands, Bamford, Thomas and Jones, 1930.)

t°	Gms. $CaBr_2$ per 100 gms. CH_3COCH_3	Solid Phase	t°	Gms. $CaBr_2$ per 100 gms. CH_3COCH_3	Solid Phase
0	2.90	$CaBr_2.2C_3H_6O$	30	2.72	$CaBr_2.2C_3H_6O$
10	2.82	"	35	2.79	"
20	2.74	"	40	2.92	"
25	2.72				

100 gms. sat. sol. of Calcium bromide in liquid ammonia contain 0.009 gm. $CaBr_2$ at 0°. (Linhard and Stephan, 1933, 1934.)

Freezing-point data are given for mixtures of calcium bromide and calcium chloride, calcium bromide and calcium fluoride by Ruff and Plato, 1903.

Freezing-point results for mixtures of calcium bromide and lithium bromide, calcium bromide and potassium bromide and calcium bromide and sodium bromide are given by Kellner, 1917.

CALCIUM PerBROMIDE $CaBr_4$.

Data for the formation of calcium perbromide in aqueous solutions at 25° are given by Herz and Bulla (1911). The experiments were made by adding bromine to aqueous solutions of $CaBr_2$ and agitating with carbon tetrachloride. From the bromine content of the CCl_4 layer, the amount of free bromine in the aqueous layer can be calculated on the basis of the distribution ratio of bromine between water and CCl_4. This furnishes the necessary data for calculating the amount of calcium perbromide existing in the aqueous layer.

CALCIUM FORMATE $Ca(HCOO)_2$.

SOLUBILITY IN WATER.

(Lumsden, 1902; see also Krasnicki, 1887.)

t°.	Gms. $Ca(HCOO)_2$ per 100 Gms. Water.	Gms. $Ca(HCOO)_2$ per 100 Gms. Solution.	t°.	Gms. $Ca(HCOO)_2$ per 100 Gms. Water.	Gms. $Ca(HCOO)_2$ per 100 Gms. Solution.
0	16.15	13.90	60	17.50	14.89
20	16.60	14.22	80	17.95	15.22
40	17.05	14.56	100	18.40	15.53

Results in good agreement with the above are given by Stanley, 1904; and by Ashton, Houston and Saylor, 1933.

SOLUBILITY OF CALCIUM FORMATE IN AQUEOUS SOLUTIONS OF FORMIC ACID AT 25°.

(Dunn and Philip, 1934.)

Gms. per 100 gms. sat. sol. HCOOH	Gms. per 100 gms. sat. sol. $Ca(HCOO)_2$	Solid Phase	Gms. per 100 gms. sat. sol. HCOOH	Gms. per 100 gms. sat. sol. $Ca(HCOO)_2$	Solid Phase
0.0	14.43	$Ca(HCOO)_2$	53.3	8.42	$Ca(HCOO)_2$
18.48	12.11	"	61.6	7.60	"
27.41	11.16	"	69.9	6.86	"
36.31	10.20	"	85.4	5.43	"

RECIPROCAL SOLUBILITY OF CALCIUM FORMATE AND FORMIC ACID.

(Kendall and Adler, 1921.)

t°	Mols. $Ca(HCOO)_2$ per 100 mols. $Ca(HCOO)_2$ + HCOOH	Solid Phase	t°	Mols. $Ca(HCOO)_2$ per 100 mols. $Ca(HCOO)_2$ + HCOOH	Solid Phase
8.4	0.0	HCOOH	35.0	1.54	$Ca(HCOO)_2$
8.1	0.16	"	45.5	1.35	"
7.7	0.48	"	49.7	1.26	"
7.4	0.71	"	61.0	1.10	"
7.2	0.93	"	79.0	0.83	"
6.9	1.27	"	100.0	0.57	"
6.6	1.53	"	128.6	0.39	"
30.0	1.61	$Ca(HCOO)_2$			

100 gms. methyl alcohol (CH_3OH) dissolve 0.27 gm. $Ca(HCOO)_2$ at 15° and 0.23 gm. at the b. pt. (66°). (Hemstock, 1934.)

CALCIUM METHIONATE $CaCH_2(SO_3)_2$

100 gms. H_2O dissolve 32.57 gms. $CaCH_2(SO_3)_2$ at 25°. (Backer and Terpstra, 1929.)

CALCIUM ACETATE $Ca(CH_3COO)_2.2H_2O$.

SOLUBILITY IN WATER. (Lumsden, 1902; Krasnicki, 1887.)

t°.	Gms. $Ca(CH_3COO)_2$ per 100 Gms. Solution.	Gms. $Ca(CH_3COO)_2$ per 100 Gms. Water.	Solid Phase.	t°.	Gms. $Ca(CH_3COO)_2$ per 100 Gms. Solution.	Gms. $Ca(CH_3COO)_2$ per 100 Gms. Water.	Solid Phase.
0	27.2	37.4	$Ca(CH_3COO)_2.2H_2O$	60	24.6	32.7	$Ca(CH_3COO)_2.2H_2O$
10	26.5	36.0	$Ca(CH_3COO)_2.2H_2O$	80	25.1	33.5	$Ca(CH_3COO)_2.2H_2O$
20	25.8	34.7	$Ca(CH_3COO)_2.2H_2O$	84	25.3	33.8	$Ca(CH_3COO)_2.2H_2O$
25	25.5	34.2	$Ca(CH_3COO)_2.2H_2O$	85	24.7	32.9	$Ca(CH_3COO)_2.H_2O$
30	25.3	33.8	$Ca(CH_3COO)_2.2H_2O$	90	23.7	31.1	$Ca(CH_3COO)_2.H_2O$
40	24.9	33.2	$Ca(CH_3COO)_2.2H_2O$	100	22.9	29.7	$Ca(CH_3COO)_2.H_2O$

SOLUBILITY OF CALCIUM ACETATE IN AN AQUEOUS SATURATED SOLUTION OF SUGAR AT 31.25°. (Köhler, 1897.)

100 gms. solution contain 8.29 gms. $Ca(CH_3COO)_2$ + 60.12 gms. sugar.
100 gms. water dissolve 26.3 gms. $Ca(CH_3COO)_2$ + 190.3 gms. sugar.

100 cc. anhydrous hydrazine dissolve 1 gm. calcium acetate at room temp. (Welsh and Broderson, 1915.)

SOLUBILITY OF CALCIUM ACETATE IN AQUEOUS SOLUTIONS OF ACETIC ACID AT 25°.

(Dunn and Philip, 1934.)

C_2H

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
CH_3COOH	$Ca(CH_3COO)_2$		CH_3COOH	$Ca(CH_3COO)_2$	
0.0	26.1	$Ca(CH_3COO)_2.H_2O$	10.8	21.7	$Ca(CH_3COO)_2.CH_3COOH.H_2O$
2.1	25.4	"	15.75	18.73	"
6.4	24.3	"	26.3	14.7	"
7.5	24.7	"	41.6	11.7	"
7.6	25.1	" + $Ca(CH_3COO)_2.CH_3COOH.H_2O$	58.6	9.2	"
			78.4	6.0	"
			86.2	4.12	"

RECIPROCAL SOLUBILITY OF CALCIUM ACETATE AND ACETIC ACID DETERMINED BY THE FREEZING POINT METHOD.

(Davidson and McAllister, 1930.)

t°	Mols. $Ca(CH_3COO)_2$ per 100 mols. $Ca(CH_3COO)_2 + CH_3COOH$	Solid Phase	t°	Mols. $Ca(CH_3COO)_2$ per 100 mols. $Ca(CH_3COO)_2 + CH_3COOH$	Solid Phase
21.5	0.0594	$CaCH_3COO)_2CH_3COOH$	77.5	0.4005	$Ca(CH_3COO)_2.CH_3COOH$
23.6	0.0670	"	82.8	0.4935	"
36.2	0.0933	"	84.5	0.5398	"
37.2	0.0968	"	85.2	0.5573	"
52.5	0.1576	"	88.0	0.6287	"
60.9	0.2210	"	89.0	0.6290	"
67.5	0.2823	"	91.0	0.7082	"
75.1	0.3726	"	97.8	0.9128	"
			111.0	1.386	"

100 gms. Methyl Alcohol (CH_3OH) dissolve 0.75 gm. $Ca(CH_3COO)_2$ at 15° and 1.01 gm. at the b. pt. (66°). (Henstock, 1934.)

CALCIUM (Tri) Methyl **ACETATE** $Ca[(CH_3)_3CCOO]_2$.

CALCIUM (Di) Ethyl **ACETATE** .$Ca[(C_2H_5)_2CHCOO]_2$.

CALCIUM Methyl Ethyl **ACETATE** $Ca[CH_3(C_2H_5).CHCOO]_2$.

SOLUBILITY OF EACH IN WATER.

(Landau — Monatsh. Chem. 14, 717, '93; Keppish — *Ibid.* 9, 600, '88; Sedlitzki — *Ibid.* 8, 573, '87.)

t °.	Ca. Tri Methyl Acetate. Gms. $Ca(C_5H_9O_2)_2$ per 100 Gms.		Ca. Di Ethyl Acetate. Gms. $Ca(C_6H_{11}O_2)_2$ per 100 Gms.		Ca. Methyl Ethyl. Acetate. Gms. $Ca(C_5H_9O_2)_2$ per 100 Gms.	
	Water.	Solution.	Water.	Solution.	Water.	Solution.
0	7.30	6.81	30 3	23.22	28.78	22.35
10	6.84	6.40	27.8	21.75	31.71	24.07
20	6.54	6.14	25.6	20.38	33.76	25.23
30	6.40	6.01	23.7	19.16	34.92	25.89
40	6.44	6.05	22.1	18.10	35.20	26.04
50	6.64	6.22	20.8	17.22	34.60	25.71
60	6.86	6.42	19.9	16.60	33.11	24.89
70	7.11	6.64	19.2	16.11	30.74	23.41
80	7.38	6.87	...	...	27.49	21.56

CALCIUM Methyl Propyl **ACETATE** $Ca[CH_3(C_3H_7).CHCOO]_2$.

CALCIUM (Di) Propyl **ACETATE** $Ca[(C_3H_7)_2CHCOO]_2$.

CALCIUM (Iso) Butyl **ACETATE** $Ca[(CH_3)_2CH(CH_2)_2COO]_2$.

C_2H

SOLUBILITY OF EACH IN WATER.

(Stiassny — Monatsh. Chem. 12, 596, '91; Furth — *Ibid.* 9, 313, '88; König — *Ibid.* 15, 22, '94.)

t °.	Ca. Methyl Propyl Acetate. Gms. $Ca(C_6H_{11}O_2)_2$ per 100 Gms.		Ca. Di Propyl Acetate. Gms. $Ca(C_8H_{15}O_2)_2$ per 100 Gms.		Ca. Iso Butyl Acetate. Gms. $Ca(C_6H_{11}O_2)_2$ per 100 Gms.	
	Water	Solution.	Water.	Solution.	Water.	Solution.
0	16.58	14.22	9.57	8.73	7.48	6.96
10	15.80	13.65	8.35	7.71	6.38	5.99
20	15.14	13.15	7.19	6.71	5.66	5.36
30	14.61	12.75	6.11	5.77	5.31	5.04
40	14.21	12.45	5.09	4.84	5.31	5.04
50	13.94	12.24	4.14	3.98	5.68	5.37
60	13.79	12.13	3.25	3.15	6.41	6.02
70	13.78	12.12	2.44	2.38	7.51	6.98
80	13.89	12.20	1.65	1.62	8.97	8.23
90	...	...	...	...	10.79	9.74

CALCIUM PROPIONATE $Ca(CH_3CH_2COO)_2.H_2O$

SOLUBILITY OF CALCIUM PROPIONATE IN WATER.

(Lumsden, 1902; Krasnicki, 1887.)

t^0	Gms. $Ca(C_2H_5COO)_2$ per 100 gms. Solution	Gms. $Ca(C_2H_5COO)_2$ per 100 gms. Water
0	29.97	42.80
20	28.48	39.85
40	27.76	38.45
60	27.07	38.25
80	28.48	39.85
90	29.66	42.15
100	32.63	48.44

C_3H

100 gms. Methyl Alcohol (CH_3OH) dissolve 1.25 gm. $Ca(C_2H_5COO)_2$ at 15° and 3.31 gms. at the b. pt. (66.°1). Calcium propionate forms with methyl alcohol an alcoholate in the form of non hygroscopic prisms of the composition $Ca(C_2H_5COO)_2.CH_3OH$. (Henstock, 1934.)

CALCIUM LACTATE $(CH_3CHOHCOO)_2.5H_2O$

100 gms. H_2O dissolve 3.1 gms. of the salt at 0°, 5.4 gms. at 15° and 7.9 gms. at 30°. (Hill and Cocking, 1912.)

THE SOLUBILITY OF ANHYDROUS CALCIUM LACTATE IN METHYL ALCOHOL.

(Henstock, 1934.)

Results estimated from the author's diagram.

t°	Gms. $Ca(CH_3CHOHCOO)_2$ per 100 gms. CH_3OH	t°	Gms. $Ca(CH_3CHOHCOO)_2$ per 100 gms. CH_3OH
15	11.0(13.3)	55	52.0
25	20.0	65	56.0
35	30.0	69.8(b.pt.)	73.8
45	41.0		

Evidence was determined that above 55° an alcoholate of the composition $Ca(CH_3CHOHCOO)_2.5\frac{1}{2}CH_3OH$ was formed.

C_4H

CALCIUM (Neutral) **MALATE** $Ca(C_4H_4O_5).3H_2O$.

CALCIUM (Acid) **MALATE** $Ca(C_4H_5O_5)_2.6H_2O$.

CALCIUM MALONATE $Ca(C_3H_2O_4).4H_2O$.

SOLUBILITY OF EACH IN WATER.

(Iwig and Hecht, 1886; Cantoni and Basadonna, 1906; the malonate, Miczynski, 1886.)

t°.	Ca. Neutral Malate. Gms. $Ca(C_4H_4O_5)$ per 100 Gms. H_2O.	Gms. Sol.	cc. Sol. (C and B).	Ca. Acid Malate. Gms. $Ca(C_4H_5O_5)_2$ per 100 Gms. Water.	Solution.	Ca. Malonate. Gms. $Ca(C_3H_2O_4)$ per 100 Gms. H_2O.
0	...	...	...	...	...	0.290 (0.374)
10	0.85	0.84	...	1.8	1.77	0.330 (0.419)
20	0.82	0.81	0.907	1.5	1.48	0.365 (0.460)
30	0.78	0.77	0.837	2	1.96	0.396 (0.495)
40	0.74	0.73	0.816	5.2	4.94	0.422 (0.524)
50	0.66	0.65	0.809	15	13.09	0.443 (0.544)
57	0.57	0.56	...	32.24	24.29	...
60	0.58	0.58	0.804	26	20.64	0.460
70	0.63	0.63	0.795	11	9.91	0.472
80	0.71	0.70	0.754	6.8	6.37	0.479
90	...	...	0.740			

The results for calcium malonate given above in parentheses are by Cantoni and Diotalevi (1905), but these authors fail to state the terms in which their data are reported. By comparison with other papers of the series, it is probable that in this case the figures refer to grams per 100 cc. saturated solution.

CALCIUM MALATE $CaC_4H_4O_5.H_2O$.

SOLUBILITY OF CALCIUM MALATE IN WATER AND IN ALCOHOL.

(Partheil and Hübner, 1903.)

100 gms. H_2O dissolve 0.9214 gm. $CaC_4H_4O_5.H_2O$ at 18°, and 0.8552 gm. at 25°.

100 gms. 95% alcohol dissolve 0.0049 gm. $CaC_4H_4O_5.H_2O$ at 18°, and 0.00586 gm. at 25°.

CALCIUM MALATES Active and Racemic Salts.

SOLUBILITY OF EACH SEPARATELY IN WATER.

(Duboux and Cuttat, 1921.)

Results for the active salt.

t°.	Gms. anhydrous salt per 100 gms. sat. sol.	Solid Phase.
0.....	0.670	$C_4H_4O_5Ca.2H_2O$
12.5...	0.805	"
25.0...	0.921	"
37.5...	1.011	"

Results for the racemic salt.

t°.	Gms. anhydrous salt per 100 gms. sat. sol.	Solid Phase.
0.0...	0.244	$C_8H_8O_{10}Ca_2.3H_2O$
12.5...	0.277	"
25.0...	0.310	"
37.5...	0.343	"

CALCIUM MALEATE $CaC_4H_2O_4.H_2O$ and Acid Maleate $Ca(C_4H_3O_4)_2 5H_2O$.

SOLUBILITY OF EACH SEPARATELY IN WATER.

(Weiss and Downs, 1922.)

t°.	Gms. $CaC_4H_2O_4$ per 100 gms. H_2O.	Solid Phase.
25.....	2.49	$CaC_4H_2O_4.H_2O$
40.....	2.88	"

t	Gms. $Ca(C_4H_3O_4)_2$ per 100 gms. H_2O.	Solid Phase.
25.....	21.13	$Ca(C_4H_3O_4)_2.5H_2O$
40.....	41.89	"
60.....	94.78	"

C_4H

CALCIUM (Normal) BUTYRATE $Ca[CH_3(CH_2)_2COO]_2.H_2O$.

CALCIUM (Iso) BUTYRATE $Ca[(CH_3)_2CH.COO]_2.5H_2O$.

SOLUBILITY OF EACH IN WATER.

(Lumsden — J. Chem. Soc. 81, 355, '02; see also Chancel and Parmentier — Compt. rend. 104, 474, '87; Deszathy — Monatsh. Chem. 14, 251, '93, and also Hecht — Liebig's Annalen 213, 72, '82, give results for the normal salt which are somewhat below those of Lumsden for the lower temperatures. Sedlitzki — Monatsh. Chem. 8, 566, '87, gives slightly different results for the iso salt.)

Calcium Normal Butyrate.

t°	Gms. $Ca(C_4H_7O_2)_2$ per 100 Gms.	
	Water.	Solution.
0	20.31	16.89
10	19.15	16.08
20	18.20	15.39
25	17.72	15.05
30	17.25	14.71
40	16.40	14.09
60	15.15	13.16
80	14.95	13.01
100	15.85	13.69

Calcium Iso Butyrate.

t°.	Gms. $Ca(C_4H_7O_2)_2$ per 100 Gms.		Solid Phase.
	Water.	Solution.	
0	20.10	16.78	$Ca(C_4H_7O_2)_2.5H_2O$
20	22.40	18.30	"
30	23.80	19.23	"
40	25.28	20.65	"
60	28.40	22.12	"
62	28.70	22.30	"
65	28.25	22.03	$Ca(C_4H_7O_2)_2.H_2O$
80	27.00	21.26	"
100	26.10	20.69	"

CALCIUM FUMARATES $CaC_4H_2O_4.3H_2O$ and (Acid Fumarate), $Ca(C_4H_3O_4)_2.2H_2O$.

100 gms. H_2O sat. with $CaC_4H_2O_4.3H_2O$ contain 1.56 gms. $CaC_4H_2O_4$ at 30°.
» » » $Ca(C_4H_3O_4)_2.2H_2O$ » 5.19 » $Ca(C_4H_3O_4)_2$ »

(Weiss and Downes, 1923.)

CALCIUM 2-Methyl BUTYRATE dl $Ca(C_4H_9COO)_2.5H_2O$

THE SOLUBILITY OF CALCIUM 2-METHYL BUTYRATE IN WATER.

(Houston, 1936.)

t°	Gms. $Ca(C_4H_9COO)_2$ per 100 gms. H_2O	Solid Phase	t°.	Gms. $Ca(C_4H_9COO)_2$ per 100 gms. H_2O	Solid Phase
0	23.05	$Ca(C_4H_9COO)_2.5H_2O$	50	26.60	$Ca(C_4H_9COO)_2.1H_2O$
10	23.60	"	60	24.45	"
20	24.55	"	70	22.80	"
30	27.15	"	80	21.40	"
36.5	29.90	"+$Ca(C_4H_9COO)_2.1H_2O$	90	20.35	"
40	29.10	$Ca(C_4H_9COO)_2.1H_2O$	100	19.80	"

C_4H

CALCIUM TARTRATES Active $C_4H_4O_6Ca\ 4H_2O$, Racemic $C_8H_8O_{12}Ca_2.8H_2O$.

SOLUBILITY OF ACTIVE AND RACEMIC CALCIUM TARTRATES IN WATER.

(Duboux and Cuttat, 1921.)

Results for Active Tartrate.			Results for Racemic Tartrate.		
t	Gms. $C_4H_4O_6.Ca$ per 100 gms sat. sol.	Solid Phase.	t°.	Gms. $C_8H_8O_{12}.Ca_2$ per 100 gms. sat. sol.	Solid Phase
0.....	0.0192	$C_4H_4O_6Ca.4H_2O$	0.....	0.0023	$C_8H_8O_{12}Ca_2.8H_2O$
12.5...	0.0268	»	12.5...	0.0032	»
25.0...	0.0360	»	25.0...	0.0045	»
37.5 ..	0.0498	»	37.5...	0.0056	»

Saturation was obtained by continuous rotation in a thermostat. The solutions were analyzed by evaporation and determining the calcium in the residue as oxide and as sulfate.

The following determinations by François and Lormand, 1923, were made by employing intermittent agitation during 10 days. The solutions were analyzed by evaporating 500 cc. portions on a water bath and finally in the air, to obtain a residue of a definite degree of hydration. This latter was dried and weighed, and finally converted to sulfate and again weighed. Temperature 20°.

Compound.		Formula.	Solvent.	Gms. hydrated cmpd per 100 cc. solvent.
Dextro	calcium tartrate..	$C_4H_4O_6.Ca.4H_2O$	Water	0.0232
Laevo	» ..	»	»	0.0249
Racemic	» ..	not given	»	0.00493
Dextro	» ..	$C_4H_4O_6.Ca.4H_2O$	30% aq. alcohol	0.0038

CALCIUM TARTRATE $CaC_4H_4O_6.4H_2O$.

SOLUBILITY IN WATER.

(Cantoni and Zachoder, 1905.)

t°.	Gms. $CaC_4H_4O_6.4H_2O$ per 100 cc Sol.	t°.	Gms. $CaC_4H_4O_6.4H_2O$ per 100 cc. Sol	t°.	Gms. $CaC_4H_4O_6.4H_2O$ per 100 cc. Sol.
0	0.0365	30	0.0631	70	0.1430
10	0.0401	40	0.0875	80	0.1798
20	0.0475	50	0.1100	85	0.2190
25	0.0525	60	0.1262		

100 gms. aq. Ca. tartrate solution contain 0.0185 gm. $CaC_4H_4O_6.4H_2O$ at 18°, and 0.029489 gm. at 25°.

100 gms. 95% alcohol solution contain 0.0187 gm. $CaC_4H_4O_6.4H_2O$ at 18°, and 0.02352 gm. at 25°. (Partheil and Hubner, 1903.)

100 gms. aq. Ca. tartrate solution contain 0.0364 gm. $CaC_4H_4O_6$ at 20°.

100 gms. 10% alcohol solution contain 0.0160 gm. $CaC_4H_4O_6$ at 20°.

100 gms. aqueous 5% tartaric acid solution contain 0.1632 gm. $CaC_4H_4O_6$ at 20°. (Magnanini, 1901.)

SOLUBILITY OF CALCIUM TARTRATE, $CaC_4H_4O_6.4H_2O$, IN AQUEOUS ACETIC ACID SOLUTIONS AT 26°-27°.

(Herz and Muhs, 1903; see also, Enell, 1899.)

Normality of Acetic Acid.	Gms. CH_3COOH per 100 cc. Sol.	Residue from 50 052 cc. Sol.	Normality of Acetic Acid.	Gms CH_3COOH per 100 cc Sol.	Residue from 50 052 cc Sol.
0	0	0.0217	3 80	22.80	0.2042
0.57	3.42	0.1082	5 70	34.20	0.1844
1.425	8.55	0.1635	10.09	60.54	0.1160
2.85	17.10	0.1970	16.505	93.03	0.0337

The residue was dried at 70° C.

SOLUBILITY OF CALCIUM TARTRATE IN AQUEOUS SOLUTIONS OF CALCIUM CHLORIDE, TARTARIC ACID, ETC., AT 18°.

(Paul, 1915.)

(The determinations were made by weighing the tartrate remaining undissolved and calculating the amount dissolved by difference. It was found that even a small amount of CO_2 in the water had a distinct influence on the solubility. One liter of pure CO_2 free water was found to dissolve 0.380 gm. $CaC_4H_4O_6.4H_2O$ at 18° and one liter of ordinary distilled water, 0.410 gm. at the same temperature.)

Results for Aqueous Calcium Chloride Solution.		Results for Aqueous Dipotassium Tartrate Sols.		Results for Aqueous Tartaric Acid Sols.		Results for Alcoholic Tartaric Acid Sols.		
Gms per Liter		Gms per Liter		Gms per Liter		Gms per Liter		
$CaCl_2$.	$CaC_4H_4O_6.4H_2O$	$K_2C_4H_4O_6.\frac{1}{2}H_2O$.	$CaC_4H_4O_6.4H_2O$.	$C_4H_6O_6$.	$CaC_4H_4O_6.4H_2O$.	C_2H_5OH	$C_4H_6O_6$.	$CaC_4H_4O_6.4H_2O$
0.503	0.202	0.392	0.166	1	0.910	50	0	0 263
1.005	0.179	2.139	0.160	2	1.162	"	4	1.107
3 518	0.166	2 352	0.157	4	1.511	"	16	1 85
4 523	0.154	2.614	0.150	6	1.776	80	0	0.205
5 025	0.154	4.705	0.223	8	1.972	"	4	0 867
7.538	0.171	23 524	0.263	10	2.205	"	16	1.506
10.05	0.177	47.048	0.305	12	2.380	100	0	0 190
25.125	0.182			14	2.514	"	4	0.766
50.25	0.224			16	2.643	"	16	1.297

Data for the effect of potassium chloride and of potassium acetate upon the solubility of calcium tartrate in aqueous 0.5 normal acetic acid solutions at 25°, and also for the effect of potassium monochloracetate upon the solubility of the salt in 0.5 normal chloracetic acid solutions at 25°, are given by Henderson and Taylor (1916).

CALCIUM TARTRATE

SOLUBILITY OF CALCIUM TARTRATE IN AQUEOUS SOLUTIONS OF TARTARIC ACID AT 20°.

(Richert, 1930.)

Gm. mols. per liter sat. sol.	
$H_2C_4H_4O_6$	$Ca\ C_4H_4O_6$
0.0	0.00253
0.0067	0.00399
0.0268	0.00677
0.0469	0.00810
0.0670	0.00910

SOLUBILITY OF CALCIUM TARTRATE IN AQUEOUS SOLUTIONS OF AMMONIUM, POTASSIUM AND SODIUM CHLORIDES AT SEVERAL TEMPERATURES.

(Cantoni and Jolkowsky, 1907.)

C_4H

NOTE. — (The authors refer in all cases to their determination of the amount of decomposition of the tartrate by the aqueous chloride solutions. Constant agitation and temperature were maintained.)

Gms. Chloride per Liter Solvent.	Gms. Ca Tartrate Dissolved at 16° per Liter of Aq..			t°.	Gms. Ca Tartrate per Liter of 7% Aqueous:		
	NH_4Cl	KCl	NaCl		NH_4Cl.	KCl.	NaCl.
5	0.701	0.643	0.680	16	1.676	1.504	1.637
10	0.861	0.822	0.840	30	2.417	2.031	2.275
30	1.281	1.180	1.305	55	3.712	2.154	3.579
100	1.897	1.753	1.860	70	5.080	2.546	4.148
200	2.305	2.110	2.163	85	6.699	4.264	6.305

CALCIUM SUCCINATE $Ca(C_2H_2O_2)_2$.

CALCIUM (Iso) SUCCINATE $CaCH_3.CHC_2O_4.H_2O$.

SOLUBILITY OF EACH IN WATER.
(Miczynski, 1886.)

Calcium Succinate.				Calcium Iso Succinate.			
t°.	Gms. $Ca(C_2H_2O_2)_2$ per 100 Gms. H_2O.	t°.	Gms. $Ca(C_2H_2O_2)_2$ per 100 Gms. H_2O.	t°.	Gms. $Ca(C_2H_2O_2)_2$ per 100 Gms. H_2O.	t°.	Gms. $Ca(C_2H_2O_2)_2$ per 100 Gms. H_2O.
0	1.127	50	1.029	0	0.522	50	0.440
10	1.220	60	0.894	10	0.524	60	0.396
20	1.276	70	0.770	20	0.517	70	0.342
40	1.177	80	0.657	40	0.475	80	0.279

100 cc. H_2O dissolve 1.424 gms. $CaC_4H_4O_4.H_2O$ at 18° and 1.436 gms. at 25°
(Partheil and Hübner, 1903.)

100 gms. H_2O dissolve 1.28 gms. $CaC_4H_4O_4$ at 15° and 0.66 gms. at 100°.
(Tarugi and Checchi, 1901.)

Results for calcium succinate in water, varying considerably from the above and indicating an increase of solubility with temperature, are given by Cantoni and Diotalevi (1905) but the terms used for expressing the results are not stated.

100 cc. 95% alcohol dissolve 0.00136 gm. $CaC_4H_4O_4.H_2O$ at 18° and 0.00136 gm. at 25°.
(Parheil and Hübner, 1903.)

SOLUBILITY OF CALCIUM SUCCINATE AT 25° IN AQUEOUS SOLUTIONS OF
(Walker, 1925.)

Magnesium Succinate. Gm. mols. per 1000 gms. H_2O.		Sodium Succinate. Gm. mols. per 1000 gms. H_2O.	
$Ca(C_2H_2O_2)_2$.	$Mg(C_2H_2O_2)_2$.	$Ca(C_2H_2O_2)_2$.	$Na_2(C_2H_2O_2)_2$.
0.07769	0.04121	0.08252	0.0000
0.07474	0.06179	0.08013	0.00826
0.07340	0.08230	0.07103	0.0506
0.07173	0.1231	0.06495	0.1014
0.07087	0.1631	0.06138	0.1526

CALCIUM CACODYLATE $Ca[(CH_3)_2AsOO]_2.9H_2O$

SOLUBILITY OF CALCIUM CACODYLATE IN WATER.
(Tiollais, 1938.)

t°	Gms. $Ca[(CH_3)_2AsOO]_2$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Ca[(CH_3)_2AsOO]_2$ per 100 gms. sat. sol.	Solid Phase
0	32.42	$Ca[(CH_3)_2AsOO]_2.9H_2O$	49.0	55.31	$Ca[(CH_3)_2AsOO]_2.H_2O$
4.5	33.35	"	52.5	55.35	"
9.0	34.53	"	57.0	56.14	"
19.0	37.27	"	61.0	56.83	"
24.0	39.11	"	63.5	57.10	"
27.0	40.43	"	64.0	57.29	" $+Ca[(CH_3)_2AsOO]_2$
32.5	42.62	"	67.0	56.74	$Ca[(CH_3)_2AsOO]_2$
34.7	43.70	"	75.0	55.40	"
42.0	47.17	"	88.0	55.20	"
45.0	49.73	"	98.0	55.05	"
48.5	54.89	" $+Ca[(CH_3)_2AsOO]_2.H_2O$			

SOLUBILITY OF CALCIUM CACODYLATE IN ALCOHOLS.

(Tiollais, 1936.)

Alcohol	t°	Gms. $Ca[(CH_3)_2AsOO]_2$ per 100 gms. sat. sol.
Methyl alcohol	16	39.95
Ethyl " (95%)	12	5.01
" " "	20	10.33
" " (100%)	12	16.06

CALCIUM VALERATE $Ca[CH_3(CH_2)_3COO]_2.H_2O$.

CALCIUM (Iso) **VALERATE** $Ca[(CH_3)_2.CH.CH_2.COO]_2.3H_2O$.

SOLUBILITY OF EACH IN WATER.

(Lumsden — J. Chem. Soc. 81, 355, '02; see also Furth — Monatsh. Chem. 9, 313, '88; Sedlitzky — *Ibid*, 8, 566, '87.)

Calcium Valerate.			Calcium Iso Valerate.			
t°.	Gms. $Ca(C_5H_9O_2)_2$ per 100 Gms. Water.	Gms. $Ca(C_5H_9O_2)_2$ per 100 Gms. Solution.	t°.	Gms. $Ca(C_5H_9O_2)_2$ per 100 Gms. Water.	Gms. $Ca(C_5H_9O_2)_2$ per 100 Gms. Solution.	Solid Phase.
0	9.82	8.94	0	26.05	20.66	$Ca(C_5H_9O_2)_2.3H_2O$
10	9.25	8.47	10	22.70	18.50	"
20	8.80	8.09	20	21.80	17.90	"
30	8.40	7.75	30	21.68	17.82	"
40	8.05	7.45	40	22.00	18.18	"
50	7.85	7.28	45.5	22.35	18.42	"
57	7.75	7.19	50	19.95	16.63	$Ca(C_5H_9O_2)_2.H_2O$
60	7.78	7.22	60	18.38	15.52	"
70	7.80	7.24	70	17.40	14.82	"
80	7.95	7.36	80	16.88	14.44	"
90	8.20	7.58	90	16.65	14.28	"
100	8.78	8.07	100	16.55	14.20	"

CALCIUM GLUTAMATE $Ca(CH_2)_2CH(NH_2)(COO)_2.3H_2O$

SOLUBILITY OF CALCIUM GLUTAMATE IN WATER.

(Takayama, 1930.)

t°	0	19	21	61	100
Gms. $CaC_5H_7NO_4$ per 100 gms. sat. sol.	1.322	1.928	1.979	3.943	5.698

CALCIUM LEVULINATE $Ca[CH_3CO(CH_2)_2COO]_2.2H_2O$

SOLUBILITY OF CALCIUM LEVULINATE IN WATER.

(Cox, Dodds and Claeper, 1934.)

t°	Gms. $Ca[C_5H_7O_3]_2$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Ca[C_5H_7O_3]_2$ per 100 gms. sat. sol.	Solid Phase
0	27.6	$Ca[C_5H_7O_3]_2.2H_2O$	37.0	38.7	$Ca[C_5H_7O_3]_2.2H_2O$
15.8	31.1	"	45.3	41.4	"
25.0	34.0	"	55.4	47.0	"
30.0	35.5	"			

CALCIUM CITRATE $Ca(C_6H_5O_7)_2.4H_2O$ and $Ca(C_6H_5O_7)_2.6H_2O$

SOLUBILITY OF EACH IN WATER. (Chatterjee and Dhar, 1924.)

t°.	Gms. $Ca(C_6H_5O_7)_2$ per liter of aq. solution sat.* with $Ca(C_6H_5O_7)_2.4H_2O$.	Gms. $Ca(C_6H_5O_7)_2$ per liter of aq. solution sat.* with $Ca(C_6H_5O_7)_2.6H_2O$.
30	2.2	2.01
95	1.83	2.27

CALCIUM CITRATE $Ca_3(C_6H_5O_7)_2.4H_2O$.

SOLUBILITY IN WATER AND IN ALCOHOL AT 18° AND AT 25°.
(Partheil and Hübner, 1903.)

Solvent.	Grams $Ca_3(C_6H_5O_7)_2.4H_2O$ per 100 Gms. Solvent at: 18°.	25°.
Water	0.08496	0.0959
Alcohol (Sp. Gr. 0.8092 = 95%)	0.0065	0.0089

EQUILIBRIUM IN THE SYSTEM CALCIUM OXIDE-CITRIC ACID-WATER AT 30°.
(van Itallie, 1908.)

The compositions of the solid phases were determined by the "Rest Method" of Schreinemakers (1903). The results are presented in the triangular diagram and it was necessary to select the fictitious compound $C_6H_5O_7.1\frac{1}{2}H_2O$ instead of $C_6H_8O_7$ in order to keep the citrate component within the limits of the diagram. This is in harmony with the choice of anhydrides as components in the inorganic oxy acid systems.

C_5H

Gms. per 100 Gms. Sat. Sol. $C_6H_5O_7.1\frac{1}{2}H_2O$.	CaO	Solid Phase.	Gms. per 100 Gms. Sat. Sol. $C_6H_5O_7.1\frac{1}{2}H_2O$.	CaO.	Solid Phase.
55.86	0	$C_6H_8O_7.H_2O$	20.3	0.35	$C_6H_6O_7Ca.4H_2O$
54.8	0.24	"	16.3	0.33	"
55.4	0.35	" $+(C_6H_7O_7)_2Ca.3H_2O$	12.5	0.39	"
53.7	0.40	$(C_6H_7O_7)_2Ca.3H_2O$	8.3	0.28	"
48.3	0.52	"	5.2	0.25	"
42.6	0.60	"	4.1	0.20	Quadruple pt.
38.5	0.77	"	3.2	0.20	...
36.5	0.70	" $+C_6H_6O_7Ca.4H_2O$	2.4-0	0.21-0.13	Hydrate of $(C_6H_5O_7)_2Ca_3$(?)
34.8	0.77	$C_6H_6O_7Ca.4H_2O$	0.18	0.24	Quadruple pt.
27.5	0.45	"	0	0.113	$Ca(OH)_2$

CALCIUM CAPROATE (Hexoate) $Ca[CH_3(CH_2)_4COO]_2.H_2O$.

CALCIUM 3 Methyl PENTANATE $Ca[CH_3.CH_2.CH(CH_3)CH_2.COO]_2.3H_2O$.

CALCIUM CAPRYLATE $Ca[CH_3(CH_2)_6COO]_2.H_2O$.

SOLUBILITY OF EACH IN WATER.
(Lumsden; the Pentanate, Kulisch, 1893; see also Keppish, 1888, and Altschul, 1896, for results on the Caproate.)

t°.	Ca. Caproate. Gms. $Ca(C_6H_{11}O_2)_2$ per 100 Gms. H_2O.	Ca. 3 Methyl Pentanate. Gms. $Ca(C_6H_{11}O_2)_2$ per 100 Gms. Water.	Ca. 3 Methyl Pentanate. Gms. $Ca(C_6H_{11}O_2)_2$ per 100 Gms. Solution.	Ca. Caprylate. Gms. $Ca(C_8H_{15}O_2)_2$ per 100 Gms. H_2O.
0	2.23	12.33	10.98	0.33
20	2.18	17.18	14.66	0.31
40	2.15	18.99	15.97	0.28
50	2.10	18.73	15.78	0.26
60	2.15	17.71	15.04	0.24
80	2.30	13.37	11.80	0.32
100	2.57	9.94	9.04	0.50

CALCIUM GLUCONATE $Ca[C_5H_6(OH)_5COO]_2$

SOLUBILITY OF CALCIUM GLUCONATE IN WATER.

(De Carli, 1931; at 25°, May, Weisberg and Herrick, 1929.)

t°	Gms. $Ca[C_6H_{11}O_7]_2$ per 100 gms. sat. sol.	t°	Gms. $Ca[C_6H_{11}O_7]_2$ per 100 gms. sat. sol.
20	3.596	69	13.19
25	3.85	90	26.90
40	5.022	96.4	36.40
60.2	10.80		

SOLUBILITY OF CALCIUM GLUCONATE IN AQUEOUS SOLUTIONS OF MONOBASIC SODIUM PHOSPHATE AT 20° AND VICE VERSA.

(De Carli, 1932.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
NaH_2PO_4	$Ca[C_6H_{11}O_7]_2$		NaH_2PO_4	$Ca[C_6H_{11}O_7]_2$	
0.0	2.86	$Ca(C_6H_{11}O_7)_2$	21.61	5.81	$Ca(C_6H_{11}O_7)_2NaH_2PO_4.2H_2O$
2.70	3.00	"	33.20	6.85	"
4.01	3.11	$Ca(C_6H_{11}O_7)_2NaH_2PO_4.2H_2O$	41.62	7.26	"
4.11	3.41	"	42.28	6.97	" + $NaH_2PO_4.2H_2O$
7.32	3.87	"	43.69	4.49	$NaH_2PO_4.2H_2O$
9.77	4.03	"	44.54	2.55	"
14.07	4.45	"	46.00	0.00	"

C_6H

CALCIUM Benzene SULFONATE $Ca(C_6H_5SO_3)_2H_2O$.

SOLUBILITY OF CALCIUM BENZENE SULFONATE IN WATER.

(Mameli, 1922.)

t°.	Gms. $Ca(C_6H_5SO_3)_2$ per 100 cc. sat. sol.	t°	Gms. $Ca(C_6H_5SO_3)_2$ per 100 cc. sat. sol.
0	1.766	20	1.844
10	2.001	30	1.211
15	1.968	40	0.410

SOLUBILITY OF CALCIUM BENZENE SULFONATE IN AQUEOUS SOLUTIONS OF BENZENE SULFONIC ACID AT 25°.

(Dunn and Philip, 1934.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$C_6H_5SO_3H$	$Ca(C_6H_5SO_3)_2$		$C_6H_5SO_3H$	$Ca(C_6H_5SO_3)_2$	
0.0	28.07	$Ca(C_6H_5SO_3)_2.H_2O$	36.12	4.09	$Ca(C_6H_5SO_3)_2.H_2O$
15.01	15.78	"	37.33	3.48	"
27.30	8.18	"	64.00	0.07	"

According to Ephraim and Pfister, (1925) 100 cc. sat. sol. in water contain 61.26 gms. Ca $(C_6H_5SO_3)_2$ at 20°. (An explanation of the very wide differences between the several results is not apparent.)

CALCIUM m and p Chloro BENZENE SULFONATES $Ca[C_6H_4ClSO_3]_2$

SOLUBILITY OF EACH IN WATER.

(Bollinger, 1928.)

Results for m (1.5?) $Ca[C_6H_4ClSO_3]_2$		Results for p (1.4) $Ca[C_6H_4ClSO_3]_2$	
t°	Gms. per 100 cc sat. sol.	t°	Gms. per 100 cc sat. sol.
18	0.98	18	0.19
98	5.39	98	0.84

CALCIUM BENZOATE $Ca(C_6H_5COO)_2.3H_2O$.

SOLUBILITY OF CALCIUM BENZOATE IN WATER.

(Stanbridge, 1918.)

t°.	Gms. $Ca(C_6H_5COO)_2$ per 100 gms. H_2O.	Solid Phase.	t°.	Gms. $Ca(C_6H_5COO)_2$ per 100 gms. H_2O.	Solid Phase.
-0.1	0.3098	Ice	59.8	4.708	$Ca(C_6H_5COO)_2.3H_2O$
-0.159	0.8964	"	69.9	5.675	"
-0.282	1.347	"	79.9	6.865	"
-0.308	1.421	"	90.2	8.555	" *
-0.370	1.760	"	84.7 (tr. pt.)	7.62	" $+Ca(C_6H_5COO)_2.H_2O$
-0.382	2.263	"	82.9	7.518	$Ca(C_6H_5COO)_2.H_2O$*
-0.369	3.470	"	85.0	7.588	"
-0.37 (E tec.)	2.22	" $+Ca(C_6H_5COO)_2.3H_2O$	87.0	7.708	"
+0.2	2.232	$Ca(C_6H_5COO)_2.3H_2O$	89.1	7.850	"
9.8	2.453	"	91.1	8.005	"
19.8	2.723	"	93.1	8.135	"
29.8	3.016	"	95.2	8.379	"
39.7	3.424	"	97.2	8.464	"
49.7	4.048	"	100.0 (b. pt.)	8.695	"

* Metastable point.

100 cc. sat. solution in water contain 3.02 gms. $Ca[C_6H_5COO]_2$ at 26°. (de Jong, 1912.)

100 gms. sat. solution in water contain 8.6 gms. $Ca[C_6H_5COO]_2$ at 15° and 10.2 gms. at 100°. (Tarugi and Checchi, 1901.)

SOLUBILITY OF SEVERAL CALCIUM BENZOATES IN WATER AT 20°.

(Ephraim and Pfister, 1925.)

C_6H

Salt.	Formula.	Gms. anhydrous salt. per 100 cc. sat. sol.
Calcium benzoate	$Ca(C_6H_5COO)_2.2H_2O$	2.827
Calcium-4-chloro benzoate	$Ca(C_7H_4O_2C.)_2\ 3H_2O$	0.737
" -4-nitro benzoate	$Ca(C_7H_4O_4N)_2.6H_2O$	2.548
" -4-oxy benzoate	$Ca(C_7H_5O_3)_2.4H_2O$	8.366
" -4-methoxy benzoate	$Ca(C_8H_7O_3)_2.3H_2O$	2.525

100 gms. Methyl Alcohol (CH_3OH) dissolve 0.25 gm. anhydrous Ca $(C_6H_5COO)_2$ at 15° and 0.39 gm. at the b. pt. (66°); calcium benzoate forms with methyl alcohol an alcoholate of the composition Ca $(C_6H_5COO)_2.CH_3OH$. (Henstock, 1934.)

CALCIUM p Bromo, Chloro and Iodo BENZOATES

SOLUBILITY OF EACH IN WATER AT ABOUT 20°.

(Baller, Jr. 1931.)

Compound	Formula	Millimols diss. per 100cc H_2O
Calcium p Bromo Benzoate	$Ca(C_6H_4BrCOO)_2$	1.79
" " Chloro "	$Ca(C_6H_4ClCOO)_2$	2.90
" " Iodo "	$Ca(C_6H_4ICOO)_2$	0.16

CALCIUM SALICYLATE $Ca(C_6H_4.OHCOO)_2.3H_2O$.

100 grams of the saturated aqueous solution contain 2.29 grams of the anhydrous salt at 15° and 35.75 grams at 100°. (Tarugi and Checchi, 1901.)

CALCIUM HEPTOATE (Oenanthate) $Ca[CH_3(CH_2)_5COO]_2.H_2O$.

SOLUBILITY IN WATER.

(Lumsden, 1902; see also Landau, 1893; Altschul, 1896.)

t.	0°.	20°.	40°.	60°.	80°.	100°.
Gm. $Ca(C_7H_{13}O_2)_2$ per 100 gms. solution	0.94	0.85	0.81	0.81	0.97	1.24

CALCIUM Racemic β Methyl ADIPATE $CH_2CH_2CHCH_3CH_2(COO)_2Ca$.

100 cc. of saturated solution of the neutral calcium salt of racemic β methyl adipic acid in water contain 5.3 gms. of the compound at 15°. (Mourisse.)

CALCIUM MECONATE $C_7H_2O_7.Ca$.

1000 cc. of sat. sol. in 0.1 *n* aqueous ammonia contain 0.0973 gm. $C_7H_2O_7Ca$ at 18°. (Heiduschka and Faul, 1917.)

CALCIUM THEOBROMINE $Ca(C_7H_6N_4O_2)_2$

SOLUBILITY OF CALCIUM THEOBROMINE IN AQUEOUS SOLUTION OF CALCIUM NITRITE AT 16°.

C_7H

(Kaufmann, 1938.)

Gms. per 100 gms. H_2O		Solid Phase	Gms. per 100 gms. H_2O		Solid Phase
$Ca(NO_2)_2.H_2O$	$Ca(Th)_2$		$Ca(NO_2)_2.H_2O$	$Ca(Th)_2$	
0	0.45	$Ca(Th)_2$	50	3.2	$Ca(Th_2) + Ca(Th)_2.Ca(NO_2)_2.$
5	0.46	"	55	1.52	$Ca(Th)_2.Ca(NO_2)_2.3H_2O \backslash 3H_2O$
10	0.58	"	60	1.01	"
20	0.81	"	70	0.63	"
30	1.22	"	110	0.18	"
40	1.90	"			

CALCIUM MANDELATES, Racemic and Active, $Ca(C_8H_7O_3)_2$

SOLUBILITY OF EACH SEPARATELY IN AQUEOUS SOLUTIONS OF (r) AND (-) MANDELIC ACID AT 25°.

(Ross and Morrison, 1933; Ross, Morrison and Johnstone, 1937.)

Results for the Racemic (r) Compounds			Results for the Active (-) Compounds		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$C_8H_8O_3$	$Ca(C_8H_7O_3)_2$		$C_8H_8O_3$	$Ca(C_8H_7O_3)_2$	
0.0	1.8	$Ca(C_8H_7O_3)_2$	0.0	2.3	$Ca(C_8H_7O_3)_2$
0.4	1.7	" + 1.1	2.9	2.1	"
1.2	0.7	1.1	5.7	2.6	" + 1.1
4.2	0.2	"	7.0	2.1	1.1
6.5	0.1	"	8.2	2.1	"
10.5	0.1	"	9.2	1.8	" + 1.2
12.2	0.1	"	9.4	1.9	1.2
14.1	0.1	"	9.6	1.5	"
16.9	0.0	$C_8H_8O_3$	11.2	1.4	$C_8H_7O_3$
			10.2	1.0	"
			10.1	0.0	"

1.1 = $Ca(C_8H_7O_3)_2.(C_8H_8O_3)_2$

1.2 = $Ca(C_8H_7O_3)_2.2(C_8H_8O_3)_2$

CALCIUM XYLENE SULFONATES o, m and p $Ca(C_8H_9SO_3)_2$

SOLUBILITY OF EACH SEPARATELY IN WATER AT 25°.

(Nakatsuchi, 1930.)

Compound	Formula	Gms. Cmpd. per 100 gms. H_2O.
Calcium o xylene sulfonate	$Ca(C_6H_3(CH_3)_2SO_3)_2$	21.91
" m " "	"	32.67
" p " "	"	11.81

CALCIUM CINNAMATE $Ca(C_6H_5.CH:CHCOO)_2.3H_2O$.

SOLUBILITY OF CALCIUM CINNAMATE AND ITS ISOMERS IN SEVERAL SOLVENTS.

Name of Salt.	Formula.	Solvent.	t°.	Gms. Anhydrous Salt per 100 Gms. Solvent.
Calcium Cinnamate	$Ca(C_6H_5CH:CHCOO)_2.3H_2O$	Water	2	0.19(1)
" "	"	"	15	0.21(2)
" "	"	"	26	0.24(1)
" "	"	"	100	1.15(2)
" Isocinnamate	$Ca(C_9H_7O_2)_2.2H_2O$	"	20	23.8 (3)
" "	"	Acetone	20	19.6 (3)
" Allocinnamate	$Ca(C_9H_7O_2)_2.3H_2O$	"	20	2 (3)
" "	$Ca(C_9H_7O_2)_2.2H_2O$	Water	20	10.2 (4)
" "	"	Acetone	18	2.7 (5)
" Hydrocinnamate	$Ca(C_9H_7O_2)_2?H_2O$	"	14	0.19(5)
" "	"	"	19	0.21(5)
" "	"	Water	27	4.25(3)
" "	"	Acetone	25	3.3 (3)

(1) = De Jong, 1909; (2) = Tarugi and Checchi, 1901; (3) = Michael, 1901; (4) = Liebermann, 1903; (5) = Michael and Garner, 1903.

100 gms. sat. sol. of calcium cinnamate in water contain 0.340 gms. Ca $C_{18}H_{14}O_4$ at 20°.

(Ephraim and Pfister, 1925.)

CALCIUM PELARGONATE (Nonate) $Ca[CH_3(CH_2)_7COO]_2.H_2O$

SOLUBILITY OF CALCIUM PELARGONATE IN WATER.

(Lumsden, 1902; Krasnicki, 1887.)

t°	Gms. $Ca[CH_3(CH_2)_7COO]_2$ per 100 gms. H_2O	t°	Gms. $Ca[CH_3(CH_2)_7COO]_2$ per 100 gms. H_2O
0	0.16	80	0.15
20	0.14	90	0.18
40	0.13	100	0.26
60	0.12		

CALCIUM *d* CAMPHORATE $C_{10}H_{14}O_4Ca.7H_2O$.

SOLUBILITY OF CALCIUM CAMPHORATE IN AQUEOUS SOLUTIONS OF CAMPHORIC ACID AT 15° AND VICE VERSA.

(Jungfleisch and Landrieu, 1914.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
$C_8H_{14}(COOH)_2$.	$C_{10}H_{14}O_4Ca$.		$C_8H_{14}(COOH)_2$.	$C_{10}H_{14}O_4Ca$.	
1.35	1.23	$C_8H_{14}(COOH)_2$	2.90	7.75	$C_8H_{14}(COOH)_2$
1.57	1.97	"	3	8.66	" $+C_{10}H_{14}O_4.Ca.7H_2O$
1.71	2.55	"	3.07	8.57	$C_{10}H_{14}O_4Ca.7H_2O$
2.18	4.34	"	1.50	7.94	"
2.33	4.73	"	0	7.37	"

Calcium camphorate tetrahydrate exists at higher temperatures. Its solubility at 100° was found to be 8.68 gms. $C_{10}H_{14}O_4Ca$ per 100 gms. sat. solution. By careful work, the result at 15° for $C_{16}H_{14}O_4Ca.4H_2O$ was found to be 12.21 gms. $C_{10}H_{14}O_4Ca$ per 100 gms. sat. solution.

CALCIUM ALKYL SULFONATES

$C_{10}H$

SOLUBILITY OF EACH SEPARATELY IN WATER.

(Reed and Tartar, 1936.)

Compound	Formula	t^0	Gms. anhydrous * cmpd. per 100 gms. H_2O	
Calcium n Decyl Sulfonate	$Ca[CH_3(CH_2)_8CH_2SO_3]_2$	25	0.155	(1)
" " "	"	60	0.260	(1)
" Lauryl "	$Ca[CH_3(CH_2)_{10}CH_2SO_3]_2$	25	0.011	(1)
" " "	"	60	0.033	(1)
" Myristyl "	$Ca[CH_3(CH_2)_{12}CH_2SO_3]_2$	25	0.0014	(1)
" " "	"	60	0.0050	(1)
" Cetyl "	$Ca[CH_3(CH_2)_{14}CH_2SO_3]_2$	25	0.0005	(1)
" " "	"	60	0.0013	(1)
" n Octyldecyl "	$Ca[CH_3(CH_2)_{16}CH_2SO_3]_2$	25	0.0006	(1)
" " "	"	60	0.0007	(1)

CALCIUM CYMENE SULFONATE $Ca[CH_3C_6H_4(CH_2)_3SO_3]_2$

SOLUBILITY OF CALCIUM CYMENE SULFONATE IN WATER.

(Hausllck, 1935.)

t^0	Gm. mols. $Ca[CH_3C_6H_4(CH_2)_3SO_3]_2$ per 100 gms. H_2O	t^0	Gm. mols. $Ca[CH_3C_6H_4(CH_2)_3SO_3]_2$ per 100 gms. H_2O
1.0	0.003	79	0.062
30.0	0.011	93	0.111
37.0	0.016	99	0.192
64.0	0.022		

CALCIUM NAPHTHALENE and other SULFONATES

SOLUBILITY OF EACH SEPARATELY IN WATER.

Compound	Formula	t°	Gms. anhy. cmpd. per 100 gms. sat. sol.	
Calcium Naphthalene-2-Sulfonate	$Ca[C_{10}H_7SO_3]_2.H_2O$	16.5	1.98	(1)
" " 1.4 Chlor "	$Ca[C_{10}H_6ClSO_3]_2.?H_2O$	18	0.19	(2)
" " " " "	"	98	0.84	(2)
" " 1.5 " "	$Ca[C_{10}H_6ClSO_3]_2.1\frac{1}{2}H_2O$	18	0.98	(2)
" " " " "	"	20	0.37	(1)
" " " " "	"	98	5.11	(2)
" Naphthylamine 2.5.7 Di "	$Ca(C_{10}H_5NH_2SO_3)_2$	15	40.2	(3)
" " 2.6.8 " "		15	29.1	(3)
" " 1.2.4.7 Tri "	$CaC_{10}H_4NH_2(SO_3)_3H$	20	14.4	(4)
" " " "	"	80	24.2	(4)
" Anthracene -1- "	$Ca(C_{14}H_9SO_3)_2.3H_2O$	20	0.027	(1)
" " -2- "	$Ca(C_{14}H_9SO_3)_2.H_2O$	20	0.016	(1)
" Phenanthrene -2- "	$Ca(C_{14}H_9SO_3)_2$	20	0.024	(5)
" " -3- "	$Ca(C_{14}H_9SO_3)_2.2H_2O$	20	0.083	(5)
" " -10- "	"	20	0.300	(5)
" " 10 Chlor-3 or 6 "	$Ca(C_{14}H_8ClSO_3)_2.H_2O$	20	0.015	(6)
" Anthraquinone-1- "	$Ca(C_{14}H_7O_2SO_3)_2.3H_2O$	18	0.41	(7)
" " " "	"	100	1.79	(7)
" " 1.5 Di "	$CaC_{14}H_6O_2(SO_3)_2.3H_2O$	18-100	0.91	(7)
" " 1.6 " "	$CaC_{14}H_6O_2(SO_3)_2.5H_2O$	18	1.51	(7)
" " " " "	"	100	14.2	(7)
" " 1.7 " "	$CaC_{14}H_6O_2(SO_3)_2.6H_2O$	18-100	14.2	(7)
" " 1.8 " "	$CaC_{14}H_6O_2(SO_3)_2.5\frac{1}{2}H_2O$	18	0.07	(7)
" " " " "	"	100	1.12	(7)
" " 1.5 Chloro "	$Ca(C_{14}H_6O_2ClSO_3)_2.2H_2O$	18	0.13	(7)
" " " " "	"	100	0.40	(7)
" " 1.6 " "	"	18	0.15	(7)
" " 1.7 " "	"	18	1.31	(7)
" " 1.8 " "	$Ca(C_{14}H_6O_2ClSO_3)_2.4H_2O$	18	0.39	(7)
" " " " "	"	100	1.96	(7)

(1) Ephraim and Pfister, 1925(a); (2) Ferrero and Bolliger, 1928; (3) Braunschweig, 1922-26; (4) Frisch, 1934; (5) Sandquist, 1912; (6) Sandquist, 1917; (7) Fierz-David, Krebser & Anderau, 1927.

CALCIUM HELIANTHATE $Ca(C_{14}H_{14}N_3SO_3)_2.4H_2O$.

1000 cc. H_2O dissolve 0.177 gms. calcium helianthate at 20-25°. (Stark and Dehn, 1918.)

CALCIUM OLEATE $(C_{18}H_{33}O_2)_2Ca$.
CALCIUM PALMITATE $[CH_3(CH_2)_{14}COO]_2Ca$.
CALCIUM STEARATE $[CH_3(CH_2)_{16}COO]_2Ca$.

SOLUBILITY OF EACH SEPARATELY IN WATER AND IN AQUEOUS SODIUM CHLORIDE SOLUTIONS. (Zink and Liere, 1915.)

About 0.25 gm. of each compound was rubbed with water and allowed to stand at room temperature for 36 hours. The solution was filtered and the Ca in 750 cc. determined.

Solvent	Milligrams per liter of sat. sol.		
	$(C_{18}H_{33}O_2)_2Ca$	$[CH_3(CH_2)_{14}COO]_2Ca$.	$[CH_3(CH_2)_{16}COO]_2Ca$.
Water................	65.88-91.67	27.50-28.77	38.95-41.87
Aq. 0.05 % NaCl......	77.38	39.28	46.20
0.10 "	102.5	56.27	69.24

SOLUBILITY OF CALCIUM OLEATE IN SEVERAL SOLVENTS.

Solvent	t°	Gms. $Ca(C_{18}H_{33}O_2)_2$ per 100 gms. solvent	Authority
Water	(?)	0.01	(Farion, 1916.)
Methyl alcohol	15	0.30	(Henstock, 1934.)
" " (at b. pt.)	66	0.57	" "
Acetone	15	2.26	" "
Benzene	15	3.44	" "
Glycerol (d = 1.114)	(?)	1.18	(Asselin, 1873.)

Experiments upon the solubility of Calcium Stearate in aqueous solutions of bile showed that at about 23° concentrations of bile up to 16 volume percent do not appreciably increase the amount of calcium stearate dissolved in water alone. The solubility product of calcium stearate in water, calculated from the calcium determination is (Ca) x (Stearate ion) = 3.61×10^{-15}. (Langley, Rosenbaum and Rosenbaum, 1932.)

CALCIUM AZIDE $Ca(N_3)_2$

100 gms. sat. solution of Calcium Azide in Water contain 27.6 gm. $Ca(N_3)_2$ at 0° and 31.0 gms. at 15.2°. (Curtius and Rissom, 1898.)

CN **CALCIUM** Potassium **FERRO CYANIDE**

CALCIUM Ammonium **FERRO CYANIDE**

CALCIUM Rubidium **FERRO CYANIDE**

SOLUBILITY OF EACH SEPARATELY IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL.

(Diez de Rada and Bermejo, 1929.)

Results for $CaK_2Fe(CN)_6$ at 20°		Results for $Ca(NH_4)_2Fe(CN)_6$ at 22°		Results for $CaRb_2Fe(CN)_6$ at 22°	
Wt. percent C_2H_5OH in solvent	Gms. $CaK_2Fe(CN)_6$ per 100 gms. sat. sol.	Wt. percent C_2H_5OH in solvent	Gms. $Ca(NH)_2Fe(CN)_6$ per 100 gms. sat. sol.	Wt. percent C_2H_5OH in solvent	Gms. $CaRb_2Fe(CN)_6$ per 100 gms. sat. sol.
0.0(=H_2O)	0.498	0.0(=H_2O	0.297	0.0(=H_2O)	0.059
5.0	0.344	5.0	0.240	5.0	0.050
10.0	0.209	10.0	0.171	10.0	0.035
15.0	0.136	15.0	0.115	15.0	0.026
20.0	0.092	20.0	0.076	20.0	0.016
25.0	0.054	25.0	0.52	25.0	0.010
30.0	0.035	30.0	0.31	35.0	0.000
40.0	0.019	40.0	0.012		

100 gms. H_2O dissolve 0.125 gm. $CaK_2Fe(CN)_6$ at 15° and 0.69 gm. at 100° (Kunheim and Zimmerman, 1884.)

100 gms. H_2O dissolve 0.41 gm. $CaK_2Fe(CN)_6$ at 15-17°. (Brown, 1907.)

100 gms. H_2O dissolve 0.258 gm. $Ca(NH_4)_2Fe(CN)_6$ at 15-17°. Brown, 1907.)

CALCIUM FERROCYANIDE $Ca_2Fe(CN)_6.11H_2O$.

SOLUBILITY OF CALCIUM FERROCYANIDE IN WATER.

(Farrow, 1926, 1927.)

t°	Density of sat. solution	Gms. $Ca_2Fe(CN)_6$ per 100 gms. sat. sol.	Solid Phase
-10.1 Eutec.	1.198	30.45	Ice + $Ca_2Fe(CN)_6.11H_2O$
24.9	1.3563	36.44	$Ca_2Fe(CN)_6.11H_2O$
34.9	1.3662	39.22	"
49.8	1.3970	42.04	"
59.7	—	44.2	" + $Ca_2Fe(CN)_6.xH_2O$
64.7	1.4074	44.44	$Ca_2Fe(CN)_6.xH_2O$
90.0	1.401	44.4	"

SOLUBILITY OF CALCIUM FERROCYANIDE IN AQUEOUS SOLUTIONS OF SODIUM FERROCYANIDE AND VICE VERSA.

(Farrow, 1927.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$Ca_2Fe(CN)_6$	$Na_4Fe(CN)_6$	
	Results at 25°		
1.356	37.16	0.0	$Ca_2Fe(CN)_6.11H_2O$
1.369	35.27	3.67	"
1.373	35.10	4.79	"
1.381	33.24	7.55	" + $Ca_2Fe(CN)_6.xH_2O$
—	31.45	8.60	$Na_4Fe(CN)_6.10H_2O$ + "
1.344	28.02	9.64	$Na_4Fe(CN)_6.10H_2O$
—	22.22	11.50	"
1.130	0.0	17.05	"
	Results at 50°		
1.392	42.2	0.0	$Ca_2Fe(CN)_6.11H_2O$
—	40.51	2.91	"
1.437	40.00	2.91	" + $CaNa_2Fe(CN)_6$
1.363	33.08	6.50	$CaNa_2Fe(CN)_6$
1.332	24.40	12.90	"
1.314	20.05	16.24	"
1.310	17.8	18.31	" + $Na_4Fe(CN)_6.10H_2O$
1.280*	9.53	25.25	" + "
1.300	16.26	18.65	$Na_4Fe(CN)_6.10H_2O$
1.296	15.57	19.37	"
1.281	13.18	20.10	"
1.255	9.13	22.11	"
1.200	0.0	26.20	"
	Results at 90°		
1.401	44.40	0.0	$CaFe(CN)_6.xH_2O$
—	42.42	3.12	" + $Na_2Fe(CN)_6$
1.335	34.74	5.02	$Na_2Fe(CN)_6$
1.307	29.09	8.08	"
1.307	21.34	13.09	"
1.249	16.64	16.28	"
1.238	11.72	20.39	"
1.241	6.52	26.77	"
1.256	3.83	31.36	"
1.284	2.21	35.77	"
1.286	1.72	36.97	" + $Na_4Fe(CN)_6.xH_2O$
1.288	1.37	37.35	$Na_4Fe(CN)_6.xH_2O$
1.290	0.0	38.00	"

* = unstable equilibrium

CALCIUM CARBONATE $CaCO_3$.

EQUILIBRIUM IN THE SYSTEM $CaO-H_2O-CO_2$ AT 16°.

The following data for the solubility of calcite ($CaCO_3$) in water at 16° in contact with air containing the partial pressure P of CO_2 were calculated from the results of Schloesing (1872), Engel (1888), and others by Johnston (1915) and Johnston and Williamson (1916). These authors describe the changes in the system resulting from a gradual increase in partial pressure of CO_2, as follows:

> "We begin by considering the equilibrium between the hydroxide $M(OH)_2$ and the aqueous solution saturated with it as affected by a progressive increase from zero of the partial pressure *P* of CO_2 in the atmosphere in contact with the solution. Addition of CO_2 is followed by a distribution between the vapor and liquid phases until there is equilibrium between the residual partial pressure of CO_2 and the H_2CO_3 in solution, and in turn between the latter and the several ions; the net effect of this is a definite decrease in $[OH^-]$, the concentration of hydroxide ion, which necessitates that more of the hydroxide dissolve in order to keep the solubility-product $[M^{++}][OH^-]^2$ constant. Consequently the total concentration of M^{++} increases, part of it being now associated with carbonate and bicarbonate; in other words, the apparent solubility of the base increases if the method of analysis of the solution is a determination of M, whereas it would decrease if one should determine $[OH^-]^2$. This process continues until the product $[M^{++}][CO_3^{=}]$ reaches the value requisite for the precipitation of MCO_3 (on the assumption that supersaturation does not occur) which, for a given base, takes place at a definite value of *P* which depends only upon the temperature; this transition pressure P_1 is, at a given temperature, the highest under which solid hydroxide is stable and the lowest at which solid carbonate is stable.
>
> CO
>
> At P_1 the solubility (as measured by the total [M]) begins to diminish, because increase of *P* increases $[CO_3^{=}]$ while the product $[M^{++}][CO_3^{=}]$ must remain constant so long as MCO_3 is the stable solid phase; this increase of $[CO_3^{=}]$ continues until a definite pressure P_0 is reached, when the formation of bicarbonate in the solution becomes the predominant reaction and $[CO_3^{=}]$ begins to decrease again. P_0 is thus a minimum in the solubility curve. With further increase beyond P_0 the concentration of both M^{++} and HCO_3^- increases steadily until the precipitation value of the product $[M^{++}][HCO_3^-]^2$ is reached at P_2, which is a transition pressure at which both carbonate and bicarbonate are present as stable solid phases. Beyond P_2 bicarbonate alone is stable, and its total solubility falls off very slowly with further increase of partial pressure of CO_2."

THE CALCULATED ION-CONCENTRATIONS AND SOLUBILITY OF CALCITE IN WATER AT 16° IN CONTACT WITH AIR CONTAINING THE PARTIAL PRESSURE *P* OF CO_2.

Partial Pressure *P* of CO_2 Measured in Atmospheres.	Ion-concentrations per Liter $\times 10^{-4}$.				Total Ca, Mols. per Liter $\times 10^{-4}$.	Grams $CaCO_3$ per Liter.
	Ca^{++}.	OH^-.	$CO_3^{=}$.	HCO_3^-.		
3.16×10^{-14}	138.5	277	0.0071	0.0000235	...	2.000
2.80×10^{-10}	6.81	13.3	0.144	0.01	...	0.074
9.78×10^{-9}	2.377	3.82	0.414	0.10	...	0.026
6.14×10^{-8}	1.654	1.82	0.593	0.30	...	0.018
2.19×10^{-7}	1.476	1.02	0.665	0.60	...	0.016
3.73×10^{-7}	1.459	0.787	0.672	0.787	...	0.0159
3.85×10^{-7}	1.459	0.774	0.672	0.80	...	0.0159
6.07×10^{-7}	1.473	0.614	0.666	1	...	0.016
7.62×10^{-6}	2.051	0.147	0.478	3	...	0.022
7.63×10^{-5}	3.777	0.034	0.260	7	...	0.040
2.15×10^{-4}	5.197	0.0174	0.188	10	...	0.056
2×10^{-4}	5.09	0.0182	0.19	9.76	5.52	0.055
2.5×10^{-4}	5.46	0.0157	0.18	10.54	5.93	0.059
3×10^{-4}	5.79	0.0.40	0.17	11.22	6.31	0.063
3.5×10^{-4}	6.08	0.0126	0.16	11.82	6.64	0.066
4×10^{-4}	6.35	0.0115	0.16	12.36	6.94	0.069
4.5×10^{-4}	6.59	0.0107	0.15	12.86	7.21	0.072
5×10^{-4}	6.82	0.0100	0.14	13.32	7.46	0.075

THE SOLUBILITY OF CALCIUM CARBONATE (CALCITE) IN WATER AT 16° IN CONTACT WITH AIR CONTAINING PARTIAL PRESSURE P OF CO_2.

(Calc. from Schloesing, 1872, and Engel, 1888, by Johnston, 1915.)

Partial Pressure *P* of CO_2 in Atmospheres.	Total Ca. Mols. per Liter.	Total $Ca(HCO_3)_2$ Mols. per Liter.	Partial Pressure *P* of CO_2 in Atmospheres.	Total Ca. Mols. per Liter.	Total $Ca(HCO_3)_2$ Mols. per Liter
0.000504	0.000746	0.000731	0.4167	0.007825	0.007874
0.000808	0.000850	0.000837	0.5533	0.008855	0.008854
0.00333	0.001372	0.001364	0.7297	0.00972	0.00972
0.01387	0.002231	0.002226	0.9841	0.01086	0.01086
0.02820	0.002965	0.002961	1	0.01085	0.01085
0.05008	0.003600	0.003597	2	0.01411	0.01411
0.1422	0.005330	0.005328	4	0.01834	0.01834
0.2538	0.006634	0.006632	6	0.02139	0.02139

THE SOLUBILITY OF CALCIUM CARBONATE[1] (CALCITE) IN WATER AT 25° IN CONTACT WITH CO_2 UNDER INCREASING PRESSURES.

(McCoy and Smith, 1911.)

Approx. Pressure of CO_2 in Atmospheres.*	Mols. per Liter Sat. Solution.		Gms. per Liter Sat. Sol.		Solid Phase.
	H_2CO_3.	$Ca(HCO_3)_2$.	H_2CO_3.	$Ca(HCO_3)_2$.	
0.1	0.003522	0.004116	0.22	0.67	$CaCO_3$
1.1	0.03728	0.009734	2.3	1.58	"
9.9	0.3329	0.02236	20.6	3.62	"
13.2	0.444	0.02495	27.5	4.04	"
16.3	0.550	0.02600	34.1	4.21	$Ca(HCO_3)_2$
25.4	0.858	0.02603	53.2	4.22	"

* Calc. by Henry's Law from CO_2 concentrations. See also remarks under Ferrous Bicarbonate.

These results show that the solution becomes saturated with $Ca(HCO_3)_2$ at about 15 atmospheres pressure of CO_2, and it would be theoretically possible to convert all the $CaCO_3$ to $Ca(HCO_3)_2$ by introducing sufficient CO_2 at pressures greater than 15 atmospheres. Under the conditions of the present experiment, it was calculated that more than 3 months time would have been required for the complete conversion. CO

The solubility of calcium carbonate in water saturated with CO_2 at one atmosphere pressure was found by Cavazzi (1916) to be 1.56 gms. $CaCO_3$ at 0° and 1.1752 gms. at 15°. A supersaturated solution prepared by passing a rapid stream of CO_2 through sat. $Ca(OH)_2$ solution at 15° contained 2.29 gms. $CaCO_3$.

SOLUBILITY OF CALCIUM CARBONATE IN WATER AT 15°. (Treadwell and Reuter, 1896.)

SOLUBILITY OF CALCIUM CARBONATE IN WATER AT 15°. (Treadwell and Reuter, 1896.)
SOLUBILITY OF CALCIUM CARBONATE IN WATER AT 15°. (Treadwell and Reuter, 1896.)
SOLUBILITY OF CALCIUM CARBONATE IN WATER AT 15°. (Treadwell and Reuter, 1896.)
SOLUBILITY OF CALCIUM CARBONATE IN WATER AT 15°. (Treadwell and Reuter, 1896.)
SOLUBILITY OF CALCIUM CARBONATE IN WATER AT 15°. (Treadwell and Reuter, 1896.)
SOLUBILITY OF CALCIUM CARBONATE IN WATER AT 15°. (Treadwell and Reuter, 1896.)
SOLUBILITY OF CALCIUM CARBONATE IN WATER AT 15°. (Treadwell and Reuter, 1896.)
SOLUBILITY OF CALCIUM CARBONATE IN WATER AT 15°. (Treadwell and Reuter, 1896.)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.89	14.4	0.0347	0.1492	0.0368
1.72	13.1	0.0243	0.1331	0.0329
0.79	6	0.0145	0.1249	0.0308
0.41	3.1	0.0047	0.0821	0.0203
0.25	1.9	0.0029	0.0595	0.0147
0.08	0.6	...	0.0402	0.0099
...	...	...	0.0385	0.0095

Therefore 1 liter sat. solution at 15° and 0 partial pressure of CO_2 contains 0.385 gram $Ca(HCO_3)_2$. Determinations similar to the above, made in 0.1 *n* NaCl solutions at 15°, are also given. It is pointed out by Johnston (1915), that although Treadwell and Reuter made very painstaking analyses, their mode of working did not secure equilibrium conditions, a fact which is borne out by the lack of constancy of the calculated solubility-product constant.

SOLUBILITY OF CALCIUM CARBONATE (CALCITE) IN WATER IN CONTACT WITH AIR AT DIFFERENT TEMPERATURES.

(Wells, 1915.)

(Joplin, Mo., calcite was used. The solutions were kept in a thermostat and agitated by a current of out-door air filtered through cotton and washed by water. The CO_2 content of the air varied from 3.02 to 3.27 parts per 10,000. The calcium content of the solutions was determined by titrating with 0.02 *n* $NaHSO_4$, using methyl orange as indicator. The solutions were slightly acid to phenolphthaleine, showing that the calcium was present chiefly as bicarbonate.)

t°.	Gms. $CaCO_3$ per Liter.
0	0.081
10	0.070
20	0.065
25	0.056 (0.046)
30	0.052
40	0.044
50	0.038 (0.029)

Results in parentheses by Kendall (1912). In connection with these it is stated by Johnston (1915), that assurance is wanting that the partial pressure of CO_2 was the same at both temperatures and the results are, therefore, not necessarily comparable.

CO

SOLUBILITY OF CALCIUM CARBONATE IN WATER AT DIFFERENT TEMPERATURES AND IN CONTACT WITH AIR CONTAINING DIFFERENT PARTIAL PRESSURES OF CO_2.

(Leather and Sen, 1909.)

Results at 15°.			Results at 25°.			Results at 40°.		
Partial Pressure CO_2 in Gas Phase.	Gms. per Liter Sol.		Partial Pressure CO_2 in Gas Phase	Gms. per Liter Sol		Partial Pressure CO_2 in Gas Phase	Gms. per Liter Sol	
	$CaCO_3$	CO_2.		$CaCO_3$	CO_2		$CaCO_3$.	CO_2.
0.8	0.193	0.117	0.7	0.159	0.091	0.6	0.136	0.078
1.5	0.193	0.152	1.6	0.177	0.111	1.7	0.143	0.085
1.7	0.238	0.135	4.6	0.341	0.208	2.9	0.175	0.106
6.8	0.445	0.327	7.8	0.446	0.301	3.5	0.232	0.169
9.9	0.627	0.456	16.5	0.539	0.522	7	0.284	0.234
13.6	0.723	0.560	30.1	0.743	0.715	14.9	0.384	0.293
14.6	0.686	0.623	35.5	0.755	0.803	22.2	0.427	0.333
31.6	1.050	1.117				31.7	0.480	0.476

Similar results also given for 20°, 30° and 35°.

The mixtures were constantly agitated at constant temperature. The solid phase in each case was found to be $CaCO_3$ and it is concluded that $Ca(HCO_3)_2$ cannot exist in this solid state above 15°.

In discussing the experiments of Leather and Sen, Johnston (1915) points out that their method of analysis gives low results for CO_2. A calculation of the data yields very irregular results and the most that can be deduced from them is that the solubility-product constant of calcite probably decreases somewhat with temperature, becoming apparently about 0.5×10^{-8} at 40°.

Data for the solubility of $CaCO_3$ in boiling water are given by Cavazzi (1917).

Data for the solubility of calcium carbonate in water containing excess of carbon dioxide are also given by Seyler and Lloyd (1909). The experiments were made at room temperature. Additional experiments showed that small amounts of $CaCl_2$, $CaSO_4$ or $NaHCO_3$ did not affect the solubility-product constant. Small amounts of NaCl, Na_2SO_4 and $MgSO_4$, containing no ion in common with $CaCO_3$, resulted in an increase of the total calcium in the solution.

Data for the solubility of calcium carbonate in water, determined by the conductivity method, are given by Holleman and by Kohlrausch and Rose (1893).

THE SOLUBILITY OF CALCIUM CARBONATE (CALCITE) IN WATER AT 25° IN PRESENCE OF CARBON DIOXIDE AT PRESSURES VARYING FROM 0.0003 TO 1.0 ATMOSPHERE.

(Frear and Johnston, 1929.)

By means of a plot of the available data published between 1916 and 1929 the following values were obtained.

Partial Pressure of CO_2 in Atmos.	0.00032	0.001	0.01	0.1	1.0	10.
Millimols $CaCO_3$ per kg. H_2O	0.53	0.78	1.7	3.9	9.0	22.5

"The temperature coefficient of the solubility is, within the accuracy of the measurements, independent of the partial pressure of carbon dioxide, particularly in the range 0.0003 to 1. atm.; consequently it suffices to give the ration r of the solubility at t° to that at 25°."

t°	0°	10°	20°	25°	30°	50°
r	1.8	1.4	1.1	1.0	0.9	0.6

These values of r are on the line log r = 830/T-2.78; this formula when extrapolated to 100° yields results in harmony with analyses of waters from boilers.

REDETERMINATIONS OF THE SOLUBILITY OF CALCITE IN WATER AT 25°. (W. D. Kline.)

(Frear and Johnston, 1929.)

CO

Partial pressure of CO_2 in Atm.	Milligram mols. per 1000 gms. H_2O Calcium $1000[Ca^{++}]$	Bicarb $1000[HCO_3^-]$
0.00031	0.52	1.02
0.00038	0.56	1.10
0.00093	0.76	1.50
0.00334	1.17	2.32
0.00690	1.51	3.01
0.0160	2.01	4.01
0.0432	2.87	5.74
0.1116	4.03	8.06
0.9684	8.91	17.82

One liter of sat. solution of carefully washed $CaCO_3$ in boiled distilled H_2O, contains 0.01447 gm. $CaCO_3$ at 17°. (Stumper. 1925.)

SOLUBILITY OF CALCIUM CARBONATE OF DIFFERENT ORIGINS AND FINENESS IN WATER CONTAINING CARBON DIOXIDE. (Hager and Kern, 1916-1920.)

The authors show that the degree of fineness influences greatly the velocity of solution of calcium carbonate in water containing CO_2. The shorter the period of action, the more pronounced are the differences observed. The variations increase with increase of CO_2 in the water.

SOLUBILITY OF CALCITE AND OF ARAGONITE IN WATER CONTAINING CARBON DIOXIDE. (Bäckström, 1921.)

The aragonite was prepared by heating in a sealed tube to 140°, a 1.0 molecular solution of $CaCl_2$ (sat. with CO_2) and urea. It contained 0.5 % calcite and 0.6 % urea. The calcite was obtained by grinding Iceland spar and removing all particles smaller than 10 μ by decanting with conductivity water. Equilibrium was not reached with calcite because of the extremely small velocity of the reaction. The most likely values are given.

		Results for Aragonite.			Results for Calcite.		
t°.	Pressure of CO_2.	Sp conductivity $x.10^{-2}$	Gm equiv $CaCO_3$ per liter.	Gm $CaCO_3$ per liter.	Sp conductivity $x.10^{-2}$.	Gm. equiv. $CaCO_3$ per liter.	Gm. $CaCO_3$ per liter.
9..	777^{mm}	1.534	0.0291	1.46	1.39	0.0260	1.30
25..	762	1.723	0.0213	1.066	1.547	0.01884	0.943
35..	742	1.774	0.01751	0.876	1.573	0.01529	0.765

Results are given by Bowman and Hastings, 1937 for the solubility of Aragonite in aqueous sodium chloride solutions at 38°, containing CO_2 in amounts such that the pH at equilibrium varied between 7.2 and 7.6. These results when compared with similar determinations upon Calcite showed that Aragonite is more soluble than Calcite, the ratio of their solubility products being 1.41.

SOLUBILITY OF CALCIUM CARBONATE IN WATER IN CONTACT WITH CARBON DIOXIDE UNDER HIGH PRESSURES.

Results at 18°. (Haehnel, 1924.)		Results at 25°. (Mitchell, 1923.)		
Atmospheres pressure of CO_2.	Gms. $CaCO_3$ dissolved per 100 gms. sat. sol.	Atmospheres pressure of CO_2.	Mols. per liter of sat. sol. Total [Ca].	Mols. per liter of sat. sol. Total [CO_2].
1	0.108 = 0.175 gm. $Ca(HCO_3)_2$	4	0.0180	0.1702
2	0.140	6	0.0195	0.240
4	0.182	8	0.0213	0.3103
6	0.211	10	0.023	0.3805
10	0.256	12	0.025	0.4482
14	0.283	14	0.0265	0.4860
18	0.307	16	0.0267	0.5877
25	0.342	18	0.0267	0.6367
35	0.380	20	0.0267	0.7541
56	0.393 = 0.64 gm. $Ca(HCO_3)_2$	24	0.02674	0.8132

CO

In the case of the determinations by Haehnel the mixture was contained in a glass vessel placed inside an autoclave which was shaken six times per hour. By inverting the autoclave the saturated solution was filtered through a thimble into a receiver. Thus the entire operation was conducted at the selected pressure of CO_2. The stability limit at 18° is at 35-40 atmospheres pressure. Different kinds of $CaCO_3$ gave essentially the same results. Equilibrium was approached from above in each case since saturation was first effected at 56 atmospheres pressure and the pressure successively reduced and aliquots withdrawn for analysis. The author also used another apparatus provided with an electrically driven stirrer.

In the case of the determinations by Mitchell a steel bulb, provided with an inner silver lining, was employed. The suspension of the finely divided calcite was stirred by a stream of gas passing through the liquid at the given pressures. The sat. solution was forced out by pressure through a filter of cotton wool. The entire apparatus was kept in an oil bath maintained at 25°. No neutral carbonate was present since in all cases the molecular ratio of CO_2 to Ca in solution, was greater than 2 : 1. This author also gives results for the solubility of mixtures of calcite and magnesium carbonate trihydrate, and for Algerian dolomite in water containing various pressures of CO_2 at 25°.

SOLUBILITY OF CALCIUM CARBONATE IN WATER IN CONTACT WITH CARBON DIOXIDE AT 56 ATMOSPHERES PRESSURE AT DIFFERENT TEMPERATURES.

(Haehnel, 1924.)

The determinations wer made as described above.

t°.	Gms. $CaCO_3$ per 100 gms. sat. sol.	t°.	Gms. $CaCO_3$ per 100 gms. sat. sol.
18	0.393	45	0.339
25	0.403	55	0.255
35	0.380		

THE SOLUBILITY OF CALCIUM CARBONATE IN CO_2 FREE H_2O AT 100°.

(Leick, 1932, 1933.)

The determinations showed that 0.021 gm CaO(= 0.0375 gm. $CaCO_3$)were dissolved per liter. The value varied, however, with the amount of excess of $CaCO_3$ present in the mixture during the period of boiling. It was also found that NaCl and Na_2SO_4 increase, and NaOH and Na_2CO_3 decrease the amount of $CaCO_3$ dissolved. Results are also given for the simultaneous solubility of $CaCO_3$ and $MgCO_3$ at 100°, which show that the dissolved CaO increases about five times and the MgO decreased about ten times when the period of boiling is lengthened from 1½ to 48 hours. The author's experiments are of interest in connection with the purification of boiler waters.

SOLUBILITY OF CALCIUM CARBONATE IN WATER AND IN AQUEOUS SOLUTIONS OF SODIUM SULFATE AT HIGH TEMPERATURES.

(Straub, 1932.)

The author used small steel bombs heated electrically in large boxes. Although analyses showed that equilibrium was reached in 6-10 hours, 90 hours was allowed for each experiment.

Results at:

t° = 182° Millimols per liter		t° = 207° Millimols per liter		t° = 244° Millimols per liter		t° = 316° Millimols per liter	
Ca	SO_4	Ca	SO_4	Ca	SO_4	Ca	SO_4
0.25	0.0	0.14	0.0	0.11	0.0	0.08	0.0
0.27	3.85	0.17	1.18	0.08	3.17	0.07	3.0
0.32	11.85	0.29	3.58	0.11	11.5	0.02	2.65
0.46	17.8	0.25	11.85	0.14	16.4	0.02	11.60
		0.30	17.8			0.02	19.40

CO

SOLUBILITY OF CALCIUM CARBONATE IN AQUEOUS SALT SOLUTIONS AT 23°.

(Askow, 1923.)

Flasks of Jena glass, provided with mercury-sealed stirrers, were used. After constant stirring for several days the Ca in the solution was estimated as oxide or sulfate. The effect of traces of CO_2 is very great since ordinary distilled water gave much higher values than freshly boiled water. Thus :

Ordinary distilled water gave 19.6×10^{-5} gm. mols $CaCO_3$ per liter, and
Gas free » » 13.4×10^{-5} » » »

Salt used.	Gm. mols $CaCO_3 \times 10^{-5}$ per liter of aqueous salt solution of concentration ; $\frac{M}{1000}$.	$\frac{M}{800}$.	$\frac{M}{600}$.	$\frac{M}{500}$.	$\frac{M}{400}$.	$\frac{M}{200}$.	$\frac{M}{150}$.	$\frac{M}{100}$.	$\frac{M}{50}$.
NaCl....	16.1	16.1	17.9	17.9	17.9	24.1	25.0	28.6	52.0
»*	16.3	16.1	16.5	19.1	22.2	28.4	32.1	35.9	69.0
NaBr ...	11.6	12.5	15.2	16.1	17.1	20.5	23.4	25.0	40.9
$NaClO_3$..	17.0	17.9	16.1	16.1	16.1	25.0	27.7	32.0	63.4
$NaNO_3$..	16.1	16.1	17.9	17.9	19.3	28.6	30.4	34.5	67.8
KCl.....	14.3	–	15.0	–	17.0	24.1	25.0	26.8	32.0
KBr.....	15.2	–	16.1	–	–	21.4	»	24.1	41.7

* In ordinary distilled water, instead of frenly boiled distilled water.

Estimations of hydrolysis made by electromotive force measurements are also given.

Data for the solubility of calcium carbonate, obtained with solutions prepared by adding calcium chloride to aqueous mixtures of potassium carbonate and oxalate, are given by Ramann and Sallinger, 1921.

SOLUBILITY OF CALCITE IN SEA WATER. (Wells, 1918.)

In a previous paper (1915) the author showed that the solubility of calcite in water in contact with air is a function of the temperature. In the present case an excess of calcite was suspended in sea water and agitated by a current of out-door air for long intervals at different temperatures, and the dissolved carbonate determined by titration with 0.02 normal $Na\ H\ SO_4$ solution, using methyl orange as the indicator. The results show that « there is a tendency for the colder sea water to retain more carbonate in solution than the warmer sea water.... Ordinary sea water appears to contain so much carbonate that, in contact with the atmosphere at 1° C. it neither has, nor acquires an appreciable solvent action on calcite. »

THE EQUILIBRIUM CONSTANTS FOR AQUEOUS SYSTEMS CONTAINING CALCIUM CARBONATE AND OTHER SALTS AT 38°. (Kugelmass and Shohl, 1924.)

The authors determined the equilibrium constants for the systems (1) $Ca\ CO_3 + Ca\ (H\ CO_3)_2 + CO_2$, (2) $Ca\ CO_3 + Ca\ (H\ CO_3)_2 + Na\ H\ CO_3 + CO_2$ and (3) $Ca\ CO_3 + Ca\ (H\ CO_3)_2 + Ca\ H\ PO_4 + Ca\ (H_2\ PO_4)_2 + CO_2$. The CO_2 tensions varied from 17 to 110 mm. The several constants are discussed in connection with similar values previously obtained by others.

CO

THE SOLUBILITY OF CALCIUM CARBONATE IN AQUEOUS SALT SOLUTIONS AND BIOLOGICAL FLUIDS AT 38°. (Hastings, Murray and Sendroy Jr., 1927.)

It is pointed out that a knowledge of the factors affecting the precipitation and solution of calcium carbonate and calcium phosphate, is necessary for the elucidation of such physiological problems as bone and tooth formation and such pathological problems as rickets and arteriosclerosis. An extensive study has, therefore, been made of the solubility of calcium carbonate, of calcium phosphate and of mixtures of the two in salt solutions and in biological fluids. The experimental data given in this first section of the paper include determinations of the solubility of $CaCO_3$ in aqueous $NaCl$ and $NaHCO_3$ solutions and in aqueous sodium citrate solutions. Results for the solubility in serum are then given and particular attention is paid to the effect upon this solubility of the variation of such factors as time of shaking, concentration of the serum, its calcium and protein content, and the $p_{\mathrm{H}}+$ value of the medium.

SIMULTANEOUS SOLUBILITY OF CALCIUM CARBONATE AND CALCIUM PHOSPHATE IN AQUEOUS SALT SOLUTIONS AND BIOLOGICAL FLUIDS AT 38°.

(Sendroy Jr. and Hastings, 1927.)

Experiments of the general type mentioned above are reported. In the case of the results with serum, it was found that the amount of the two salts dissolved is directly proportional to the serum content of the solution. It was observed that calcium exists in serum in abnormal amounts and is bound to some substance or substances which hold it in solution in unionized form.

Data for the solubility of $CaCO_3$ at 19°-21° in steer serum in contact with different amounts of CO_2 are given by Irving, 1926.

CALCIUM CARBONATE

SOLUBILITY OF MIXTURES OF CALCIUM MAGNESIUM CARBONATE (DOLOMITE) WITH CALCIUM AND MAGNESIUM CARBONATES IN WATER UNDER A PARTIAL PRESSURE OF 1 ATMOSPHERE OF CARBON DIOXIDE.

(Halla, 1935.)

The solid phases consisted of mixtures of naturally occurring minerals in finely divided state, suspended in water through which a current of CO_2 at atmospheric pressure was passed. The saturated solutions were titrated with 0.25n H_2SO_4 and the neutralized solution greatly concentrated and an equal volume of 95% alcohol added. The precipitate thus obtained was filtered, dried, weighed, dissolved in HCl, and the calcium and magnesium separately determined.

Results at 25°			Results at 38°		
Gm. mols. per liter		Solid Phase	Gm. mols. per liter		Solid Phase
Ca	Mg		Ca	Mg	
8.21	2.67	$CaMg(CO_3)_2$ + $CaCO_3$	6.03	2.20	$CaMg(CO_3)_2$ + $CaCO_3$
8.67	3.05	" + "	6.11	2.37	" "
3.41	14.48	" + $MgCO_3$	6.26	2.48	" "
3.73	12.08	" "	2.84	11.37	" + $MgCO_3$
0.30	211.2	" + $MgCO_3.3H_2O$	2.56	10.84	" "
0.17	221.8	" "	0.237	150.9	" + $MgCO_3.3H_2O$
			0.261	148.1	" "

SOLUBILITY OF MIXTURES OF CALCIUM CARBONATE (CALCITE) AND OF CALCIUM SULFATE (GYPSUM) IN WATER AT 25° AND PARTIAL PRESSURE P OF CARBON DIOXIDE.

(Frear and Johnston, 1929.)

Partial pressure of CO_2 in Atm. P	Milligram mols. per 1000 gms. H_2O		Partial pressure of CO_2 in Atm. P	Milligram mols per 1000 gms. H_2O	
	$1000[Ca(HCO_3)_2]$	$1000[CaSO_4]$		$1000[Ca(HCO_3)_2]$	$1000[CaSO_4]$
0.121	3.11	14.43	0.897*	7.40	13.60
0.167*	3.56	14.24	0.916*	7.53	13.41
0.270	4.34	13.99	0.957	7.51	13.20
0.431	5.31	13.48	0.963	7.55	13.20
0.598	6.22	13.25	0.960	7.55	12.98
0.652	6.42	13.27	0.953	7.58	13.17
0.728*	6.71	13.41	0.966	7.85	8.51
0.770*	6.95	13.46	0.962	8.30	4.13

The determinations marked * were made in an apparatus in which a mixture of air and CO_2 was made to pass continually through the system by means of a motor driven mercury circulating pump. The others were made in a special form of apparatus which permitted the solution to pass repeatedly back and forth through a filter containing the solid phase, so that the movement of the liquid provides the pump action for circulating the gas. In the case of the last two results in the table the solutions were not saturated with respect to calcium sulfate.

SOLUBILITY OF CALCIUM CARBONATE IN AQUEOUS SOLUTIONS OF ALBUMIN AND GLOBULIN AT 25°.

(Pauli and Stenzinger, 1929.)

Solvent	Gms. $CaCO_3$ per 100 gms. sat. sol.
Water	0.0011
0.5% aq. Seralbumin	0.0139
0.5% aq. Pseudoglobulin	0.0074
0.5% aq. Hemoglobulin	0.0067

Determinations of the solubility of Bone in aqueous solutions of magnesium salts (Forbes, 1931), made by digesting, with periodic shaking, finely chopped and washed, air dried beef rib bone, in pure water and in various buffer solutions containing increasing amounts of $MgCl_2$ and $MgSO_4$, showed that the amount of bone calcium in water solutions is greatly increased by magnesium salts. Increasing the calcium and phosphate concentration of the original solution decreases the dissolving action of the magnesium salts, especially at low temperatures.

SOLUBILITY OF MIXTURES OF CALCIUM CARBONATE AND CALCIUM SULFATE (ANHYDRITE) IN WATER AT HIGH TEMPERATURES.

(Clark and Hunter, 1936.)

CO The determinations were made in connection with the study of Scale formation from boiler waters. A two liter steel rotary converter (bomb) heated by a gas burner was used. The temperature was measured with a calabrated chrōmel-alumel couple. The samples were withdrawn through a copper capillary cooling coil. Total solids were determined by evaporation and weighing the deposit after drying at 150°.

t°	Gms. per 1000 gms. H_2O				t°	Gms. per 1000 gms. H_2O			
	Total solids	Ca	SO_4	CO_3		Total solids	Ca	SO_4	CO_3
159	0.210	0.058	0.131	0.006	206	0.075	0.022	0.0359	0.011
159	0.208	0.060	0.128	0.012	225	0.048	—	0.0216	0.009
178	0.139	0.041	0.076	0.013	241	0.040	—	0.0146	0.008
195	0.095	0.028	0.046	0.013	252	0.032	—	0.0117	0.008

The authors also give similar determinations for the solubility of $CaCO_3 + CaSO_4$ in aqueous solutions of Na_2SO_4, Na_2CO_3, NaCl and NaOH. The results show that the ratio of CO_3/SO_4 is greatly reduced by sodium sulfate and much less so by sodium chloride. Sodium hydroxide increases the sodium sulfate concentration at equilibrium and thus also reduces the CO_3/SO_4 ratio.

SOLUBILITY OF CALCIUM CARBONATE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AND OF POTASSIUM SULFATE AT 25°. (Cameron and Robinson, 1907.)

Results for Aqueous KCl:				Results for Aqueous K_2SO_4:			
In contact with air.		In contact with 1 atmosphere of CO_2.		In contact with air.		In contact with 1 atmosphere of CO_2.	
Gms. per 100 Gms. Sat. Sol.		Gms. per 100 Gms. Sat. Sol.		Gms. per 100 Gms. Sat. Sol.		Gms. per 100 Gms. Sat. Sol.	
KCl.	$CaCO_3$.	KCl.	$CaCO_3$.	K_2SO_4.	$CaCO_3$.	K_2SO_4	CaO.
0	0.0013	0	0.062	1.60	0.0104	0.69	0.69
3.9	0.0078	3.9	0.145	3.15	0.0116	1.37	0.69
7.23	0.0078	7.23	0.150	4.73	0.0132	1.67	0.47*
13.82	0.0072	13.82	0.165	6.06	0.0148	2.18	0.30*
18.21	0.0070	18.21	0.154	8.88	0.0192	2.99	0.24*
26	0.0060	26	0.126	10.48	0.0188		

* Solid phase syngenite.

The results of Cameron and co-workers are considered by Frear and Johnston, 1929, to be of only qualitative significance since the experimental conditions were insufficiently controlled.

One liter aqueous solution containing 223.8 gms. KCl dissolves 0.075 gm. calcite at 60°.

One liter aqueous solution containing 223.8 KCl dissolves 0.093 gm. aragonite at 60°. (Warynski and Kouropatwinska, 1916.)

In an attempt to ascertain whether salts of potassium are fixed in the soil by their action upon calcium carbonate according to the reversible reaction $CaCO_3 + 2KCl \rightleftarrows K_2CO_3 + CaCl_2$ Dubrisay and Francois, 1931, showed that aqueous solutions of KCl of increasing concentration, saturated with calcium carbonate in absence of CO_2, required increasing amounts of N/3 H_2SO_4 to neutralize their alkalinity.

SOLUBILITY OF CALCIUM CARBONATE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE.

Results at 12°-18°. (Cantoni and Goguelia, 1905.) (Flasks allowed to stand 98 days.)

Gms. per Liter Sat. Sol.	
NH_4Cl.	$CaCO_3$.
53.5	0.423
100	0.609
200	0.645

Results at 25°. (Rindell, 1910.) (Constant agitation 24 hrs.)

Gms. per Liter Sat. Sol.	
NH_4Cl.	$CaCO_3$.
6.7	0.285
13.4	0.373
26.8	0.502
53.5	0.678

Results at 60° for Calcite and Aragonite. (Warynski and Kouropatwinska, 1916.)

Gms. per Liter.		Gms. per Liter.	
NH_4Cl.	Calcite.	NH_4Cl.	Aragonite.
0	0.028	0	0.041
1.07	0.164	1.07	0.184
5.35	0.333	5.35	0.371
10.70	0.453	10.70	0.505
26.76	0.664	26.76	0.728
53.52	0.934	53.52	1.015
160.56	1.21	160.56	1.36

SOLUBILITY OF CALCIUM CARBONATE IN AQUEOUS SOLUTIONS OF AMMONIUM NITRATE AND OF TRIAMMONIUM CITRATE.

In Aq. NH_4NO_3 at 18°. (Berju and Kosminiko, 1904.)

Gms. per Liter Sat. Sol.	
NH_4NO_3.	$CaCO_3$.
0	0.131
5	0.211
10	0.258
20	0.340
40	0.462
80	0.584

In Aq. NH_4NO_3 at 25°. (Rindell, 1910.)

Gms. per Liter Sat. Sol.	
NH_4NO_3.	$CaCO_3$.
5	0.200
10	0.278
20	0.383
40	0.526

In Aq. Triammonium Citrate at 25°, (Rindell, 1910.)

Mols. Citrate per Liter.	Gms. $CaCO_3$ per Liter.
0.0625	1.492
0.125	2.264
0.250	3.980
0.500	6.687

SOLUBILITY OF CALCIUM CARBONATE IN AQUEOUS SOLUTIONS OF MAGNESIUM CHLORIDE, MAGNESIUM SULFATE, SODIUM CHLORIDE AND SODIUM SULFATE UNDER CO_2 PRESSURE OF TWO ATMOSPHERES. (Ehlert and Hempel, 1912.)

Aq. Salt Solution.	t°.	Gms. Hydrated Salt per 1000 Gms. H_2O.	Gms. $CaCO_3$ per 1000 cc. Solvent.	Aq. Salt Solution.	t°.	Gms. Hydrated Salt per 1000 Gms. H_2O	Gms. $CaCO_3$ per 1000 cc. Solvent.
$MgCl_2.6H_2O$	5	0	2.337	NaCl	5	50	3.740
"	5	6.1	2.352	"	5	86	3.783
"	5	50	3.404	"	5	106.9	3.690
"	5	86.9	4.083	"	5	175.6	3.350
"	5	350	3.301	"	5	263.4	2.811
"	5	700	2.736	"	8	351.2	2.163
"	5	1150	2.205	$MgSO_4.7H_2O$	14	105.3	2.177
"	5	1725	1.706	"	14	(sat.)	0.914
"	5	2300 sat.	1.406	$Na_2SO_4.10H_2O$	14	137.7	1.406
NaCl	5	28	3.280	"	14	(sat.)	1.920

SOLUBILITY OF CALCIUM CARBONATE IN AQUEOUS SOLUTIONS OF SODIUM CARBONATE AT VARIOUS TEMPERATURES.

(Bury and Redd, 1933.)

At the lower temperatures the three components were rotated in tubes for 7-14 days. At the higher temperatures they were stirred in a bottle fixed in a thermostat. The saturated solutions and solid phases were analyzed. The amount of $CaCO_3$ in the sat. solutions was too small to be determined.

CO

t°	Gms. Na_2CO_3 per 100 gms. sat. sol.	Solid Phase	t°	Gms. Na_2CO_3 per 100 gms. sat. sol.	Solid Phase	t°	Gms. Na_2CO_3 per 100 gms. sat. sol.	Solid Phase
15	8.91	C	30	21.68*	P	37.5	32.97	P + M
"	12.10	C	35	7.0	C	39	21.26	C + G
"	14.11	C + G	"	16.90	C	"	25.72	G + P
"	14.12	G + D	"	18.91	C	"	27.35	P
"	16.78*	G	"	19.49	C + G	45	11.40	C
"	22.51*	G	"	20.86	G	"	18.15	C
20	14.81	C + G	"	23.10	G	"	22.18	C + P
25	6.86	C	"	28.01	G	"	23.74	P
"	12.33	C	"	30.09	G	"	27.87	P
"	14.65	C	"	32.88	C + H	"	30.31	P
"	15.81	C + G	37.5	18.14	C	"	32.15	P
"	16.49	G	"	19.87	C	"	32.46	P + M
"	18.03	G	"	20.53	C + G	55	23.07	C + P
"	20.30	G	"	23.16	G	65	24.02	C + P
"	22.63	G + D	"	26.32	G	75	24.93	C + P
"	19.84*	C	"	29.26	G	85	25.87	C + P
"	20.52*	C + P	"	32.43	G + P	95	26.81	C + P
"	21.14*	P	"	32.68	P	15	14.11	C + G + D
30	16.20	C	"	21.48*	C + P	22.5	20.4	C + G + D
"	17.42	C + G	"	24.62*	P	40.0	21.7	C + G + P
"	18.78	G	"	27.81*	P	37.3	33.0	G + P + D
"	20.05*	C	"	31.37*	P	103.2	27.5	C + P
"	20.90*	C + P						

C = $CaCO_3$; G = Gaylussite, $CaCO_3.Na_2CO_3.5H_2O$; P = Pirssonite, $CaCO_3.Na_2CO_3.2H_2O$; D = $Na_2CO_3.10H_2O$; H = $Na_2CO_3.7H_2O$; M = $Na_2CO_3.H_2O$.
* denotes metastable equilibrium.

SOLUBILITY OF CALCIUM CARBONATE IN AQUEOUS SOLUTIONS OF SODIUM CARBONATE AT 13°.

(Pratolongo, 1924.)

Gms. per liter of sat. sol.		
Na_2CO_3.	$CaCO_3$	Solid phase.
0.0	0.013	Calcite
10 0	0.007	»
50.0	0.005	Gay Lussite-$Na_2CO_3.CaCO_3$
150.0	0.000	Na_2CO_3

CALCIUM CARBONATE

SOLUBILITY OF CALCIUM CARBONATE (CALCITE) IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AT 25°.

(Frear and Johnston, 1929.)

A stream of CO_2 was bubbled through the salt solution containing suspended $CaCO_3$. In solutions more concentrated than shown below equilibrium was not attained even after a week.

Partial pressure of CO_2 in Atm. p	Milligram molecules per 1000 gms. H_2O		Partial pressure of CO_2 in Atm. p	Milligram molecules per 1000 gms. H_2O	
	$1000[Ca(HCO_3)_2]$	$1000[NaCl]$		$1000[Ca(HCO_3)_2]$	$1000[NaCl]$
0.965	8.96	3.79	0.963	12.34	297.
0.965	9.37	14.8	0.953	14.73	599.
0.965	9.67	34.8	0.968	14.67	816.
0.962	10.70	82.8	0.955	15.55	878.
0.958	12.41	236.	0.953	14.55	1089.
			0.968	16.18	1154.

SOLUBILITY OF CALCIUM CARBONATE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AT 25°.

Solutions in contact with.

CO_2 Free Air. (Cameron, Bell and Robinson, 1907.)		Ordinary Air. (Cameron and Seidell, 1902.)		CO_2 at One Atmos. Pressure. (Cameron, Bell and Robinson, 1907.)	
Gms. per 100 Gms. H_2O.		Gms. per 100 cc. Sat. Sol.		Gms. per 100 Gms. H_2O.	
NaCl.	$CaCO_3$.	NaCl.	$CaCO_3$.	NaCl.	$CaCO_3$.
1.60	0.0079	1	0.0112	1.49	0.150
5.18	0.0086	4	0.0140	5.69	0.160
9.25	0.0094	8	0.0137	11.06	0.174
11.48	0.0104	10	0.0134	15.83	0.172
16.66	0.0106	15	0.0119	19.62	0.159
22.04	0.0115	20	0.0106	29.89	0.123
30.50	0.0119	25	0.0085	35.85	0.103

Data for the solubility of calcium carbonate in aqueous solutions of mixtures of sodium chloride and sodium sulfate in contact with air and with CO_2 are given by Cameron, Bell and Robinson (1907).

Data for solubility of $CaCO_3$ in aqueous NaCl and other salt solutions, determined by boiling and cooling the solution, are given by Gothe (1915).

Data for the solubility of mixtures of calcium carbonate and calcium sulfate in aqueous solutions of sodium chloride at 25° are given by Cameron and Seidell (1901).

Data for the solubility of mixtures of calcium carbonate and calcium sulfate in aqueous solutions of mixtures of sodium chloride and sodium sulfate at 25°, in contact with air and with CO_2, are given by Cameron, Bell and Robinson (1907).

The results of Cameron and co-workers are considered by Frear and Johnston, 1929, to be of only qualitative significance since the experimental conditions were insufficiently controlled.

One liter aqueous solution containing 175.5 gms. NaCl dissolves 0.062 gm. calcite at 60°.

One liter aqueous solution containing 175.5 gms. NaCl dissolves 0.071 gm. aragonite at 60°.

(Warynski and Kouropatwinska, 1916.)

SOLUBILITY OF CALCIUM CARBONATE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE IN CONTACT WITH CO_2 FREE AIR.

(LeBlanc and Novotny, 1906.)

Solvent.	Gms. $CaCO_3$ per Liter Sat. Sol. At 18°.	Gms. $CaCO_3$ per Liter Sat. Sol. At 95°-100°.
Water	0.0128	0.0207
About 0.0001 *n* NaOH	0.0087	0.0096
" 0.0010 *n* "	0.0042	0.0069
" 0.0100 *n* "	0.0042	0.0057

Data on the equilibrium in aqueous solutions of $CaCO_3$, Na_2CO_3 and NaOH are given by Wegscheider and Walter (1907).

SOLUBILITY OF CALCIUM CARBONATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE.

Solutions in contact with:

CO_2 Free Air at 25°. (Cameron, Bell and Robinson, 1907.) Gms. per 100 Gms. H_2O. Na_2SO_4.	Gms. per 100 Gms. H_2O. $CaCO_3$.	Ordinary Air at 24°. (Cameron and Seidell, 1902.) Gms. Na_2SO_4 per Liter.	Gms. Total Ca per Liter Calc. as $Ca(HCO_3)_2$.
0.97	0.0151	5	0.175
1.65	0.0180	10	0.232
4.90	0.0262	20	0.277
12.69	0.0313	40	0.332
14.55	0.0322	80	0.400
19.38	0.0346	150	0.510
23.90	0.0360	250	0.725

CO

Fusion-point data have been determined for:

$CaCO_3 + CaCl_2$	(Sackur, 1911-12.)
$CaO + CO_2 + Na_2O + K_2O + TiO_2 + SiO_2$	(Niggli, 1916-19.)
$CaCO_3 + CaO$	(Smyth and Adams, 1923.)
$CaCO_3 + CaSiO_3$	(Eitel, 1922-1923.)
$CaCO_3 + NaAlSiO_4$	" " "
$CaCO_3 + Na_2CO_3$	(" 1925.)
$CaCO_3 + Li_2CO_3$	(Skatiks, 1928.)

CALCIUM Camphor CARBONATE $Ca(C_{10}H_{15}O.CO_2)_2$

SOLUBILITY IN WATER AND OTHER SOLVENTS.

(Picon, 1931.)

The compound was prepared by precipitating aqueous 10 percent sodium camphor carbonate with 10 percent calcium chloride solution at about 95°. The following results for other solvents than water and alcohols were obtained with calcium camphor carbonate which had been boiled with benzene. This treatment was found to render the compound soluble in a number of solvents in which it is insoluble before treatment with benzene.

Solvent	t°	Gms. $Ca(C_{11}H_{15}O_3)_2$ per liter sat. sol.	Solvent	t°	Gms. $Ca(C_{11}H_{15}O_3)_2$ per liter sat. sol.
Water	5.5	8.53	Chloroform	14	49.6
Methyl alcohol	5.5	1.64	Carbon tetrachloride	15	96.75
Ethyl alcohol	5.5	2.35	Carbon disulfide	15	183.05
Ethyl acetate	15.0	18.85	Petroleum ether	14	5.12
Benzene	5.5	132.0	Petroleum	14	6.8

CALCIUM OXALATE $Ca(COO)_2.H_2O$.

SOLUBILITY IN WATER, BY ELECTROLYTIC CONDUCTIVITY METHOD.

(Holleman, Kohlrausch, and Rose, 1893; Richards, McCaffrey, and Bisbee, 1901.)

t°.	Gms. CaC_2O_4 per Liter of Solution.	t°.	Gms. CaC_2O_4 per Liter of Solution.
13	0.0067 (H)	25	0.0068 (R, McC and B)
18	0.0056 (K and R)	50	0.0095 "
24	0.0080 (H)	95	0.0140 "

The following additional determinations have been reported.

t°	Gms. CaC_2O_4 per liter sat. solution	Authority
18	0.0060	(Scholder, Gadenne and Niemann, 1937.)
20	0.0066	(Aumeras, 1927.)
20	0.0073	" "
25	0.0082	(Bassett, 1934.)
37	0.0071	(Hammarsten, 1929.)
45	0.0090	(Aumeras, 1927.)
55	0.0100	" "
65	0.0120	" "

The solubility product of calcium oxalate is given by Ruff, 1929, as 1.78×10^{-9}.

COO

SOLUBILITY OF CALCIUM OXALATE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 25°.

(Henderson and Taylor, 1916.)

Normality of HCl.	Gms. CaC_2O_4 per Liter Sat. Sol.	Normality of HCl.	Gms. CaC_2O_4 per Liter Sat. Sol.
0	0.009	0.500	2.638
0.125	0.717	0.625	3.319
0.250	1.359	0.750	3.922
0.375	2.019	1	5.210

These authors also give data showing the effect of increasing amounts of KCl and KNO_3 upon the solubility of calcium oxalate in 0.5 normal HCl at 25°, and also of the effect of increasing amounts of potassium trichloracetic acid upon the solubility in 0.5 normal trichloracetic acid, and of increasing amounts of potassium monochloracetic acid upon the solubility of calcium oxalate in 0.5 normal monochloracetic acid.

Determinations of the solubility of calcium oxalate in dilute HCl made by a titration method are reported by Aumeras, 1927. The author mixed measured volumes of 0.1 normal solutions of oxalic acid and of calcium chloride, and added successive amounts of normal hydrochloric acid, until the precipitate of calcium oxalate just disappeared. He gave results showing the influence of excess of oxalic acid, of calcium chloride and of increase in temperature, upon the solubility of calcium oxalate measured in this manner.

This system was also studied by Trapp, 1935. Increasing amounts of calcium chloride and oxalic acid were added to mixtures of these compounds and water, shaken together at 20°. The results are expressed in terms of volume of standard sodium hydroxide and potassium permanganate required for a given weight of the sat. solution.

SOLUBILITY OF CALCIUM OXALATE IN AQUEOUS SOLUTIONS OF ACETIC ACID AT 26°-27°.

(Herz and Muhs, 1903.)

Normality of Acetic Acid.	G. CH_3COOH per 100 cc. Sol.	Residue from 50.052 cc. Solution.
0	0.00	0.0017
0.58	3.48	0.0048
2.89	17.34	0.0058
5.79	34.74	0.0064

The residues were dried at 70° C.

SOLUBILITY OF CALCIUM OXALATE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AND OF SODIUM PHOSPHATE.

(Gerard, 1901.)

Salt in Aq. Solution.	Gms. Salt per Liter.	t°.	Gms. CaC_2O_4 per Liter.	Salt in Aq. Solution.	Gms. Salt per Liter.	t°.	Gms. CaC_2O_4 per Liter
NaCl	1	25	0.0075	NaCl	25	37	0.0414
"	5	25	0.0188	$Na_2H(PO_4)_2$	4.8	15	0.016
"	10	25	0.0255	"	4.8	37	0.033
"	25	25	0.0291				

COO One liter 45% ethyl alcohol dissolves 0.000525 gm. calcium oxalate, temp. not stated. (Guerin, 1912)

SOLUBILITY OF CALCIUM OXALATE IN AQUEOUS SALT SOLUTIONS AT 18-20°.

(Maljaroff and Gluschakoff, 1933.)

An excess of precipitated, washed and air dried calcium oxalate was shaken from time to time with each salt solution, until successive titrations of the supernatant solution with standard permanganate, showed no further change.

Gms. salt per 100 gms. aq. solvent	Gms. CaC_2O_4 per liter sat. solution in Aq.:					
	$MgCl_2$	$MgSO_4$	NH_4Cl	NH_4NO_3	$(NH_4)_2SO_4$	NaCl
0.312	0.0322	0.0375	0.0092	0.0059	0.0059	—
0.625	0.0556	0.0682	0.0162	0.0077	0.0077	—
1.25	0.1049	—	0.0216	0.0097	0.0094	0.0019
2.50	0.1732	0.1855	0.0291	0.0115	0.0112	0.0024
5.00	0.2812	0.3501	0.0373	0.0158	0.0129	0.0030
10.00	0.4649	0.5256	0.0437	0.0221	0.0153	0.0036

One liter aq. 1.99 normal NH_3 solution dissolves 0.0297 gm. CaC_2O_4 at 25°.

One liter aq. 2.12 normal NH_3 solution dissolves 0.0385 gm. CaC_2O_4 at 25°. (Bassett, 1934.)

SOLUBILITY OF CALCIUM OXALATE IN AQUEOUS SALT SOLUTION AT 37°.

(Hammarsten, 1929.)

Gm. mols. salt per liter aq. solvent	Gm. mols. $CaC_2O_4 \times 10^{-5}$ per liter sat. sol. in aq: KCl	LiCl	NaCl
0.0	5.55	5.55	5.55
0.001	—	—	6.75
0.005	7.9	8.1	8.20
0.01	9.7	6.9	9.15
0.02	10.3	9.9	10.25
0.04	11.3	12.4	11.98
0.10	15.6	15.0	16.10
0.20	19.6	19.9	19.2
0.40	—	—	25.7
0.60	—	—	29.4

The pH of the above solutions was approx. 6.5 in all cases.

Gm. mols. salt per liter aq. solvent	Gm. mols. $CaC_2O_4 \times 10^{-5}$ per liter sat. sol. in aq: K_2SO_4	$MgCl_2$	NaH_2PO_4	Na_2HPO_4
0.002	6.9 (10.7)	15.4(7.0)	—	11.1
0.004	6.5 (11.7)	20.7(6.5)	7.9(5.4)	14.3
0.008	—	28.5(7.0)	8.8(5.1)	135.9
0.012	—	—	—	186.5
0.016	6.8 (15.4)	40.3(7.0)	8.8(5.1)	231.2
0.024	6.7 (17.8)	—	—	—
0.032	6.8((19.5)	57.2(6.7)	10.6(5.0)	364.5
0.047	—	—	11.2(5.0)	—
0.098	—	—	15.9(5.0)	—

COO

The figures in parentheses show the pH of the solutions. Results are also given for the solubility of calcium oxalate in phosphate buffer solutions and mixturesof some of the above salts.

SOLUBILITY OF CALCIUM OXALATE IN AQUOUS SOLUTIONS OF URANYL OXALATE AND VICE VERSA.

(Colani, 1934.)

Weighed amounts of calcium oxalate and uranyl oxalate were added to a given volume of water and the mixtures agitated until attaiment of equilibrium. The supernatant solutions were analyzed gravimetrically. This method is not sufficiently accurate for the determination of the solubility of the alkaline earth oxalates, but due to the considerable increase in the solubility of these oxalates, by very small quantities of uranyl oxalate, it yields satisfactorily concordant results.

Results at 15°

Gms. per 100 gms. sat. sol. $UO_2C_2O_4$	CaC_2O_4	Solid Phase
0.088	0.075	$CaC_2O_4 \cdot H_2O$
0.137	0.079	"
0.260	0.011	"
0.469	0.012	$UO_2C_2O_4 \cdot 3H_2O$
0.470	0.000	"

Results at 50°

Gms. per 100 gms. sat. sol. $UO_2C_2O_4$	CaC_2O_4	Solid Phase
0.239	0.017	$CaC_2O_4 \cdot H_2O$
0.924	0.037	"
1.04	0.038	"
1.07	0.044	$UO_2C_2O_4 \cdot 3H_2O$
0.996	0.022	"
1.00	0.0	"

SOLUBILITY OF CALCIUM OXALATE IN AQUEOUS SOLUTIONS OF UREA AT 25°.

(Pedersen, 1939.)

Gm. Mols. per liter sat. sol.			Solid Phase
$CO(NH_2)_2$	CaC_2O_4 (Obs.)	CaC_2O_4 (calc.)*	
0.0	4.84×10^{-5}	4.84×10^{-5}	$CaC_2O_4.H_2O$
0.25	4.85 "	5.06 "	"
0.50	4.87 "	5.27 "	"
0.75	4.90 "	5.48 "	"
1.00	5.02	5.79	"
2.00	5.23	6.69	"

* The calc. values were obtained by applying a correction to the observed values for 1.66×10^{-5} mol. Ca per mol. of urea estimated to be present in the sample of urea used for the determinations.

CALCIUM CHLORIDE $CaCl_2$.

Cl

SOLUBILITY IN WATER

(Roozeboom — Z. physik. Chem. 4, 42, '89; see also Mulder; Ditté — Compt. rend. 92, 242, '81; Engel — Ann. chim. physic. [6] 13, 381, '88; Etard — *Ibid.* [7] 2, 532, '94.)

t°.	Gms. $CaCl_2$ per 100 Gms. Water.	Gms. $CaCl_2$ per 100 Gms. Solution.	Solid Phase.	t°.	Gms. $CaCl_2$ per 100 Gms. Water.	Gms. $CaCl_2$ per 100 Gms. Solution.	Solid Phase.
−55	42.5	29.8	Ice + $CaCl_2.6H_2O$	60	136.8	57.8	$CaCl_2.2H_2O$
−25	50.0	33.3	$CaCl_2.6H_2O$	70	141.7	58.6	$CaCl_2.2H_2O$
0	59.5	37.3	$CaCl_2.6H_2O$	80	147.0	59.5	$CaCl_2.2H_2O$
10	65.0	39.4	$CaCl_2.6H_2O$	90	152.7	60.6	$CaCl_2.2H_2O$
20	74.5	42.7	$CaCl_2.6H_2O$	100	159.0	61.4	$CaCl_2.2H_2O$
30.2	102.7	50.7	$CaCl_2.6H_2O$	120	173.0	63.4	$CaCl_2.2H_2O$
20	91.0	47.6	$CaCl_2.4H_2O\alpha$	140	191.0	65.6	$CaCl_2.2H_2O$
29.8	100.6	50.1	$.4H_2O\alpha + .6H_2O$	160	222.5	69.0	$CaCl_2.2H_2O$
40	115.3	53.4	$.4H_2O\alpha$	170	255.0	71.8	$CaCl_2.2H_2O$
20	104.5	51.1	$CaCl_2.4H_2O\beta$	175.5	297.0	74.8	$CaCl_2.2H_2O$ + $CaCl_2.H_2O$
29.2	112.8	53.0	$.4H_2O\beta + .6H_2O$	180	300.0	75.0	$CaCl_2.H_2O$
35	122.5	55.0	$.4H_2O\beta$	200	311.0	75.7	$CaCl_2.H_2O$
38.4	127.5	56.0	$.4H_2O\beta + CaCl_2.2H_2O$	235	332.0	76.8	$CaCl_2.H_2O$
45.3	130.2	56.6	$.4H_2O\alpha + CaCl_2.2H_2O$	260	347.0	77.6	$CaCl_2.H_2O$

Density of saturated solution at 0° = 1.367, at 15° = 1.399, at 18° = 1.417; at 25° = 1.47.

THE ICE CURVE FOR MIXTURES OF CALCIUM CHLORIDE AND WATER.

(Klein and Svanberg, 1920; Rodebush, 1918.)

t° of f. pt.	Gms. $CaCl_2$ per 100 gms. H_2O	t°. of f. pt.	Gms. $CaCl_2$ per 100 gms. H_2O
0.486	0.555*	-15.23	22.02
1.227	1.387*	29.83	34.87
2.626	2.775*	31.25	36.04
4.21	8.51	51.0 (Eutec.	48.00
8.63	14.83		

* These results by Klein and Svanberg are gms. $CaCl_2$ per 100 cc. solution instead of 100 gms. H_2O.

100 gms. sat. solution of $CaCl_2.6H_2O$ in water contain 46.08 gm. $CaCl_2$ at 25°. (Benrath, 1927.)

SOLUBILITY OF THE TETRAHYDRATES OF CALCIUM CHLORIDE IN WATER.

(Roozeboom, 1889; Bassett, Barton, Foster and Pateman, 1933.)

In addition to the two tetrahydrates reported by Roozeboom a third one has now been found by Bassett and co-workers. This has been designated $CaCl_2.4H_2O\ \beta$ and the one formerly given this designation by Roozeboom now becomes $CaCl_2.4H_2O\ \gamma$. The following results were read from the curves drawn by plotting the original determinations. Information in regard to the crystalline characteristics of the three forms of calcium chloride tetrahydrate are given by Bassett, Gordon and Henshall, 1937.

t^0	Gms. $CaCl_2$ per 100 gms. sat. solution in contact with:			
	$CaCl_2.6H_2O$	$CaCl_2.4H_2O\ \alpha$	$CaCl_2.4H_2O\ \beta$	$CaCl_2.4H_2O\ \gamma$
0	37.3	—	—	—
10	39.3	—	—	—
20	42.7	47.5*	50.0*	51.1*
25	45.3	48.7*	51.2*	52.1*
27.5	47.2	49.3*	51.8*	52.7*
29.0	48.5	49.7*	52.1*	53.0(1)
29.5	49.1	49.8*	52.3(2)	53.2
30.2	50.1(3)	50.1(3)	52.5	53.5
32.5	—	50.7	53.1	54.0
35.0	—	51.5	53.9	54.8
37.5	—	52.4	54.7	55.7
38.5	—	52.7	55.1	56.0(4)
40.0	—	53.4	55.9	56.2(7)
41.0	—	53.8	56.3(5)	—
45.1	—	56.6(6)	—	—

Metastable equilibrium

(1) Tr.pt. $CaCl_2.6H_2O + CaCl_2.4H_2O\ \gamma$; (2) Tr.pt. $CaCl_2.6H_2O + CaCl_2.4H_2O\ \beta$;
(3) Tr.pt. $CaCl_2.6H_2O + CaCl_2.4H_2O\ \alpha$; (4) Tr.pt. $CaCl_2.2H_2O + CaCl_2.4H_2O\ \gamma$;
(5) Tr.pt. $CaCl_2.2H_2O + CaCl_2.4H_2O\ \beta$; (6) Tr.pt. $CaCl_2.2H_2O + CaCl_2.4H_2O\ \alpha$;
(7) Solid phase is $CaCl_2.2H_2O$.

SOLUBILITY OF CALCIUM CHLORIDE IN AQUEOUS SOLUTIONS OF CALCIUM HYPOCHLORITE AT 0° AND VICE VERSA.

(O'Connor, 1927.)

$d\frac{0}{4}$ of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	$d\frac{C}{4}$ of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$Ca(ClO)_2$	$CaCl_2$			$Ca(ClO)_2$	$CaCl_2$	
1.370	0.0	37.6	$CaCl_2.6H_2O$	1.270	8.8	19.4	$Ca(ClO)_2.3H_2O$
1.382	1.6	36.9	"	1.255	11.0	15.4	"
1.388	2.6	36.4	"$+Ca(ClO)_2.3H_2O$	1.238	14.0	10.8	"
1.366	2.9	34.0	$Ca(ClO)_2.3H_2O$	1.234	16.1	8.4	"
1.333	4.2	30.7	"	1.228	18.6	5.3*	"
1.322	4.5	28.5	"	1.220	19.6	3.1	"
1.285	7.4	22.2	"	1.213	21.8	0.0	"

SOLUBILITY OF CALCIUM CHLORIDE IN AQUEOUS SOLUTIONS OF CALCIUM CHLORATE AT 20° AND VICE VERSA.

(Mazzetti, 1929.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$Ca(ClO_3)_2$	$CaCl_2$		$Ca(ClO_3)_2$	$CaCl_2$	
0.0	42.7	$CaCl_2.6H_2O$	33.47	28.29	$CaCl_2.4H_2O+Ca(ClO_3)_2.2H_2O$
6.74	39.49	" "	42.85	19.67	$Ca(ClO_3)_2.2H_2O$
10.56	37.35	"	49.61	12.83	"
15.13	35.83	"	53.57	10.34	"
22.88	33.84	"$+CaCl_2.4H_2O$	58.74	7.16	"
29.23	31.46	$CaCl_2.4H_2O$	66.16	0.0	"

SOLUBILITY OF CALCIUM CHLORIDE IN AQUEOUS SOLUTIONS OF CALCIUM CHLORATE AT 25° AND VICE VERSA.

(Ehret, 1932.)

Cl

d_{25} sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d_{25} sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$Ca(ClO_3)_2$	$CaCl_2$			$Ca(ClO_3)_2$	$CaCl_2$	
1.453	0.0	44.92	$CaCl_2.6H_2O$	1.641	22.14	35.59	$CaCl_2.4H_2O$
1.490	2.36	43.26	"	1.659	25.20	34.69	"
1.480	3.85	44.06	"	1.718	30.11	31.51	"
1.544	8.85	42.60	"$+CaCl_2.4H_2O$	1.725	32.01	31.49	"
1.570	10.70	41.22	$CaCl_2.4H_2O$	1.744	33.36	30.65	"$+Ca(ClO_3)_2.2H$
1.565	12.12	41.70	"	1.735	33.01	30.43	$Ca(ClO_3)_2.2H_2$
1.578	12.29	40.15	"	1.733	34.71	29.21	"
1.580	13.41	40.53	"	1.730	36.02	28.15	"
1.603	16.55	38.82	"	1.731	44.59	19.19	"
1.614	16.91	37.92	"	1.751	53.45	10.31	"
1.607	17.69	38.17	"	1.767	58.65	5.86	"
1.618	19.65	37.75	"	1.781	66.05	0.00	"
1.625	21.52	36.91	"				

EQUILIBRIUM IN THE SYSTEM CALCIUM CHLORIDE, CALCIUM OXIDE AND WATER AT 0°.

(O'Connor, 1927.)

$d\frac{0}{4}$ of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	$d\frac{0}{4}$ of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	CaO	$CaCl_2$			CaO	$CaCl_2$	
1.370	0.0	37.6	$CaCl_2.6H_2O$	1.133	0.164	15.2	1.3.16
1.338	0.190	34.9	1.3.16	1.111	0.172	12.5	"
1.280	0.152	29.7	"	1.089	0.186	10.2	"
1.265	0.138	28.0	"	1.067	0.212	7.6	"
1.240	0.142	25.6	"	1.056	0.216	6.8	"$+Ca(OH)_2$
1.213	0.145	22.8	"	1.048	0.226	5.5	$Ca(OH)_2$
1.186	0.148	20.0	"	1.025	0.214	2.7	"
1.155	0.152	17.4	"				

1.3.16 = $CaCl_2.3CaO.16H_2O$

EQUILIBRIUM IN THE SYSTEM CALCIUM CHLORIDE, CALCIUM NITRATE AND WATER AT 30°.

(Barhaudy, 1923.)

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
$CaCl_2$.	$Ca(NO_3)_2$.		$CaCl_2$.	$Ca(NO_3)_2$.	
45.0	10.81	$CaCl_2.4H_2O\alpha$	10.7	54.4	$Ca(NO_3)_2.4H_2O$
44.7	11.45	»	11.05	53.4	»
42.35	17.03	»	7.27	52.9	»
7.57	65.26	$Ca(NO_3)_2.4H_2O$	4.6	55.0	»

SOLUBILITY OF CALCIUM CHLORIDE IN AQUEOUS SOLUTIONS OF CALCIUM NITRATE AT 25° AND VICE VERSA.

(Ehret, 1932.)

d_{25} of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d_{25} of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$Ca(NO_3)_2$	$CaCl_2$			$Ca(NO_3)_2$	$CaCl_2$	
1.453	0.0	44.92	$CaCl_2.6H_2O$	1.692	41.92	21.75	1.1.4.
1.474	2.95	44.75	"	1.700	43.02	21.10	"
1.524	5.43	44.14	"	1.733	49.28	16.92	"
1.523	6.74	44.24	"	1.749	52.21	15.20	" + $Ca(NO_3)_2.4H_2O$
1.541	7.60	44.98	" + $CaCl_2.4H_2O$	1.790	50.86	15.75	$Ca(NO_3)_2.4H_2O$
1.556	9.03	43.78	$CaCl_2.4H_2O$	1.713	51.30	14.45	"
1.619	16.86	40.35	"	1.696	48.01	15.06	"
1.630	18.07	39.75	"	1.655	46.94	14.57	"
1.630	20.55	37.73	" + 1.1.4	1.625	46.45	12.91	"
1.630	20.94	37.36	1.1.4	1.616	46.17	12.02	"
1.624	21.80	36.80	"	1.595	48.72	9.19	"
1.623	22.29	37.04	"	1.590	48.93	8.24	"
1.651	31.63	29.01	"	1.588	48.88	7.78	"
1.660	34.20	27.57	"	1.581	55.03	2.26	"
				1.579	58.35	0.0	"

C1

1.1.4 = $CaCl_2.Ca(NO_3)_2.4H_2O$

EQUILIBRIUM IN AQUEOUS SOLUTIONS SIMULTANEOUSLY SATURATED WITH CALCIUM AND POTASSIUM CHLORIDES AND NITRATES AT -10°.

(Kritschewski and Iskowitsch, 1933.)

Gm. equiv. per 1000 gms. H_2O				Solid Phase
$\frac{1}{2}CaCl_2$	$\frac{1}{2}Ca(NO_3)_2$	KCl	KNO_3	
8.923	8.254	—	—	$CaCl_2.6H_2O$ + $Ca(NO_3)_2.4H_2O$
7.595	—	0.715	—	" + KCl
6.353	—	0.306	1.616	" + " + KNO_3
7.040	7.208	—	2.985	" + $Ca(NO_3)_2$ + KNO_3
—	13.192	—	2.571	" + "
—	—	3.314	0.575	KCl + KNO_3

EQUILIBRIUM IN THE SYSTEM CALCIUM CHLORIDE, CALCIUM OXIDE AND WATER.

(Millikan, 1917.)

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
CaO.	$CaCl_2$.	Solid Phase.	CaO.	$CaCl_2$.	Solid Phase.	CaO.	$CaCl_2$.	Solid Phase.
t° = 10°			t° = 25°			t° = 50°		
0.130	0	$Ca(OH)_2$	0.060	38.61	1.1.2	0.096	0.0	$Ca(OH)_2$
0.102	15.46	» +1.3.16	0.048	41.32	»	0.112	4.08	»
0.110	26.30	1.3.16	0.030	44.30	»	0.142	15.02	»
0.115	32.38	»	0.022	44.51	1.1.2+$CaCl_2.6H_2O$	0.538	29.41	»
0.140	34.60	»	0.036	44.64	»	0.436	29.57	»
0.151	35.44	» +1.1.2	0.0	44.77	$CaCl_2.6H_2O$	0.362	29.66	» +1.1.5
0.106	38.23	1.1.2	t° = 40°			0.517	29.60	1.1.5
0.126	38.45	»	0.104	0.0	$Ca(OH)_2$	0.470	31.70	»
0.0	39.4	$CaCl_2.6H_2O$	0.455	29.38	»	0.106	35.20	»
t° = 25°			0.609	31.93	$Ca(OH)_2$+1.1.2	0.113	36.95	» +1.1.2
0.101	5.02	$Ca(OH)_2$	0.571	31.90	»	0.146	36.82	» »
0.115	10.00	»	0.580	31.86	»	0.124	36.93	1.1.2
0.128	12.94	»	0.055	49.97	1.1.2+$CaCl_2.4H_2O$	0.069	39.43	»
0.140	15.14	»	0.0	51.18	$CaCl_2.4H_2O$	0.051	45.57	»
0.145	17.20	»	t° = 65°			0.046	46.42	»
0.148	18.15	» +1.3.16	0.100	0.0	$Ca(OH)_2$	0.034	47.19	»
0.147	21.02	1.3.16	0.621	31.72	$Ca(OH)_2$+1.1.2	0.046	48.75	»
0.146	23.80	»	0.634	31.95	»	0.058	54.05	1.1.2+$CaCl_2.2H_2O$
0.147	24.33	»	0.442	35.87	1.1.2	0.0	56.95	$CaCl_2.2H_2O$
0.170	28.37	»	0.069	38.12	»	t° = [illegible]		
0.180	29.54	»	0.074	43.31	»	0.434	31.80	$Ca(OH)_2$+1.1.5
0.225	32.67	»	0.047	52.10	»	–	31.73	»
0.245	33.21	» +1.1.2	0.121	59.96	1.1.2+$CaCl_2.2H_2O$	0.320	32.86	1.1.5+1.1.2
0.173	34.36	1.1.2	0.0	57.19	$CaCl_2.2H_2O$			

EQUILIBRIUM IN THE SYSTEM CALCIUM OXIDE, HYDROCHLORIC ACID AND WATER AT 25°.

(Millikan, 1918.)

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
CaO.	HCl.	Solid Phase.	CaO.	HCl.	Solid Phase.	CaO.	HCl.	Solid Phase.
14.05	40.10	$CaCl_2.2H_2O$	22.02	30.57	$CaCl_2.6H_2O$	14.50	18.64	1.3.16
14.43	40.07	$CaCl_2.2H_2O$ +$CaCl_2.4H_2O$	22.62	29.42	»	12.44	15.99	»
14.11	38.84	$CaCl_2.4H_2O$	22.56	29.31	» +1.1.2	12.17	15.64	»
17.36	35.52	»	22.41	29.11	1.1.2	10.77	13.81	»
17.39	35.38	»	20.92	27.15	»	9.28	11.88	1.3.16+$Ca(OH)_2$
18.52	34.87	»	19.56	25.37	»	8.83	11.30	$Ca(OH)_2$
19.44	34.46	»	17.53	22.58	»	7.79	9.95	»
21.77	33.35	»	17.15	22.00	» +1.3.16	6.66	8.50	»
22.48	32.57	$CaCl_2.4H_2O$ +$CaCl_2.6H_2O$	16.73	21.47	1.3.16	5.17	6.57	»
22.08	31.68	$CaCl_2.6H_2O$	15.10	19.41	»	2.64	3.30	»

1.3.16 = $CaCl_2.3CaO.16H_2O$;

1.1.2 = $CaCl_2.CaO.2H_2O$;

1.1.5 = $CaCl_2.CaO.5H_2O$ (or $4H_2O$).

SOLUBILITY OF CALCIUM CHLORIDE IN AQUEOUS SOLUTIONS OF COBALT CHLORIDE AT 0°, 25° AND 50° AND VICE VERSA.

(Bassett, Gordon and Henshall, 1937.)

Gms. per 100 gms. sat. sol. $CoCl_2$	Gms. per 100 gms. sat. sol. $CaCl_2$	Solid Phase
Results at 0°		
0.0	37.00	$CaCl_2.6H_2O$
1.64	36.25	"
2.36	35.82	"
2.85	35.48	" + $CoCl_2.6H_2O$
2.82	36.77	$CoCl_2.6H_2O$
7.22	26.42	"
29.50	0.0	"
Results at 25°		
0.0	52.13*	$CaCl_2.4H_2O$ γ
6.92	47.24*	"
0.0	51.30*	$CaCl_2.4H_2O$ β
7.56	46.27*	"
0.0	48.85*	$CaCl_2.4H_2O$ α
2.14	46.91*	"
4.92	45.27*	"
8.76	42.91*	"
9.51	42.53*	" + $CoCl_2.2H_2O$
0.0	45.05	$CaCl_2.6H_2O$
2.77	43.37	"
8.34	41.13	"
10.36	40.63	" + $CoCl_2.2H_2O$
9.75	41.99*	$CoCl_2.2H_2O$

= metastable equilibrium

Gms. per 100 gms. sat. sol. $CoCl_2$	Gms. per 100 gms. sat. sol. $CaCl_2$	Solid Phase
Results at 25°		
11.43	38.54	$CoCl_2.2H_2O$
13.64	34.90	"
13.51	34.83	" + $CoCl_2.6H_2O$
12.52	33.46	$CoCl_2.6H_2O$
11.39	29.92	"
12.44	26.10	"
18.50	18.66	"
23.66	12.61	"
26.88	9.08	"
35.87	0.0	"
Results at 50°		
0.0	56.70	$CaCl_2.2H_2O$
6.75	51.43	"
11.55	47.74	"
12.79	46.63	" + $CoCl_2.2H_2O$
13.72	42.85	$CoCl_2.2H_2O$
23.24	25.98	"
27.67	20.87	"
35.41	11.88	"
40.22	7.87	"
41.92	6.31	" + $CoCl_2.6H_2O$
43.50	3.34	$CoCl_2.6H_2O$
46.00	0.0	"

Additional data on this system at 25° are given by Benrath, 1927.

SOLUBILITY OF CALCIUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 0°.

(Engel, 1887.)

Gms. per 100 cc. Sat. Sol. $CaCl_2$.	Gms. per 100 cc. Sat. Sol. HCl.	d_0 of Sat. Sol.	Gms. per 100 cc. Sat. Sol. $CaCl_2$.	Gms. per 100 cc. Sat. Sol. HCl.	d_0 of Sat. Sol.
51.45	0	1.367	29.84	15.84	1.283
46.45	3.32	1.344	20.12	23.15	1.250
42.80	5.83	1.326	11.29	34.62	1.238
36.77	10.66	1.310			

SOLUBILITY OF CALCIUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 25°. (Millikan, 1918.)

Gms. per 100 gms. sat. sol. $CaCl_2$.	Gms. per 100 gms. sat. sol. HCl.	Solid Phase.	Gms. per 100 gms. sat. sol. $CaCl_2$.	Gms. per 100 gms. sat. sol. HCl.	Solid Phase.
44.77	0.0	$CaCl_2.6H_2O$	36.66	10.78	$CaCl_2.4H_2O$
43.59	1.92	»	34.43	12.75	»
43.71	2.96	»	34.36	12.94	»
44.50	3.33	» + $CaCl_2.4H_2O$	27.94	20.48	»
43.10	5.03	$CaCl_2.4H_2O$	28.45	21.40	» + $CaCl_2.2H_2O$
38.49	9.17	»	27.81	21.83	$CaCl_2.2H_2O$

EQUILIBRIUM IN THE SYSTEM CALCIUM CHLORIDE, MERCURIC CHLORIDE AND WATER AT 25°.

(Bassett, Barton, Foster and Pateman, 1933.)

This system is of unusual complexity due to the occurrence at 25° of two double salts and three different hydrates of calcium chloride of which one, the tetrahydrate, occurs in no less than three distinct forms. Four of the curves are entirely metastable.

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$HgCl_2$	$CaCl_2$		$HgCl_2$	$CaCl_2$		$HgCl_2$	$CaCl_2$	
0.0	45.05	6	51.20	24.46•	4α	49.16	26.17•	2
17.04	38.36	6	0.0	51.30•	4β	50.30	25.50•	2
20.08	37.04	6	24.71	37.73•	4β + 6	50.76	25.38•	2 + C
23.73	35.95	6	32.73	33.65•	4β	50.81	25.30•	B + C
24.00	36.00	6 + 4α	46.03	27.15•	4β	50.76	25.24•	B + 2
24.71	37.73•	6 + 4β	45.82	27.90•	4β + 2	52.15	23.53	B + 4α
23.00	39.30•	6 + 4γ	0.0	52.13•	4γ	54.87	20.40	B
0.0	48.85	4α	24.25	38.50•	4γ + 6	55.58	17.81	B
30.70	32.72	4α	25.10	37.99•	4γ	55.68	14.70	B
39.97	29.01	4α	37.14	32.36•	4γ	56.31	12.60	B
41.62	27.99	4α	39.24	31.61•	4γ + 2	56.71	11.35	B + $HgCl_2$
47.19	25.65	4α	0.0	55.00•	2	52.66	10.53	$HgCl_2$
50.08	24.71	4α	45.82	27.90•	4β + 2	38.50	7.25	"
52.21	23.62	4α	46.06	27.70•	2	6.90	0.0	"
51.97	23.96•	4α + B	47.01	27.22•	2			

• = unstable equilibrium

6 = $CaCl_2.6H_2O$; 2 = $CaCl_2.2H_2O$; 4α = $CaCl_2.4H_2O$α; 4β = $CaCl_2.4H_2O$β; 4γ = $CaCl_2.4H_2O$γ; β = $[Ca(H_2O)_6][(HgCl_2)_6Cl_2]$; C = $[Ca(H_2O)_4][HgCl_4]$.

SOLUBILITY OF CALCIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AND VICE VERSA.

Results at 0°

(Igelsrud and Thompson, 1936.)

Gms. per 100 gms. sat. sol.		Solid Phase
KCl	$CaCl_2$	
0.0	37.55	$CaCl_2.6H_2O$
0.69	37.41	"
1.96	37.36	" + KCl
2.62	33.42	KCl
3.88	25.89	"
6.48	20.03	"
8.38	16.43	"
12.78	10.52	"
16.93	5.54	"
21.87	0.0	"

Results at 20°

(Mazetti, 1929.)

Gms. per 100 gms. sat. sol.		Solid Phase
KCl	$CaCl_2$	
0.0	42.7	$CaCl_2.6H_2O$
0.63	43.8	" + KCl
1.19	35.78	KCl
2.54	30.70	"
6.8	19.80	"
10.62	14.14	"
19.41	6.21	"
25.40	0.0	"

SOLUBILITY OF CALCIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AND VICE VERSA.

d_{25} of sat. sol.	Results at 25°. (Lee and Egerton, 1923.) Gms. per 100 gms. sat. sol.			Results at 30°. (Barbaudy, 1923.) Gms. per 100 gms. sat. sol.		
	$CaCl_2$.	KCl.	Solid Phase.	$CaCl_2$.	KCl.	
1.47	45.06	0.0	$CaCl_2.6H_2O$	50.0	0.3	$CaCl_2.4H_2O\alpha$
–	44.73	3.28	»	49.6	2.1	»
1.485	44.72	3.06	»	49.5	3.35	»
1.485	44.66	3.05	» + KCl	49.2	4.4	» + KCl
1.402	37.82	3.15	KCl	46.8	4.0	KCl
1.349	32.34	3.72	»	30.3	4.85	»
1.273	23.15	7.52	»	24.0	7.9	»
1.236	16.55	11.64	»	16.0	12.85	»
1.204	8.53	17.63	»	9.25	18.5	»
1.182	0.00	26.74	»	2.33	24.8	»

Data for the Quarternary System $CaCl_2 + KCl + MgCl_2 + H_2O$ at 0° are given by Igelsrud and Thompson, 1936(a).

Data for equilibrium in the reaction $CaCl_2 + 2KClO_3 \rightleftharpoons 2KCl + Ca(ClO_3)_2$ in aqueous solution at 15° and at 45° are given by Osaka and Nishio (Takesuye), 1930.

Cl

SOLUBILITY OF CALCIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM BICHROMATE AT 25°.

(Herz and Hiebenthal, 1929.)

Gm. Mols. per liter 1/2 $CaCl_2$	Gm. Mols. per liter 1/6 $K_2Cr_2O_7$	Gm. Mols. per liter 1/2 $CaCl_2$	Gm. Mols. per liter 1/6 $K_2Cr_2O_7$
11.45	0.0	11.48	0.25
11.34	0.10	11.36	0.35
11.38	0.16	11.42	1.88

SOLUBILITY OF CALCIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE AT 30° AND VICE VERSA.

(Barbaudy, 1923.)

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
$CaCl_2$.	KNO_3.	Solid Phase.	$CaCl_2$.	KNO_3.	Solid Phase.
50.4	3.67	$CaCl_2.4H_2O\alpha$	26.2	14.2	KCl
50.7	5.1	»	24.2	17.6	»
50.7	5.2	» + KCl	22.7	19.8	»
50.3	5.2	KCl	21.8	21.5	»
42.5	5.42	»	20.3	24.6	»
38.3	5.82	»	19.8	25.3	»
34.8	6.4	»	19.6	26.0	» + KNO_3
31.1	7.64	»	19 4	26.0	KNO_3
29.9	10.3	»	17.8	25.9	»
28.6	11.9	»	14.37	26.3	»
27.8	12.4	»	11.3	27.0	»
36.9	13.5	»	9.5	27.6	»

CALCIUM CHLORIDE

SOLUBILITY OF CALCIUM CHLORIDE IN AQUEOUS SOLUTIONS OF MAGNESIUM CHLORIDE & VICE VERSA.

(Prutton and Tower, 1932.)

Liquid ammonia and liquid air were used as the cooling agent. Constant agitation for 8 hours was found sufficient for the attainment of equilibrium.

Results at -30°			Results at -15°		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$MgCl_2$	$CaCl_2$		$MgCl_2$	$CaCl_2$	
0.0	32.92	$CaCl_2.6H_2O$	0.0	34.78	$CaCl_2.6H_2O$
2.50	30.07	"	2.83	31.92	"
5.49	27.04	"	3.90	30.50	"
8.61	23.55	"+$MgCl_2.12H_2O$	11.97	22.42	"
12.26	19.78*	$CaCl_2.6H_2O$	24.14	10.73	"+$MgCl_2.8H_2O$ α
16.76	15.23*	"	25.71	9.43*	$CaCl_2.6H_2O$
25.55	7.40*	"	28.07	7.52*	"+$MgCl_2.6H_2O$
27.20	6.14*	"	29.98	5.11*	$MgCl_2.6H_2O$
9.94	19.13	$MgCl_2.12H_2O$	33.86	0.0*	"
10.20	19.44	"	25.68	8.67	$MgCl_2.8H_2O$ α
14.70	11.39	"	26.15	7.70	"
14.65	11.27	"	27.17	6.46	"
16.99	7.63	"	28.70	4.42	"
22.19	0.0	"	31.85	0.0	"
20.47	0.0	Ice	0.0	12.23	Ice
16.45	4.83	"	14.69	0.0	"
17.16	6.18	"	10.85	5.0	"
0.0	25.03	"	4.01	13.35	"

The following monovariant points were determined

t°	Gms. per 100 gms. sat. sol.		Solid Phase
	$MgCl_2$	$CaCl_2$	
-52.2	2.93	27.40	$CaCl_2.6H_2O$ + $MgCl_2.12H_2O$ + Ice
-20.7	23.23	10.56	$CaCl_2.6H_2O$ + $MgCl_2.12H_2O$ + $MgCl_2.8H_2O$ α
- 6.7	26.40	9.90	$CaCl_2.6H_2O$ + $MgCl_2.8H_2O$ α + $MgCl_2.6H_2O$

SOLUBILITY OF CALCIUM CHLORIDE IN AQUEOUS SOLUTIONS OF MAGNESIUM CHLORIDE AT 0° AND VICE VERSA.

(Prutton and Tower, 1932; Igelsrud and Thompson, 1936.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$MgCl_2$	$CaCl_2$		$MgCl_2$	$CaCl_2$	
0.0	37.44	$CaCl_2.6H_2O$	23.84	13.88	$CaCl_2.6H_2O$+$MgCl_2.6H_2O$
6.82	30.22	"	23.91	13.87	$MgCl_2.6H_2O$
9.81	27.17	"	29.91	5.84	"
11.95	25.10	"	30.04	5.70	"
14.94	22.12	"	30.89	4.51	"
22.83	14.89	"	34.62	0.0	"

SOLUBILITY OF CALCIUM CHLORIDE IN AQUEOUS SOLUTIONS OF MAGNESIUM CHLORIDE AND VICE VERSA AT 25°. (Lee and Egerton, 1923.)

$d_{25/25}$ of sat. sol.	Gms. per 100 gms. sat. sol. CaCl₂.	MgCl₂.	Solid Phase.	$d_{25/25}$ of sat. sol.	Gms. per 100 gms. sat. sol. CaCl₂.	MgCl₂.	Solid Phase.
1.470	45.06	0.0	$CaCl_2.6H_2O$	1.455	31.17	14.54	$1.2.12+MgCl_2.6H_2O$
1.465	41.87	4.06	"	1.441	28.12	16.31	$MgCl_2.6H_2O$
1.472	38.95	7.93	"	1.428	25.09	18.13	"
1.486	38.70	9.43	"+1.2.12	1.391	16.05	23.33	"
1.473	36.37	10.78	1.2.12	1.371	10.33	27.61	"
1.460	32.82	13.55	"	1.341	0.0	35.54	"

1.2.12 = Tachhydrite = $CaCl_2.2MgCl_2.12H_2O$.

The following results, differing in some respects from the above, were obtained by Bury and Davies, 1933.

Gms. per 100 gms. sat. sol. $CaCl_2$	$MgCl_2$	Solid Phase	Gms. per 100 gms. sat. sol. $CaCl_2$	$MgCl_2$	Solid Phase	Gms. per 100 gms. sat. sol. $CaCl_2$	$MgCl_2$	Solid Phase
45.0	0.0*	C+Mg(OH)₂	33.36	13.58*	3.1.11+1.2.12	43.42	5.97	C4α
44.88	0.168*	C+Mg(OH)₂	31.32	14.60*	3.1.11+1.2.12+M	43.38	6.01	"
44.55	0.612*	C+3.1.11	22.29	19.32*	3.1.11+M	43.19	6.24	"
42.14	3.098	C	7.87	29.25*	"	41.99	7.30	"
41.48	4.115	C	7.46	29.84*	"	40.03	8.52	"
39.58	6.47	C	48.80	0.0	C4α	38.88	9.43	"
38.82	8.14*	C+3.1.11	46.49	2.739	"	38.94	9.38	"
38.80	9.42*	"+1.2.12	44.71	4.742	"			

Cl

C = $CaCl_2.6H_2O$; 3.1.11 = $3MgO.MgCl_2.11H_2O$; 1.2.12 = Tachhydrite, $CaCl_2.2MgCl_2.12H_2O$; M = $MgCl_2.6H_2O$; C4α = $CaCl_2.4H_2O$α. *These solutions also contained 0.002 gms. MgO.

SOLUBILITY OF MIXTURES OF CALCIUM CHLORIDE, MAGNESIUM CHLORIDE AND CALCIUM MAGNESIUM DOUBLE CHLORIDE (TACHHYDRITE).

(Van't Hoff and Kenrick, 1912.)

t°.	Gms. per 100 Gms. H₂O. CaCl₂.	MgCl₂.	Solid Phase.
16.7	41.2	31.6	$MgCl_2.6H_2O+CaCl_2.6H_2O$
21.95	57.1	26	" " +Tachhydrite
28.2	54.5	28.4	Tachhydrite+$MgCl_2.6H_2O$
116.7	0	85.63	" + " +$MgCl_2.4H_2O$
25	32.3	17.9	+$CaCl_2.6H_2O+CaCl_2.4H_2O$
28.2	80.1	16.1	" +$CaCl_2.4H_2O$
28.2	88.7	7.24	$CaCl_2.6H_2O+CaCl_2.4H_2O$

Tachhydrate = $2MgCl_2.CaCl_2.12H_2O$.

100 grams H_2O dissolve 63.5 grams $CaCl_2$ + 4.9 grams KCl at 7° (M).

100 grams H_2O dissolve 57.6 grams $CaCl_2$ + 2.4 grams NaCl at 4° (M).

100 grams H_2O dissolve 59.5 grams $CaCl_2$ + 4.6 grams NaCl at 7° (M).

100 grams H_2O dissolve 72.6 grams $CaCl_2$ + 16 grams NaCl at 15° (R).

(M) = Mulder. (R) = Rüdorff.

CALCIUM CHLORIDE

SOLUBILITY OF CALCIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AT 0° AND VICE VERSA.

(Igelsrud and Thompson, 1936.)

Gms. per 100 gms. sat. sol.		Solid Phase
$CaCl_2$	NaCl	
37.55	0.0	$CaCl_2.6H_2O$
37.50	0.31	" + NaCl
35.31	0.93	NaCl
27.14	3.59	"
20.60	7.78	"
16.12	11.36	NaCl
9.53	17.28	"
5.33	21.19	"
0.0	26.42	$NaCl.2H_2O$

SOLUBILITY OF CALCIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AT 25° AND VICE VERSA.

(Cameron, Bell and Robinson, 1907.)

$d_{\frac{25}{25}}$ Sat. Sol.	Gms. per 100 Gms. H_2O.		Solid Phase.
	$CaCl_2$.	NaCl.	
...	84	0	$CaCl_2.6H_2O$
1.4441	78.49	1.846	" +NaCl
1.3651	58.48	1.637	NaCl
1.3463	53.47	1.799	"
1.2831	36.80	7.77	"
1.2653	30.08	10.70	NaCl
1.2367	19.53	18.85	"
1.2080	3.92	32.48	"
1.2030	0	35.80	"

SOLUBILITY OF CALCIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AT 50° AND AT 94°.5 AND VICE VERSA.

(Pelling and Robertson, 1913.)

Results at 50°.

Gms. per 100 gms. sat. sol.		Solid Phase.
$CaCl_2$.	NaCl.	
57.0	0.0	$CaCl_2.2H_2O$
56.3	0.9	» +NaCl
30.9	3.6	NaCl
15.1	13.2	»
3.3	24.4	»
0.0	26.8	»

Results at 94°.5.

Gms. per 100 gms. sat. sol.		Solid Phase.
$CaCl_2$.	NaCl.	
58.1	0.8	$CaCl_2.2H_2O$ + NaCl
57.4	1.1	NaCl
45.7	1.3	»
32.8	4.3	»
15.3	15.0	»
11.5	18.1	»

100 gms. sat. solution of $CaCl_2$ in selenium oxychloride ($SeOCl_2$) contain 6.11 gms. $CaCl_2$ at 25°. (Wise, 1923.)

FUSION-POINT DATA ARE GIVEN FOR THE FOLLOWING MIXTURES OF CALCIUM CHLORIDE AND OTHER SALTS.

$CaCl_2+CaF_2$ (1)(2)
$CaCl_2+CaI_2$ (1)
$CaCl_2+CaO$ (3)
$CaCl_2+CaSiO_3$ (4)
$CaCl_2+CaSO_4$ (3)
$CaCl_2+CaSO_4+KCl+K_2SO_4$ (15)
$CaCl_2+CdCl_2$ (14)
$CaCl_2+CoCl_2$ (14)
$CaCl_2+CuCl$ (5)
$CaCl_2+FeCl_2$ (14)
$CaCl_2+PbCl_2$ (5)(6)(7)
$CaCl_2+LiCl$ (7)(8)(11)
$CaCl_2+MgCl_2$ (5)(6)
$CaCl_2+MnCl_2$ (6)(7)(14)
$CaCl_2+KCl$ (5)(3)(12)(13)
$CaCl_2+NaCl$ (5)(3)(12)(13)
$CaCl_2+NaCl+KCl$ (12)(13)
$CaCl_2+AgCl$ (5)
$CaCl_2+SrCl_2$ (6)(7)(3)(10)
$CaCl_2+SrO$ (3)
$CaCl_2+TlCl$ (9)
$CaCl_2+SnCl$ (5)
$CaCl_2+ZnCl$ (5)

(1) = Ruff and Plato, 1903; (2) = Plato, 1907; (3) = Sackur, 1911-12; (4) = Karandeeff, 1910; (5) = Menge, 1911; (6) = Sandonnini, 1911; (7) = Sandonnini, 1913; (8) = Sandonnini, 1913; (9) = Korreng, 1914; (10) = Schaefer, 1914. (11) = Grube and Rudel, 1924; (12) = Scholich, 1920; (13) = Lautsberry and Page, 1920; (14) = Ferrari-Inganni, 1928; (15) = Janecke and Muhlhaussen, W. 1936.

SOLUBILITY OF CALCIUM CHLORIDE IN MIXTURES OF AMMONIA AND WATER AT 0°.

(Guyer, Bieler and Schmid, 1934.)

The determinations were made in a steel tube provided with a cap and valve. The results are presented only in the form of a curve from which the following approx. values were read.

Percent H_2O in NH_3+H_2O mixtures	0	10	15	20	25	27	28	29	30
Gms. $CaCl_2$ per 100cc sat. sol.	0	0.1	0.25	0.5	0.7	1.0	2.0	4.0	10+

SOLUBILITY OF CALCIUM CHLORIDE IN AQUEOUS ALCOHOL AT ROOM TEMPERATURE.

(Bödtker, 1897.),

Solution Used.	Vol. Per Cent Alcohol.	Gms. $CaCl_2$ per 5 cc. Sol.
15 Gms. $CaCl_2.6H_2O$ + 20 cc. alcohol	92.3	1.430
15 Gms. $CaCl_2.6H_2O$ + 20 cc. alcohol	97.3	1.409
15 Gms. $CaCl_2.6H_2O$ + 20 cc. alcohol	99.3	1.429
15 Gms. $CaCl_2.6H_2O$ + 20 cc. alcohol + 1 Gm. $CaCl_2$	99.3	1.529

Solution Used.	Vol. Per Cent Alcohol.	Gms. $CaCl_2$ per 5 cc. Sol.
15 Gms. $CaCl_2.6H_2O$ + 20 cc.: alcohol + 2 Gms. $CaCl_2$	99.3	1.561
" + 3 " "	99.3	1.590
" + 4 " "	99.3	1.641
" + 5 " "	99.3	1.709

SOLUBILITY OF CALCIUM CHLORIDE IN AQUEOUS SOLUTIONS OF ACETONE AT 20°.

C1

(Frankforter and Cohen, 1914.)

Measured amounts of acetone were added to known solutions of $CaCl_2$ in water, until opalescence, indicative of the separation of a second liquid layer, was observed. The composition of a large number of such mixtures gives the limiting values for the binodal curve of the system. Tie lines were also determined in several instances by using such quantities of the three components that an adequate amount of each layer would be formed to permit the determination of the $CaCl_2$ in it. The points thus located on the curve fix the tie lines, and from them the approximate position of the plait point can be estimated.

Points on the Binodal Curve at 20°.

Gms. per 100 Gms. Sat. Sol.		
Acetone.	$CaCl_2$.	
9	40.5*	(solid phase $CaCl_2$)
22.7	38.16†	
20.8	31.2	
20.2	28	
21	24.4	
23	21.1	
25	19.2	
30	15.6	
35	12.8	
40	10.5	
45	8.8	
50	7.4	
55	6.1	
60	5	
65	3.9	
70	2.8	
75	1.8	
80	1	
85	0.5	
90	0.2	
95	0.1	

* Point on solubility curve. † Quadruple point.

Composition of Points Representing Tie Lines at 20°.

Gms. per 100 Gms. Upper Layer.			Gms. per 100 Gms. Lower Layer.	
Acetone.	$CaCl_2$.		Acetone.	$CaCl_2$.
90.2	0.186		28.5	16.61
83.3	0.628		34.6	12.97
81	0.948		40	10.6
78.5	1.321		43.5	9.36
60	5	(plait point)	60	5

Points on the Binodal Curve at Different Temperatures.

t°.	Gms. per 100 Gms. Sat. Sol.	
	Acetone.	$CaCl_2$.
5	31.09	15.52
10	22.77	23.64
15	31.09	15.52
18	30.58	15.27
25	21.44	22.25
25	29.83	14.89
30	20.99	21.79
30	29.27	14.62
35	21.14	20.91
35	28.59	14.29
40	19.83	20.58
40	27.90	13.93

SOLUBILITY OF CALCIUM CHLORIDE IN AQUEOUS SOLUTIONS OF UREA AND VICE VERSA.

(De Carli, 1928a)

Results at 11°

Gms. per 100 gms. sat. sol. $CO(NH_2)_2$	Gms. per 100 gms. sat. sol. $CaCl_2$	Solid Phase
0.0	38.80	$CaCl_2.6H_2O$
5.90	39.35	"
9.50	39.90	" + 1.4.2
17.59	32.55	1.4.2
16.51	28.75	"
26.77	23.56	"
32.72	20.59	"
47.75	13.18	" + $CO(NH_2)_2$
47.31	12.78	$CO(NH_2)_2$
45.40	8.02	"
40.84	0.0	"

Results at 25°

Gms. per 100 gms. sat. sol. $CO(NH_2)_2$	Gms. per 100 gms. sat. sol. $CaCl_2$	Solid Phase
0.0	45.97	$CaCl_2.6H_2O$
4.52	45.22	"
6.66	45.03	"
13.27	43.99	" + 1.4
17.41	38.37	1.4
29.77	27.11	"
40.76	21.60	"
44.45	19.24	"
53.85	14.95	" + $CO(NH_2)_2$
54.57	12.34	$CO(NH_2)_2$
55.29	11.04	"
46.92	0.0	

1.4.2 = $CaCl_2.4CO(NH_2)_2.2H_2O$ 1.4 = $CaCl_2.4CO(NH_2)_2$

SOLUBILITY OF CALCIUM CHLORIDE IN AQUEOUS SOLUTIONS OF URETHAN AT 25° AND VICE VERSA.

(Palitzsch, 1928, 1929.)

Cl

Gm. Mols. per 1000 gms. H_2O $NH_2COOC_2H_5$	Gm. Mols. per 1000 gms. H_2O $CaCl_2$	Solid Phase
0.0	7.305	$CaCl_2.6H_2O$
0.3356	7.359	" + $NH_2COOC_2H_5$
0.7004	5.949	$NH_2COOC_2H_5$
11.093	4.482	"
53.09	0.0	"

CALCIUM CHLORIDE ALCOHOLATES $CaCl_2.3CH_3OH$, $CaCl_2.3C_2H_5OH$.

(The compounds were prepared by mixing anhydrous $CaCl_2$ with the alcohol. In the case of the methyl alcohol compound, the tri CH_3OH salt crystallizes above 55°, the tetra salt below this temperature.)

SOLUBILITY OF EACH IN THE RESPECTIVE ALCOHOL AT VARIOUS TEMPERATURES, DETERMINED BY THE SYNTHETIC METHOD.

(Menschutkin, 1906.)

Results for $CaCl_2.3CH_3OH$.

t°.	Gms. per 100 Gms. Sat. Sol. $CaCl_2.3CH_3OH$	Gms. per 100 Gms. Sat. Sol. $= CaCl_2$.	Solid Phase.	t°.	Gms. per 100 Gms. Sat. Sol. $CaCl_2.3CH_3OH$	Gms. per 100 Gms. Sat. Sol. $= CaCl_2$.	Solid Phase.
0	33.3	17.85	1.4	95	66.3	35.5	1.3
10	37.6	20.15	"	115	70.3	37.6	"
20	42.2	22.6	"	135	75.2	40.3	"
30	47	25.2	"	155	81.8	43.8	"
40	52	27.8	"	165	86.2	46.2	"
50	57.3	30.7	"	170	89.5	47.9	"
55	60	32.1	"	174	93.5	50.1	"
56	61.3	32.8	"	177*	100	53.6	"
55	60.5	32.4	" +1.3	190	...	55.7	1.1(?)
75	63.1	33.8	1.3	215	...	57.7	"

Results for $CaCl_2.3C_2H_5OH$.

t°.	Gms. per 100 Gms. Sat. Sol. $CaCl_2.3C_2H_5OH$	Gms. per 100 Gms. Sat. Sol. $= CaCl_2$.
0	34.8	15.5
20	46	20.5
40	58.7	26.1
60	73	32.5
70	80.8	36
80	86.8	38.7
85	89.2	39.7
90	91.9	40.8
95	96.2	42.8
97*	100	44.5

* M. pt.

1.4 = $CaCl_2.4CH_3OH$. 1.3 = $CaCl_2.3CH_3OH$, 1.1 = $CaCl_2.CH_3OH$.

SOLUBILITY OF CALCIUM CHLORIDE IN A SATURATED SOLUTION OF SUGAR AT 31.25°.

(Köhler, 1897.)

100 grams saturated solution contain 42.84 grams sugar + 25.25 grams $CaCl_2$, or 100 grams water dissolve 135.1 grams sugar + 79.9 grams $CaCl_2$.

SOLUBILITY OF CALCIUM CHLORIDE IN THE HIGHER ALCOHOLS.

(Lloyd, Brown, Glynwyn, Bonnel and Jones, 1928.)

t°	Gms. $CaCl_2$ per 100 gms. of each alcohol				
	n Propyl	n Butyl	n Amyl	iso Amyl	Benzyl
0	8.3	16.2	—	—	—
10	11.9	21.4	7.0	3.0	2.1
20	15.8	25.7	11.5	7.2	1.82
30	20.0	29.1	17.0	12.1	1.64
40	24.5	31.6	22.6	17.0	1.45
50	29.1	33.5	28.5	22.8	1.34
60	34.9	34.8	34.4	26.9	1.25
70	—	—	41.3	31.6	—

In each case the solid phase in contact with the saturated solution is the tri alcoholate of calcium chloride. These are respectively: n Propyl = $CaCl_2.3n\text{-}C_3H_7OH$; n Butyl = $CaCl_2.3nC_4H_9OH$; n Amyl = $CaCl_2.3nC_5H_{11}OH$; iso Amyl = $CaCl_2.3isoC_5H_{11}OH$; Benzyl = $CaCl_2.3C_6H_5.CH_2OH$.

CALCIUM CHLORIDE ACETAMIDATE $CaCl_2.3CH_3CONH_2$.

SOLUBILITY IN ACETAMIDE AT VARIOUS TEMPERATURES, DETERMINED BY THE SYNTHETIC METHOD. C1

(Menschutkin, 1908.)

t°.	Gms. per 100 Gms. Sat. Sol. $CaCl_2.3CH_3CONH_2$	= $CaCl_2$.	Solid Phase.	t°.	Gms. per 100 Gms. Sat. Sol. $CaCl_2.3CH_3CONH_2$	= $CaCl_2$	Solid Phase.
82 m. pt.	0	0	CH_3CONH_2	100	65.6	25.3	1.3
78	8	3.1	"	150	70.5	27.1	"
74	15.4	5.9	"	165	74.8	28.8	"
66	27	10.4	"	175	80.6	31	"
54	39.2	15.1	"	180	85.5	32.9	"
46 Eutec.	45	17.3	" +1.6	184	90.5	34.8	"
58	48.5	18.7	1.6	186 tr. pt.	94.5	36.4	" + $CaCl_2$(?)
62	54.5	21	"	200	97.5	37.5	$CaCl_2$(?)
64 tr. pt.	62.1	23.9	1.6+1.3	210	100	38.5	"

1.6 = $CaCl_2.6CH_3CONH_2$. 1.3 = $CaCl_2.3CH_3CONH_2$.

CALCIUM CHLORIDE ACETIC ACIDATE $CaCl_2.4CH_3COOH$.

SOLUBILITY IN ACETIC ACID AT VARIOUS TEMPERATURES, DETERMINED BY THE SYNTHETIC METHOD.

(Menschutkin, 1906.)

t°.	Gms. per 100 Gms. Sat. Sol. $CaCl_2.4CH_3COOH$	= $CaCl_2$.	Solid Phase.	t°.	Gms. per 100 Gms. Sat. Sol. $CaCl_2.4CH_3COOH$	= $CaCl_2$.	Solid Phase.
16.2 m. pt.	0	0	CH_3COOH	40	54.7	17.3	1.4
15	18	5.7	"	45	63	19.9	"
14	27	8.5	"	50	69.5	21.9	"
13	34	10.7	"	60	79.5	25.1	"
11.1 Eutec.	42	13.3	" +1.4	65	84.5	26.7	"
30	47.6	15	1.4	70	91.2	28.8	"
25	50	15.8	"	72 m. pt.	100	31.6	"

SOLUBILITY OF CALCIUM CHLORIDE IN ACETONE.

(Bell, Rowlands, Bamford, Thomas and Jones, 1930.)

t°	Gms. $CaCl_2$ per 100 gms. C_3H_6O	Solid Phase	t°	Gms. $CaCl_2$ per 100 gms. C_3H_6O	Solid Phase
0	0.0062	$CaCl_2.2C_3H_6O$	30	0.0131	$CaCl_2.2C_3H_6O$
10	0.0073	"	35	0.0154	"
15	0.0086	"	40	0.0173	"
20	0.0101	"	45	0.0190	"
25	0.0118	"	50	0.0213	"

100 gms. 95% formic acid dissolve 43.1 gms. $CaCl_2$ at 19°. (Aschan, 1913.)

100 cc. anhydrous hydrazine dissolve 16 gms. $CaCl_2$ at room temp. (Welsh and Broderson, 1915.)

100 gms. 95% formic acid dissolve 43.1 gms. $CaCl_2$ at 19°. (Aschan, 1913.)
100 cc. anhydrous hydrazine dissolve 16 gms. $CaCl_2$ at room temp. (Welsh and Broderson, 1915.)

C10

100 gms. abs. Pyridine dissolve 1.66 gm. $CaCl_2$ at 25°. (Muller, 1925.)

CALCIUM Hypo CHLORITE $Ca(ClO)_2.3H_2O$

EQUILIBRIUM IN THE SYSTEM CALCIUM HYPOCHLORITE, CALCIUM OXIDE AND WATER AT 0°.

(O'Connor, 1927.)

$d\frac{0}{4}$ of sat. sol.	Gms. per 100 gms. sat. sol. CaO	Gms. per 100 gms. sat. sol. $Ca(ClO)_2$	Solid Phase	$d\frac{0}{4}$ of sat. sol.	Gms. per 100 gms. sat. sol. CaO	Gms. per 100 gms. sat. sol. $Ca(ClO)_2$	Solid Phase
1.213	0.0	21.8	$Ca(ClO)_2.3H_2O$	1.142	0.077	15.1	1.3.3
1.203	0.106	21.2	1.2.2	1.123	0.093	13.0	"
1.188	0.106	19.8	"	1.104	0.093	11.1	"
1.189	0.113	19.2	"	1.093	0.091	9.9	"
1.172	0.105	17.7*	"	1.133	0.111	14.0*	variable
1.154	—	16.1*	"	1.122	—	12.7*	"
1.171	—	18.0	"+1.3.3	1.103	0.114	11.0*	"
1.168	—	17.8	1.3.3	1.077	0.110	8.2	$Ca(OH)_2$
1.161	—	16.9	"	1.053	0.105	5.7	"
				1.030	0.106	3.0	"

1.2.2 = $Ca(ClO)_2.2CaO.2H_2O$ 1.3.3 = $Ca(ClO)_2.3CaO.3H_2O$

* = unstable equilibrium

CALCIUM CHLORATE $Ca(ClO_3)_2.2H_2O$.

100 grams saturated aqueous solution contain 64 grams $Ca(ClO_3)_2$ at 18°. Density of solution is 1.729. (Mylius and Funk, 1897.)

SOLUBILITY OF CALCIUM CHLORATE IN WATER.

(Jegorow, 1931.)

t^0	Gms. $Ca(ClO_3)_2$ per 100 gms. sat. sol.	Solid Phase	t^0	Gms. $Ca(ClO_3)_2$ per 100 gms. sat. sol.	Solid Phase
-1.0	4.67	Ice	-26.3	55.0	$Ca(ClO_3)_2 \cdot 4H_2O$
-4.2	13.9	"	-16.2	58.0	"
-9.1	23.2	"	-12.3	60.0	"
-17.1	32.5	"	-7.8 tr.pt.	62.7	" + $Ca(ClO_3)_2 \cdot 2H_2O$
-32.9	42.0	"	-5.0	63.0	$Ca(ClO_3)_2 \cdot 2H_2O$
-39.6	45.0	"	+19.5	66.2	"
-41.0 (Eutec.)	45.5	" + $Ca(ClO_3)_2 \cdot 6H_2O$	25.0	66.05	"
-37.5	46.0	$Ca(ClO_3)_2 \cdot 6H_2O$	73.5	76.3	"
-30.2	48.0	"	76. tr.pt.	77.0	" + $Ca(ClO_3)_2$
-28.0	51.2	"	93.0	78.0	$Ca(ClO_3)_2$
-26.8 tr.pt.	55.0	" + $Ca(ClO_3)_2 \cdot 4H_2O$	127.0	80.1	"
			203.0	85.0	"

SOLUBILITY OF CALCIUM CHLORATE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORATE AT 20° AND VICE VERSA.

(Mazetti, 1929.)

C10

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$KClO_3$	$Ca(ClO_3)_2$		$KClO_3$	$Ca(ClO_3)_2$	
0.0	66.16	$Ca(ClO_3)_2 \cdot 2H_2O$	2.45	28.60	$KClO_3$
1.10	64.31	" + $KClO_3$	2.97	11.15	"
2.40	47.52	$KClO_3$	6.76	0.0	"
2.39	36.89	"			

CALCIUM Per CHLORATE $Ca(ClO_4)$.

SOLUBILITY OF ANHYDROUS CALCIUM PERCHLORATE IN SEVERAL SOLVENTS AT 25°.

(Willard and Smith, 1923.)

Solvent.	*d* of sat. sol.	Gms. $Ca(ClO_4)_2$ per 100 gms. sat. sol.
Water	1.7191	65.35
Methyl alcohol	1.6155	70.36
Ethyl »	1.4342	62.44
n Propyl »	1.3806	59.17
n Butyl »	1.2868	53.17
iso » »	1.0903	36.29
Acetone	1.1475	38.18
Ethyl acetate	1.3325	43.06
Ethyl ether	0.7098	0.26

CALCIUM Hexa Antipyrine Per **CHLORATE** $[Ca(COC_{10}H_{12}N_2)_6](ClO_4)_2$

100 cc sat. solution in water (d^{24}_{4} = 1.316) contain 2.78 gm. $Ca(COC_{10}H_{12}N_2)_6(ClO_4)_2$ at 20°. (Wilke-Dörfurt and Schliephake, 1929.)

CALCIUM CHROMATE $CaCrO_4$.

SOLUBILITY OF THE SEVERAL HYDRATES IN WATER.

(Mylius and Wrochem — Wiss. Abh. p. t. Reichanstalt 3, 462, '00.)

t°.	Gms. $CaCrO_4$ per 100 Gms. Water.	Gms. $CaCrO_4$ per 100 Gms. Solution.	Mols. $CaCrO_4$ per 100 Mols. H_2O.
Solid Phase, α $CaCrO_4.2H_2O$. (Monoclinic.)			
0	17.3	14.75	2.0
18	16.68	14.3	1.93
20	16.6	14.22	1.93
30	16.5	13.89	1.85
45	14.3	12.53	1.65
Solid Phase, β $CaCrO_4.2H_2O$ (Rhombic.)			
0	10.9	9.8	1.25
13	11 5	10.3	1.33
40	11.6	10 4	1.34
Solid Phase, $CaCrO_4.H_2O$.			
0	13.0	11.5	1.50
18	10.6	9.6	1.22
25	10.0	9.1	1.15
40	8.5	7.8	0.98
60	6.1	5.7	0.70
75	4.8	4.6	0.56
100	3.2	3.1	0.37

CrO

t°.	Gms. $CaCrO_4$ per 100 Gms. Water.	Gms. $CaCrO_4$ per 100 Gms. Solution.	Mols. $CaCrO_4$ per 100 Mols. H_2O.
Solid Phase, $CaCrO_4.\frac{1}{2}H_2O$.			
0	7.3	6.8	0.84
18	4.8	4.4	0.51
31	3.84	3.7	0.44
38.5	2.67	2 6	0.31
50	1.63	1.6	0.19
60	1.13	1.1	0.13
100	0.81	0.8	0.09
Solid Phase, $CaCrO_4$			
0	4.5	4.3	0.52
18	2.32	2.27	0.27
31	2.92	1.89	0.22
50	1.12	1.11	0.13
60	0.83	0.82	0.11
70	0.80	0.79	0.09
100	0.42	0.42	0.05

Densities of the saturated solutions of the above several hydrates at 18° are: α $CaCrO_4.2H_2O$, 1.149; β $CaCrO_4.2H_2O$, 1.105; $CaCrO_4.H_2O$, 1.096; $CaCrO_4.\frac{1}{2}H_2O$, 1.044; $CaCrO_4$, 1.023.

100 cc. 29% alcohol dissolve 1.206 grams $CaCrO_4$.
100 cc. 53% alcohol dissolve 0.88 gram $CaCrO_4$.

(Fresenius — Z. anal. Chem. 30, 672, '91.)

CALCIUM FLUORIDE CaF_2

F

SOLUBILITY OF CALCIUM FLUORIDE IN WATER.

t°	Gms. CaF_2 per liter sat. sol.		Authority
0	0.013	(fluorspar)	Kohlrausch, 1904-05, 1908
15	0.015	(fluorspar)	"
18	0.016		"
18	0.018		Mougnard, 1931
18	0.015	(calcined)	"
25	0.018		Aumeras, 1927a
25	0.016	(fluorspar)	Kohlrausch, 1904-05, 1908
25	0.040	(pH = 6.4)	Carter, 1928
40	0.017	(fluorspar)	Kohlrausch, 1904-05, 1908)

SOLUBILITY OF CALCIUM FLUORIDE IN AQUEOUS SOLUTIONS OF ACETIC ACID.

(Duparc, Wengen and Graz, 1925.)

t°.	Gms. CaF$_2$ dissolved per 100 cc. in aqueous 0.5 Normal CH$_3$COOH.	1.0 Normal CH$_3$COOH.	2.0 Normal CH$_3$COOH.
40	0.0153	0.0175	0.0192
60	0.0178	0.0203	0.0229
80	0.0206	0.0237	0.0267
100	0.0229	0.0264	0.0300

SOLUBILITY OF CALCIUM FLUORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID.

(Tananaew and Tchrelachwili, 1936.)

The solutions were shaken 6-10 days in paraffined vessels. The calcium was determined by permanganate titration. Temp?

Normality of aq. HCl	Gm. mols. CaF$_2$ dissolved per liter	pH of sat. sol.
0.01	0.00087	2.02
0.10	0.0053	1.05
1.00	0.0280	0.04

Results for this system are also given by Aumeras, 1927a. Measured volumes of standard HF and CaCl$_2$ solutions were mixed and the resulting precipitate of CaF$_2$ caused to redissolve by successive additions of standard HCl, keeping the volume at 100 cc and temperature at 25°. The results are expressed in terms of normality of HF and HCl.

SOLUBILITY OF CALCIUM FLUORIDE IN AQUEOUS SOLUTIONS AT 18°.

(Mougnard, 1931.)

Aq. solution of:	Normality of aq. solvent	Gms. CaF$_2$ dissolved per liter
Acetic acid	0.083n CH$_3$COOH	0.0308
" "	0.166n "	0.0383
" "	0.333n "	0.0407
" "	0.833n "	0.0498
Ammonia	1.0n NH$_4$OH	0.0176
"	1.66n "	0.0175
Ammonium Chloride	0.25n NH$_4$Cl	0.0208
" "	0.50n "	0.0258
" "	1.0n "	0.0278
" "	1.66n "	0.0278
" Acetate	0.33n CH$_3$COONH$_4$.	0.0203
" "	0.71n "	0.0219
" "	1.42n "	0.0245
" "	1.66n "	0.0255

Fusion point data are given for:

CaF$_2$ + CaI$_2$	Ruff and Plato, 1903
CaF$_2$ + CaSiO$_3$	Karandeef, 1910
CaF$_2$ + MgF$_2$	Fuseya, Mori and Imamura, 1933
CaF$_2$ + MgF$_2$ + NaF	Grube and Heune, 1930
CaF$_2$ + NaF	Fedotieff and Iljinsky, 1923

CALCIUM Hexa Antipyrine Boro **FLUORIDE** $[Ca(COC_{10}H_{12}N_3)_6](BF_4)_2$

100 cc sat. solution in water (d_{25} = 1.313) contain 3.5 gm. $Ca(COC_{10}H_{12}N_3)_6$ $(BF_4)_2$ at 20°. (Wilke-Dorfurt and Mureck, 1929.)

F

CALCIUM Silico **FLUORIDE** $CaSiF_6.2H_2O$

100 cc sat. solution in water contain 10.58 gm. $CaSiF_6$ at 22°. A commercial sample of calcium silico fluoride dissolved only to the extent of 0.331 gms. per 100 cc sat. solution at 25°. A "calcium fluosilicate compound", used as insecticide, dissolved only to the extent of 0.153 gm. per 100 cc at 25°. (Carter, 1930.)

CALCIUM IODIDE CaI_2.

SOLUBILITY IN WATER.

(Average curve from the results of Kremers — Pogg. Ann. 103, 65, '58; Etard — Ann. chim. phys. [7] 2, 532, '94.)

t°.	Gms. CaI_2 per 100 Gms. Solution.	t°.	Gms. CaI_2 per 100 Gms. Solution.	t°.	Gms. CaI_2 per 100 Gms. Solution.
0	64.6	30	69	80	78
10	66.0	40	70.8	100	81
20	67.6	60	74		

Density of solution saturated at 20° = 2.125.

100 gms. sat. solution of Calcium Iodide in liquid ammonia contain 3.85 gms. CaI_2 at 0°. (Linhard and Stephan, 1933, 1934.)

I

SOLUBILITY OF CALCIUM IODIDE IN METHYL ALCOHOL.

(Lloyd, Broun, Glynwyn, Bonnell and Jones, 1928.)

t°	Gms. CaI_2 per 100 gms. CH_3OH	Solid Phase	t°	Gms. CaI_2 per 100 gms. CH_3OH	Solid Phase
0	116.4	$CaI_2.6CH_3OH$	30	131.2	$CaI_2.6CH_3OH$
10	121.1	"	40	136.8	"
15	123.7	"	50	142.2	"
20	126.1	"	60	148.8	"

SOLUBILITY OF CALCIUM IODIDE IN ACETONE.

(Bell, Rowlands, Bamford, Thomas and Jones, 1930.)

t°	Gms. CaI_2 per 100 gms. C_3H_6O	Solid Phase	t°	Gms. CaI_2 per 100 gms. C_3H_6O	Solid Phase
0	72.6	$CaI_2.3C_3H_6O$	40	105.6	$CaI_2.3C_3H_6O$
10	80.5	"	50	112.9	"
20	88.8	"	60	119.6	"
30	97.2	"			

Fusion-point data for mixtures of CaI_2 + I are given by Olivari, 1908.

CALCIUM Mercuric IODIDE $CaI_2.HgI_2.8H_2O$

A saturated solution of CaI_2 and HgI_2 in water at 15.9° was found by Duboin (1906) to have the composition $CaI_2.1.3HgI_2.12.3H_2O$; $d = 2.89$ and the solid phase in contact with the solution was $CaI_2.HgI_2.8H_2O$.

CALCIUM PerIODIDE CaI_4

Data for the formation of calcium periodide in aqueous solution at 25° are given by Herz and Bulla (1911). (See reference note under calcium perbromide)

CALCIUM IODATE $Ca(IO_3)_2.6H_2O$

SOLUBILITY OF CALCIUM IODATE IN WATER.

(Hill and Broun, 1931.)

t°	Gms. $Ca(IO_3)_2$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Ca(IO_3)_2$ per 100 gms. sat. sol.	Solid Phase
5	0.119	$Ca(IO_3)_2.6H_2O$	50	0.590	$Ca(IO_3)_2.H_2O$
15	0.195	"	57.5	0.621	" + $Ca(IO_3)_2$
25	0.306	"	60	0.652*	$Ca(IO_3)_2.H_2O$
30	0.384	"	70	0.811*	"
35	0.476	" + $Ca(IO_3)_2.4H_2O$	60	0.617	$Ca(IO_3)_2$
40	0.584*	$Ca(IO_3)_2.6H_2O$	70	0.644	"
25	0.405*	$Ca(IO_3)_2.H_2O$	80	0.665	"
40	0.517	"	90	0.668	

* unstable equilibrium

IO

The previous results of Mylius and Funk, 1897, 1900, are shown to be in error, especially at the higher temperatures, due doubtless to the metastability of the monohydrate.

The density of the saturated solution at 18° is 1.00.

SOLUBILITY OF CALCIUM IODATE IN AQUEOUS SALT SOLUTIONS AT 25°.

(Wise and Davies, 1938.)

Salt in aq. solvent	d_{25} of sat. sol.	Gm. mols. per liter		Salt in aq. solvent	d_{25} of sat. sol.	Gm. mols. per liter	
		Salt	$Ca(IO_3)_2$			Salt	$Ca(IO_3)_2$
None(=H_2O)	0.9998	0.00	0.00784	$MgSO_4$	1.004	0.01875	0.01042
$CaCl_2$	1.0001	0.00625	0.00669	"	1.004	0.025	0.01095
"	1.0016	0.025	0.00544	NaCl	1.001	0.0125	0.00829
"	1.0036	0.050	0.00490	"	1.0015	0.025	0.00868
$K_4Fe(CN)_6$	1.0007	0.00125	0.00838	"	1.0025	0.050	0.00929
"	1.0013	0.0025	0.00884	"	1.0050	0.100	0.01023
"	1.0018	0.00375	0.00943	Na_2SO_4	1.001	0.00625	0.00890
"	1.0023	0.0050	0.00980	"	1.002	0.0125	0.00975
KCl	1.0008	0.0125	0.00831	"	1.003	0.01875	0.01045
"	1.0017	0.025	0.00873	"	1.004	0.025	0.01105
"	1.0032	0.050	0.00939	$C_8H_7O_3Na$*	1.0002	0.020	0.00918
"	1.0057	0.100	0.01042	"	1.0047	0.050	0.01069
$MgSO_4$	1.001	0.00625	0.00904	"	1.0090	0.100	0.01283
"	1.002	0.0125	0.00979				

* sodium mandelate, $C_6H_5CH(OH)COONa$

The difference between the above result for 0.025 molecular $CaCl_2$ and that reported by Kilde, is believed to be due to incomplete saturation, for which more time is required in solutions containing a common ion.

SOLUBILITY OF CALCIUM IODATE IN AQUEOUS SOLUTIONS OF ACID BASES AND SALTS AT 18°, 25°, AND 30°.

(Kilde, 1934.)

t°	Salt in aq. solvent	Gm. mols. per liter Salt	Gm. mols. per liter $Ca(IO_3)_2$	t°	Salt in aq. solvent	Gm. mols. per liter Salt	Gm. mols. per liter $Ca(IO_3)_2$
18	None(=H_2O)	0.0	0.00569	18	$MgCl_2$	0.0503	0.00841
25	"	0.0	0.00784	"	"	0.505	0.0153
30	"	0.0	0.00991	25	"	0.0503	0.0112
18	$CaCl_2$	0.005	0.00478	"	"	0.505	0.0200
"	"	0.010	0.00433	30	"	0.503	0.0138
"	"	0.025	0.00375	"	"	0.505	0.0243
"	"	0.050	0.00330	18	NaCl	0.0998	0.00777
25	"	0.005	0.00681	"	"	0.250	0.00924
"	"	0.010	0.00644	"	"	0.500	0.01105
"	"	0.025	0.00557	"	"	1.000	0.0138
"	"	0.050	0.00491	25	"	0.0998	0.0105
30	"	0.005	0.00865	"	"	0.250	0.0123
"	"	0.010	0.00822	"	"	0.500	0.0146
"	"	0.025	0.00724	"	"	1.000	0.0179
"	"	0.050	0.00658	30	"	0.998	0.0129
18	$Ca(OH)_2$	0.0108	0.0045	"	"	0.250	0.0150
25	"	0.0108	0.0064	"	"	0.500	0.0177
30	"	0.0108	0.0086	"	"	1.000	0.0216
18	HCl	0.0998	0.0094	18	NaOH	0.0100	0.0062
"	"	1.000	0.0317	"	"	0.0250	0.0071
25	"	0.0998	0.0126	"	"	0.0500	0.0080
"	"	1.000	0.0424	25	"	0.0100	0.0084
30	"	0.0998	0.0154	"	"	0.0250	0.0094
"	"	1.000	0.0523	"	"	0.0500	0.0105
18	KIO_3	0.0167	0.00203	30	"	0.010	0.0110
25	"	0.0167	0.00375	"	"	0.025	0.0117
30	"	0.0167	0.00537	"	"	0.050	0.0129

The author also gives determinations of the solubility of Calcium Iodate in aqueous solutions of mixtures of HCl + NaCl, NaOH + NaCl, $Ca(OH)_2$ + NaCl and $Ca(OH)_2$ + sugar at the three temperatures.

SOLUBILITY OF CALCIUM IODATE IN AQUEOUS SOLUTIONS OF CALCIUM LACTATE AND SODIUM LACTATE.

(Kilde, 1934.)

Salt	Conc. of aq. salt solution in gm. mols. per liter		Gm. mols. $Ca(IO_3)_2$ dissolved per liter sat. sol. at: 18°	25°	30°
Ca Lactate	0.00496	$Ca(C_3H_5O_3)_2$	0.00499	0.00715	0.00914
"	0.00992	"	0.00464	0.00677	0.00874
"	0.0198	"	0.00429	0.00633	0.00830
"	0.0496	"	0.00398	0.00593	0.00784
"	0.0992	"	0.00392	0.00585	0.00775
Na Lactate	0.0100	$NaC_3H_5O_3$	0.00631	0.00853	0.01058
"	0.0200	"	0.00693	0.00918	0.01131
"	0.0400	"	0.00781	0.01032	0.1274
"	0.1000	"	0.01003	0.01315	0.1609
"	0.200	"	0.01329	0.01689	0.02042
"	0.400	"	0.01781	0.02287	0.02756

SOLUBILITY OF CALCIUM IODATE IN AQUEOUS SALT SOLUTIONS AT 25°.

(Chloupek, Danes and Danesova, 1935.)

Conc. of aq. salt solution in mols. per liter	Gms. $Ca(IO_3)_2$ per 1000 gms. sat. solution in aq.			
	KNO_3	K_2SO_4	$MgSO_4$	$MgCl_2$
0.0 (=H_2O)	3.03	3.03	3.03	3.03
0.002	—	3.196	3.219	3.121
0.005	3.125	3.389	3.397	3.262
0.01	3.207	3.666	3.663	3.444
0.02	3.393	4.008	4.09	3.736
0.05	3.695	5.077	4.952	4.331
0.10	4.102	6.290	5.768	4.924
0.20	4.677	—	—	—
0.50	5.861	—	—	—

The solid phase in all cases was $Ca(IO_3)_2.6H_2O$.

The authors' table headings are "g/1000g H_2O" but it is evident that gms. per 1000 gms. sat. solution was intended.

SOLUBILITY OF CALCIUM IODATE IN AQUEOUS SOLUTIONS OF CHLORIDES AT 25°.

(Orons and Klinghoffer, 1930.)

Conc. of aq. chloride solution in mols. per liter	Gm. Mols. $Ca(IO_3)_2.6H_2O$ per liter sat. aq. solution of:			
	KCl	NaCl	LiCl	NH_4Cl
0	0.007976	0.007976	0.007976	0.007976
0.05	0.009551	0.009677	0.009414	0.009732
0.10	0.01060	0.01052	0.01028	0.01068
0.15	0.01139	0.01123	0.01097	0.01149
0.30	0.01326	0.01303	0.01235	0.01344
0.50	0.01516	0.01474	0.01371	0.01557
0.75	0.01751	0.01648	0.01550	0.01775
1.00	0.01878	0.01867	0.01720	0.01966
1.50	0.02275	0.02115	0.01910	0.02292
2.00	0.02559	0.02365	—	—

SOLUBILITY OF CALCIUM IODATE IN AQUEOUS SOLUTIONS OF AMMONIA AT 25°.

(Kolthoff and Stenger, 1934.)

Conc. of NH_3 in mols. per liter	d_{25} of sat. sol.	Gm. mols. $Ca(IO_3)_2$ per liter	Gms. $Ca(IO_3)_2$ per 1000 gms. sat. sol.
0.0	0.999	0.00785	3.06
0.489	0.995	0.00779	3.05
0.986	0.991	0.00756	2.98
1.422	0.987	0.00733	2.89
1.966	0.983	0.00715	2.84

EQUILIBRIUM IN THE SYSTEM CALCIUM IODATE SODIUM IODATE AND WATER AT 25°.

(Hill and Brown, 1931.)

d_{25} of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$NaIO_3$	$Ca(IO_3)_2$	
—	0.00	0.306	$Ca(IO_3)_2.6H_2O$
1.00	0.522	0.084	"
1.041	5.29	0.000	"
1.074	8.58	0.000	" + $NaIO_3.H_2O$
—	8.58	0.000	$NaIO_3.H_2O$

The mixtures were rotated for about two weeks.

SOLUBILITY OF CALCIUM IODATE IN AQUEOUS SOLUTIONS OF SODIUM SALTS OF ORGANIC ACIDS AT 25°.

(Davies, 1938.)

Sodium salt	Gm. mols. Na Salt per liter aq. solvent	Gm. mols. $Ca(IO_3)_2$ per liter sat. solution
Na Glycollate	0.020	0.009315
"	0.040	0.01056
Na Methoxyacetate	0.020	0.00885
"	0.040	0.009664
Na Pyruvate	0.020	0.008837
"	0.040	0.009609
Na Amisoacetate	0.020 (1)	0.009113
"	0.040 (1)	0.01001
Na B Hydroxy butyrate	0.0215	0.00879
"	0.0430	0.00947
Na Salicylate	0.020	0.008652
"	0.040	0.009241
Na Cyanoacetate	0.020	0.008652
"	0.040	0.009241

(1) This solution also contained CaOH

NO **CALCIUM NITRITE** $Ca(NO_2)_2.4H_2O$.

SOLUBILITY IN WATER. (Oswald, 1914.)

t°.	Gms. $Ca(NO_3)_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $Ca(NO_3)_2$ per 100 Gms. Sat. Sol.	Solid Phase.
− 4	16.7	Ice	18.5	43	$Ca(NO_2)_2.4H_2O$
− 9.3	25.5	"	42	51.8	"
−12.5	29.5	"	44	53.5	" $+Ca(NO_2)_2.2H_2O$
−14.5	32	"	54	55.2	$Ca(NO_2)_2.2H_2O$
−17.5	35	" $+Ca(NO_2)_2.4H_2O$	64	58.4	"
− 9.5	36.2	$Ca(NO_2)_2.4H_2O$	70	60.3	"
0	38.3	"	73	61.5	"
16	42.3 ($d_{16}=1.4205$)	"	91	71.2	"

An aqueous solution simultaneously saturated with calcium nitrite and silver nitrite, contains 92.4 gms. $Ca(NO_2)_2$ + 11.2 gms. $AgNO_2$ per 100 gms. H_2O at 14°. (Oswald, 1914)

100 cc. sat. solution of calcium nitrite in 90 % alcohol contain 39 gms. $Ca(NO_2)_2.H_2O$ at 20°.

100 cc. sat. solution of calcium nitrite in absolute alcohol contain 1.1 gms. $Ca(NO_2)_2.H_2O$ at 20°. (Vogel, 1903.)

Additional determinations of the solubility of calcium nitrite in water by Bureau, 1935, 1937, are as follows.

t°	Gms. $Ca(NO_2)_2$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Ca(NO_2)_2$ per 100 gms. sat. sol.	Solid Phase
-3.75	10.0	Ice	28	50.7	$Ca(NO_2)_2.4H_2O$
-9.05	19.85	"	34.6(tr.pt.)	55.05	"$+Ca(NO_2)_2.H_2O$
-13.0	25.6	"	56.8(1.535)	56.25	$Ca(NO_2)_2.H_2O$
-16.8	30.0	"	58.0	57.15	"
-20.0(Eutec.)	34.2	"$+Ca(NO_2)_2.4H_2O$	64.7(1.560)	57.78	"
-15	35.4	$Ca(NO_2)_2.4H_2O$	79.5(1.577)	60.2	"
0 (1.362)	39.01	"	90.8	62.5	"
+ 2.8	40.4	"	99.5(1.651)	64.1	"
14.0	44.85	"	115.	65.7	-"
18.0(1.427)	45.8	"	128. (tr.pt.)	71.0	"$+Ca(NO_2)_2$
			129	86.4	$Ca(NO_2)_2$

The figures in parentheses show the densities of the saturated solutions.

CALCIUM NITRATE $Ca(NO_3)_2.4H_2O$.

SOLUBILITY IN WATER.

(Bassett and Taylor, 1912.)

(Silica vessels used. Constant agitation at constant temperature for two to three days. Calcium determined by precipitation as oxalate and weighing as oxide.)

t°.	Gms. $Ca(NO_3)_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $Ca(NO_3)_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $Ca(NO_3)_2$ per 100 Gms. Sat. Sol.	Solid Phase.
− 0.4	1.4	Ice	10	53.55	$Ca(NO_3)_2.4H_2O$	45	71.45	$Ca(NO_3)_2.3H_2O$
− 1.4	4.78	"	15	54.94	"	50	73.79	"
− 1.9	6.53	"	20	56.39	"	51	74.73	"
− 3.05	10	"	25	57.98	"	51.1	...†	"
− 4.15	12.98	"	30	60.41	"	49	77.49	$Ca(NO_3)_2.2H_2O$
−15.7	33.13	"	35	62.88	"	51	78.05	"
−21.7	38.7	"	40	66.21	"	55	78.16	$Ca(NO_3)_2$
−28.7	...*		42.4	68.68	"	80	78.2	"
−26.7	43.37	$Ca(NO_3)_2.4H_2O$	42.4	68.74	"	100	78.43	"
−10	47.31	"	42.7	...†	"	125	78.57	"
0	50.50	"	42.45	71.7	"	147.5	78.8	"
5	51.97	"	40	70.37	$Ca(NO_3)_2.3H_2O$	151	79	"

† m. pt. * Eutectic.

SOLUBILITY OF THE UNSTABLE CALCIUM NITRATE TETRAHYDRATE β IN WATER.

NO

(Results supplementary to the above.)

(Taylor and Henderson, 1915.)

t°.	Gms. $Ca(NO_3)_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $Ca(NO_3)_2$ per 100 Gms. Sat. Sol.	Solid Phase.
0	50.17	$\alpha Ca(NO_3)_2.4H_2O$	38	66.65	$\beta Ca(NO_3)_2.4H_2O$
22.2	56.88	"	39	67.93	"
25	57.90	"	39.6 (m. pt.)	69.50	"
30	60.16	"	39 (reflex pt.)	75.34	"
30	61.57	$\beta Ca(NO_3)_2.4H_2O$	40	66.22	$\alpha Ca(NO_3)_2.4H_2O$
34	63.66	"	42.7 (m. pt.)	69.50	"
35	62.88	$\alpha Ca(NO_3)_2.4H_2O$	42.4 (reflex pt.)	71.70	"
38	64.34	"	25	77.30	$Ca(NO_3)_2$

More recent determinations have confirmed the above results except in the vicinity of 42° at which the transition of the 4 hydrate to 3 hydrate occurs. The results of Sieverts and Petzold, 1933, for this region, which are somewhat lower than those of Bassett and Taylor, 1912, are as follows.

t^0	Gms. $Ca(NO_3)_2$ per 100 gms. sat. sol.	Solid Phase	t^0	Gms. $Ca(NO_3)_2$ per 100 gms. sat. sol.	Solid Phase
40	65.3	α $Ca(NO_3)_2.4H_2O$	46	70.6	$Ca(NO_3)_2.3H_2O$
42	67.3	"	48	71.5	"
42.75 (tr.pt.)	69.3	"+$Ca(NO_3)_2.3H_2O$	50	73.0	"
44	69.6	$Ca(NO_3)_2.3H_2O$	−28 (Eutec)	42.7	Ice+$Ca(NO_3)_2.4H_2O\alpha$

Additional determination in the region of unstable equilibrium between 20° and 51° and 70% to 78% composition, determined by very accurately controlled time cooling freezing points, are reported by Ewing, Krey, Law and Lang, 1927.

t°	Gms. $Ca(NO_3)_2$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Ca(NO_3)_2$ per 100 gms. sat. sol.	Solid Phase
42.5	71.3	α $Ca(NO_3)_2.4H_2O$	35.6	76.7	α $Ca(NO_3)_2.4H_2O$
42.2	71.8	"	32.7 (Eutec)	—	" + $Ca(NO_3)_2$
40.9	73.4	"	49.8 (Eutec)	—	$Ca(NO_3)_2.3H_2O+Ca(NO_3)_2$
39.6 (Eutec)		" + $Ca(NO_3)_2.2H_2O$	48.1	76.0	$Ca(NO_3)_2.2H_2O$
36.4	76.3	α $Ca(NO_3)_2.4H_2O$	49.8	76.7	"

The vapor pressure-temperature relations in the above system have been determined by Ewing, 1927.

SOLUBILITY OF CALCIUM NITRATE IN AQUEOUS SOLUTIONS OF CALCIUM THIOSULFATE AT 9° AND AT 25° AND VICE VERSA.

(Kremann and Rodemund, 1914.)

NO

Results at 9°.

Gms. per 100 Gms. Sat. Sol. $Ca(NO_3)_2$.	CaS_2O_3.	Solid Phase.
46.02	5.46	$Ca(NO_3)_2.4H_2O$
45.68	6.81	" $+CaS_2O_3.6H_2O$
27.92	10.46	$CaS_2O_3.6H_2O$
10.49	22.81	"
...	29.33	"

Results at 25°.

Gms. per 100 Gms. Sat. Sol. $Ca(NO_3)_2$.	CaS_2O_3.	Solid Phase.
54.03	4.27	$Ca(NO_3)_2.4H_2O$
50.25	9.10	"
45.92	13	" $+CaS_2O_3.6H_2O$
42.93	13.83	$CaS_2O_3.6H_2O$
32.01	17.09	"
19.51	23.78	"
8.15	29.85	"

SOLUBILITY OF CALCIUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 25°.

(Bassett and Taylor, 1912.)

(The mixtures were shaken intermittently, by hand, during quite long periods; one week was allowed between duplicate determinations.)

Gms. per 100 Gms. Sat. Sol. $Ca(NO_3)_2$.	HNO_3.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. $Ca(NO_3)_2$.	HNO_3.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. $Ca(NO_3)_2$.	HNO_3.	Solid Phase.
57.98	0	$Ca(NO_3)_2.4H_2O$	32.84	32.63	$Ca(NO_3)_2.4H_2O$	9.34	65.69	$Ca(NO_3)_2.2H_2O$
54.82	3.33	"	32.50	33.52	"	8.52	67.20	"
52.96	5.87	"	33.44	35.63	$Ca(NO_3)_2.3H_2O$	5.06	71.12	$Ca(NO_3)_2$
51.58	7.21	"	29.05	41.66	"	2.53	74.77	"
47.82	11.27	"	27.79	45.70	"	1.05	78.56	"
45.59	13.71	"	31.09	40.56	$Ca(NO_3)_2.2H_2O$	0.54	80.83	"
40.70	19.65	"	26.07	45.70	"	0.36	85.83	"
38.17	22.80	"	17.41	55.48	"	0.01	90.90	"
34.46	28.81	"	12.25	62.05	"	0	96.86	"

SOLUBILITY OF CALCIUM NITRATE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE AT 30° AND VICE VERSA.

(Baubaudy, 1923.)

Gms. per 100 gms. sat. sol. $Ca(NO_3)_2$.	KNO_3.	Solid Phase.	Gms. per 100 gms. sat. sol. $Ca(NO_3)_2$.	KNO_3.	Solid Phase.
59.70	0.0	$Ca(NO_3)_2.4H_2O$	50.6	31.8	$Ca(NO_3)_2.?H_2O$
57.0	10.3	"	52.0	30.4	" $+ KNO_3$
58.67	16.86	"	47.87	25.1	$KNO_3 + ?$
58.9	17.2	"	37.22	22.4	KNO_3
61.5	17.7	"	31.9	22.15	"
64.4	14.2	"	24.8	22.8	"
66.0	13.0	" $+Ca(NO_3)_2.?H_2O$	18.15	24.0	"
58.3	22.4	$Ca(NO_3)_2.?H_2O$	8.7	27.0	"

SOLUBILITY OF CALCIUM NITRATE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT 30° AND VICE VERSA. (Baubaudy, 1923.)

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
$Ca(NO_3)_2$.	KCl.	Solid Phase.	$Ca(NO_3)_2$.	KCl.	Solid Phase.
62.4	4.8	$Ca(NO_3)_2.4H_2O$	39.0	15.83	KNO_3
65.6	6.37	"	34.56	16.0	"
73.5	9.0	" + $Ca(NO_3)_2.?H_2O$	27.18	17.14	"
59.9	13.85	$Ca(NO_3)_2.?H_2O$	23.87	18.3	"
52.35	16.0	"	20.17	20.54	"
47.83	17.56	"	17.31	23.4	"
45.8	18.2	" + KNO_3	16.2	24.6	" + KCl
44.33	16.7	KNO_3	14.65	24.74	KCl
44.2	16.6	"	8.22	25.8	"

SOLUBILITY OF CALCIUM NITRATE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE AT 25° AND VICE VERSA.

(Hamid and Das, 1930.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$Ca(NO_3)_2$	KNO_3		$Ca(NO_3)_2$	KNO_3	
57.98	0.0	$Ca(NO_3)_2.4H_2O$	19.14	20.32	KNO_3
56.86	2.64	"	17.34	20.70	"
54.82	7.37	"	11.48	21.53	"
53.26	10.72	"	7.37	22.19	"
49.16	19.06	" + KNO_3	4.96	23.83	"
40.34	19.22	KNO_3	2.12	24.85	"
31.95	19.45	"	0.0	27.30	"

NO

SOLUBILITY OF CALCIUM NITRATE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE AND VICE VERSA.

(Frowein, 1928.)

Results at 0°			Results at 20°		
Gms. per 100 gms. H_2O		Solid Phase	Gms. per 100 gms. H_2O		Solid Phase
KNO_3	$Ca(NO_3)_2$		KNO_3	$Ca(NO_3)_2$	
0.0	96.0	$Ca(NO_3)_2.4H_2O$	0.0	127.5	$Ca(NO_3)_2.4H_2O$
6.15	98.5	"	8.95	131.0	"
15.1	106.0	"	22.4	135.0	"
21.9	109.0	"	34.2	138.5	"
31.4	116.5	"	49.7	141.0	"
39.5	120.0*	" + KNO_3	59.5	141.5	"
34.8	109.0	KNO_3	65.0	142.0†	" + KNO_3
31.5	97.6	"	60.6	133.3	KNO_3
26.3	83.1	"	50.47	117.41	"
21.3	69.6	"	41.25	82.46	"
18.9	56.0	"	33.70	57.00	"
15.9	43.0	"	30.12	44.92	"
13.4	28.6	"	28.75	15.88	"
13.8	0.0	"	31.8	0.0	"

* $d_0 = 1.625$ † $d_{20} = 1.680$

Data are also given for aqueous solutions simultaneously saturated with $Ca(NO_3)_2.4H_2O + KNO_3 + NaNO_3$ at 0° and at 20°.

SOLUBILITY OF CALCIUM NITRATE IN AQUEOUS SOLUTIONS OF SODIUM NITRATE AND VICE VERSA.

(Frowein, 1898.)

Results at 0°			Results at 20°		
Gms. per 100 gms. H_2O		Solid Phase	Gms. per 100 gms. H_2O		Solid Phase
$NaNO_3$	$Ca(NO_3)_2$		$NaNO_3$	$Ca(NO_3)_2$	
4.70	96.0	$Ca(NO_3)_2.4H_2O$	4.7	128.0	$Ca(NO_3)_2.4H_2O$
9.90	97.0	"	16.1	130.0	"
17.00	96.0	"	18.9	129.5	"
21.80	97.0	"	24.1	130.2	"
26.90	97.5*	" + $NaNO_3$	29.0	130.0†	" $NaNO_3$
26.17	92.65	$NaNO_3$	31.3	112.0	$NaNO_3$
28.25	81.50	"	34.4	101.1	"
31.81	72.10	"	39.0	88.5	"
35.00	63.17	"	42.0	78.50	"
39.60	52.88	"	47.2	72.0	"
44.10	40.66	"	54.95	47.60	"
57.50	35.67	"	62.85	38.60	"
59.32	22.70	"	69.80	25.78	"
68.70	11.20	"	81.66	10.00	"
71.74	5.73	"	88.0	0.0	"
73.00	0.0	"			

NO

* d_0 = 1.545 † d_{20} = 1.615

SOLUBILITY OF CALCIUM NITRATE IN AQUEOUS SOLUTIONS OF SODIUM NITRATE AT 9° AND AT 25° AND VICE VERSA.

(Kremann and Rodemund, 1914.)

Results at 9°.			Results at 25°.		
Gms. per 100 Gms Sat Sol.		Solid Phase.	Gms. per 100 Gms. Sat Sol.		Solid Phase.
$Ca(NO_3)_2$.	$NaNO_3$.		$Ca(NO_3)_2$.	$NaNO_3$.	
47.51	9.51	$Ca(NO_3)_2.4H_2O$	54.58	7.25	$Ca(NO_3)_2.4H_2O$
46.08	12.56	" $+NaNO_3$	53.22	10.70	"
26.67	23.32	$NaNO_3$	52.73	12.08	" $+NaNO_3$
11.76	34.26	"	52.40	11.88	$NaNO_3$
			37.31	19.48	"
			26.91	24.98	"
			14.61	36.12	"

These authors also give the complete solubility relations of the reciprocal salt pairs, $Ca(NO_3)_2 + Na_2S_2O_3 \leftrightarrows 2NaNO_3 + CaS_2O_3$ at 9° and 25°.

SOLUBILITY OF CALCIUM NITRATE IN AQUEOUS SOLUTIONS OF SODIUM NITRATE AND VICE VERSA.

(Pelling and Robertson, 1923).

Results at 50°.			Results at 94°.5.		
Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
$Ca(NO_3)_2$.	$NaNO_3$.		$Ca(NO_3)_2$.	$NaNO_3$.	
73.8	0.0	$Ca(NO_3)_2.3H_2O$	78.4	0.0	$Ca(NO_3)_2$
69.4	11.1	» $+NaNO_3$	74.6	4.3	»
62.7	11.5	»	68.9	14.3	»
54.7	14.8	»	67.2	17.4	»
52.8	14.4	»	66.7	18.0	» $+ NaNO_3$
52.3	14.9	»	60.2	17.8	$NaNO_3$
39.2	21.0	»	47.0	24.7	»
30.7	27.4	»	20.5	43.9	»
22.6	34.5	»	0.0	62.6	»

100 cc. pyridine dissolve 5.75 gms. $Ca(NO_3)_2$ at 25° (Müller, R., 1924.)
100 cc. Iso Amyl alcohol dissolve 4.55 » »

SOLUBILITY OF CALCIUM NITRATE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 25°. (D'Ans and Siegler, 1913.)

Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	$Ca(NO_3)_2$.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	$Ca(NO_3)_2$.	Solid Phase.
0	57.5	$Ca(NO_3)_2.4H_2O$	15.2	69.52	$Ca(NO_3)_2$ unstable
8.1	55.2	"	20.4	66.08	" "
14.1	52.9	"	35.9	57.7	" "
22.3	50.2	"	41.8	51.4	" "
29.4	49	"	27.39	61.96	$Ca(NO_3)_2$ stable
31.2	52	"	28.5	61.15	"
29.5	56.2	"	29.6	60.3	" $+Ca(NO_3)_2.2C_2H_5OH$
27.8	60	"	60.2	38.6	$Ca(NO_3)_2.2C_2H_5OH$
26.5	62.3	" $+Ca(NO_3)_2$	54.6	41.9	"
0	82.5	$Ca(NO_3)_2$ unstable	42.5	50.97	"
5.8	77	" "	35.8	55.3	"

SOLUBILITY OF CALCIUM NITRATE IN METHYL ALCOHOL.

(Lloyd, Broun, Glynwyn, Bonnel and Jones, 1928.)

NO

t°	Gms. $Ca(NO_3)_2$ per 100 gms. CH_3OH	Solid Phase	t°	Gms. $Ca(NO_3)_2$ per 100 gms. CH_3OH	Solid Phase
10	134.1	$Ca(NO_3)_2.2CH_3OH$	70	168.5	$Ca(NO_3)_2.2CH_3OH$
40	144.2	"	72	170.7	" + $Ca(NO_3)_2$
60	158.0		73	171.7	$CaNO_3$
			80	169.3	"

SOLUBILITY OF CALCIUM NITRATE IN ETHYL ALCOHOL.

(Lloyd, Brown, Glynwyn, Bonnell and Jones, 1928.)

t°	Gms. $Ca(NO_3)_2$ per 100 gms. C_2H_3OH	Solid Phase	t°	Gms. $Ca(NO_3)_2$ per 100 gms. C_2H_5OH	Solid Phase
10	46.2	$Ca(NO_3)_2.2C_2H_5OH$	50	73.5	$Ca(NO_3)_2.2C_2H_5OH$
20	51.4	"	60	82.1	"
30	56.2	"	70	90.1	$Ca(NO_3)_2$
40	62.9	"	80	91.8	"

SOLUBILITY OF CALCIUM NITRATE IN SEVERAL ORGANIC SOLVENTS.

Solvent.	t°.	Gms. $Ca(NO_3)_2$ per 100 Gms. Sat. Solution.	Authority.
Methyl Alcohol	25	65.5	(D'Ans and Siegler, 1913.)
Propyl "	25	36.5	" "
i Butyl "	25	25	" "
Amyl "	25	13.3	" "
Acetone	25	58.5	" "
Methyl Acetate	18	41 (d sat. sol. = 1.313)	(Naumann, 1909.)

100 gms. abs. C_2H_5OH dissolve 85.4 gm. (?) $Ca(NO_3)_2$ at 25°.
100 gms. 2 Propanol (iso propyl alcohol) $CH_3CHOHCH_3$ dissolve 2.67 gm. $Ca(NO_3)_2$ at 25°. (Fermer and Mellon, 1934.)
100cc Amyl Alcohol dissolve 5.6 gms. $Ca(NO_3)_2$ at 25°. (Müller, Printer and Prest, 1928.)

CALCIUM NITRATE

SOLUBILITY OF CALCIUM NITRATE IN ACETONE.

(Bell, Rowlands, Bamford, Thomas and Jones, 1930.)

t°	Gms. $Ca(NO_3)_2$ per 100 gms. CH_3COCH_3	Solid Phase	t°	Gms. $Ca(NO_3)_2$ per 100 gms. CH_3COCH_3	Solid Phase
0	20.9	$Ca(NO_3)_2 \cdot C_3H_6O$	30	17.1	$Ca(NO_3)_2 \cdot C_3H_6O$
10	17.0	"	40	17.2	"
20	16.8	"	50	18.4	"

RECIPROCAL SOLUBILITY OF CALCIUM NITRATE AND ACETIC ACID DETERMINED BY THE SYNTHETIC METHOD.

(Davidson and Geer, 1938.)

t°	Mols. $Ca(NO_3)_2$ per 100 mols. $Ca(NO_3)_2+CH_3COOH$	Solid Phase	t°	Mols $Ca(NO_3)_2$ per 100 mols. $Ca(NO_3)_2+CH_3COOH$	Solid Phase
30.3	7.87	1.3	14.37	8.90*	CH_3COOH
32.0	8.27	"	14.83	7.87*	"
33.5	8.71	"	15.18	6.57	"
33.9	'8.90	. "	15.60	4.59	"
			15.72	3.65	"
			15.86	2.70	"

NO 1.3 = $Ca(NO_3)_2 \cdot 3CH_3COOH$

* unstable equilibrium

RECIPROCAL SOLUBILITY OF CALCIUM NITRATE AND UREA DETERMINED BY THE FREEZING-POINT METHOD.

(Howells, 1931.)

t°	Gms. $Ca(NO_3)_2$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Ca(NO_3)_2$ per 100 gms. sat. sol.	Solid Phase
142.2	47.2	$Ca(NO_3)_2 \cdot 4CO(NH_2)_2$	96.3	23.18	$Ca(NO_3)_2 \cdot 4CO(NH_2)_2$
144.6	45.6	"	88 (Eutec)	21.0	" + $CO(NH_2)_2$
147.2	44.2	"	90.7	20.04	$CO(NH_2)_2$
151.5 (m.pt.)	40.5	"	100.5	18.04	"
151.3	40.13	"	111.7	12.62	"
143.1	34.55	"	121.6	7.45	"
117.7	26.88	"	127.0	3.90	"
			132.2	0.0	"

SOLUBILITY OF CALCIUM NITRATE IN LIQUID AMMONIA.

(Portnow and Wasseliew, 1935; Portnow and Schorawlew, 1936.)

t°	Gms. $Ca(NO_3)_2$ per 100 gms. NH_3	Solid Phase	t°	Gms. $Ca(NO_3)_2$ per 100 gms. NH_3	Solid Phase
-69.5	59.1	$Ca(NO_3)_2 \cdot 6\frac{1}{2}NH_3$ (?)	-9.5	83.2	$Ca(NO_3)_2 \cdot 4NH_3$
-67	59.7	"	+14.0	89.2	"
-63	62.7	"	18.0	92.3	"
-51	70.5	"	48.5	111.0	$Ca(NO_3)_2$
-41	76.0	$Ca(NO_3)_2 \cdot 4NH_3$	53	111.5	"
-19.5	79.2	"			

100 gms. Liquid Ammonia dissolve 82.2 gms. $Ca(NO_3)_2$ at 0°. (Linhard and Stephan, 1933, 1934.)
100 gms. Liquid Ammonia dissolve 80.2 gms. $Ca(NO_3)_2$ at 25°. (Hunt and Boncyk, 1933.)

Fusion-points have been determined for mixtures of:

$Ca(NO_3)_2$ + $Cd(NO_3)_2$ (Hasselblatt, 1921.)
" + KNO_3 (Rostkowski, 1929, 1930.)
" + " + $NaNO_3$ (Menzies and Dutt, 1911.)
" + $LiNO_3$ (Lehrman and Breslow, 1938; Lehrman et.al., 1937.)
" + $NaNO_3$ (Lehrman et.al., 1937; Lehrman and Breslow, 1938;
" Laybourn, Madgin and Freeman, 1934.)
" + " + $Pb(NO_3)_2$ (Laybourn, Madgin and Freeman, 1934.)
" + " + $Sr(NO_3)_2$ " " " "

CALCIUM OXIDE CaO.

100 gms. molten $CaCl_2$ dissolve 16.2 gm. CaO at about 910°. O
(Arndt and Loewenstein, 1909.)

Data for the systems, CaO + MgO and for CaO + Al_2O_3 + MgO are given by Rankin and Merwin (1916); for CaO + Al_2O_3 + SiO_2 by Rankin and Wright (1915); for CaO + Fe_2O_3 by Sosman and Merwin (1916); and for CaO + MgO + SiO_2 by Bowen (1914).

Data for the system CaO + C + CaC_2 + CO are given by Thompson (1910).

Additional determinations for the above systems are given by Konarzewski, 1931; Ruff, Ebert and Krawczynski, 1933; Tromel, 1932 and Tromel and Korber, 1932.

CALCIUM HYDROXIDE $Ca(OH)_2$.

SOLUBILITY OF CALCIUM HYDROXIDE IN WATER.

(Haslam, Calingaert and Taylor, 1924.)

Equilibrium was approached from above and from below. The excess of lime was allowed to settle and the clear supernatant solution titrated, using phenolphthalein as indicator. OH

t	Gms. CaO per 1000 gms. sat. sol	t	Gms. CaO per 1000 gms. sat. sol.	t°.	Gms. CaO per 1000 gms. sat. sol
10	1.310	56	0.884	66	0.802
42	1.018	60	0.855	70	0.762
48	0.957	61	0.842	80	0.673

Data for the solubility of commercial limes in water are given by Haslam, Whitman and Cochran, Jr. 1924. The results show that these limes do not vary more than 7 per cent from the solubility of pure calcium oxide. The differences are probably due to the presence of small amounts of sodium and potassium hydroxide in commercial limes. The content of Mg O, Si O_2 or carbonate have no effect upon the solubility of ordinary lime, but may have a marked effect upon its rate of solution.

SOLUBILITY OF CALCIUM HYDROXIDE IN WATER.

(Bassett, 1934.)

Attention has been paid in the present work particularly to the influence of particle size upon the solubility of calcium hydroxide. Freshly slacked lime is about 10 percent more soluble than lime in the form of coarse particles, and, since the growth of the particles occurs so slowly that the effect due to it is scarcely apparent when the usual tests are made to see whether true equilibrium has been reached, it is believed that this accounts for the wide variations in the results reported by different investigators. Although Miller and Witt, 1929 recognized the influence of particle size upon the solubility, their one measurement at 30° appears to be about 10 percent too high. Johnston and Grose, 1931, found 0.111 gm. CaO per 100 gms. sat. solution at 25° which is very close to the value 0.113 reported in the present paper.

The calcium hydroxide used for the present determinations was made by slacking lime prepared by igniting especially purified $CaCO_3$. The solutions were mechanically shaken in silver or platinum bottles. About one month was required for freshly slacked lime to reach its limiting value of solubility at 50°. The possibility that this high initial solubility might be due to the existence of a hydrate of calcium hydroxide or of more than one crystalline form appears improbable since all attempts to prepare a monohydrate have failed. The sources of error in the gravimetric determination of calcium have been examined and it has been found that the solubility of calcium oxalate is an important factor in this determination.

t°	Gms. CaO per 100 gms. solution saturated with: Coarse $Ca(OH)_2$	Fine $Ca(OH)_2$	Solid Phase	t°	Gms. CaO per 100 gms. solution saturated with: Coarse $Ca(OH)_2$	Fine $Ca(OH)_2$	Solid Phase
-0.088	0.100	—	Ice	40	0.100	0.107	$Ca(OH)_2$
-0.123	—	0.142	" + $Ca(OH)_2$	45	0.0962	—	"
-0.116	0.130	—	" + "	50	0.0917	0.0968	"
0	0.130	0.143(0.151)	$Ca(OH)_2$	60.8	0.0818	0.0917	"
5	0.128	0.142	"	70	—	0.0800	"
10	0.125	0.138	"	81.7	0.0657	—	"
15	0.122	0.133	"	90	0.0591	—	"
19	0.118*	—	"	95.3	0.0561	—	"
25	0.113	0.129	"	99	0.0523	—	"
30	0.109	0.121	"	150	0.0246*	—	"

Result by

* Shenstone and Cundall, 1883.

* One liter sat. aqueous solution contains 0.305 gm. CaO at 120°, 0.169 gm. at 150°, and 0.084 gm. at 190°. (Herald, 1905.)

A series of determinations by Grieve, Gurd and Maass, 1933 and by Larocque and Maass, 1935, using freshly slacked lime and estimating solubility from electrical conductivity measurements, gave results agreeing fairly closely with the above values for fine $Ca(OH)_2$.

SOLUBILITY OF CALCIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF CALCIUM CHLORIDE AT 25°.

(Schreinemakers and Figee, 1911.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
$CaCl_2$.	CaO.		$CaCl_2$.	CaO.	
5.02	0.101	$Ca(OH)_2$	33.21	0.245	$CaCl_2.4CaO.14H_2O$
10	0.115	"	33.72	0.254	" $+CaCl_2.CaO.2H_2O$
15.14	0.140	"	34.36	0.173	$CaCl_2.CaO.2H_2O$
18.15	0.148	" $+CaCl_2.4CaO.14H_2O$	38.61	0.060	"
18.01	0.152	$CaCl_2.4CaO.14H_2O$	41.32	0.048	"
21.02	0.147	"	44.30	0.030	"
28.37	0.170	"	44.61	0.029	" $+CaCl_2.6H_2O$
32.67	0.225	$Ca(OH)_2$?	44.77	...	$CaCl_2.6H_2O$

Data for the above system at 10°, 25°, 40°, 45°, 48°, and 50° are given by Milikau (1916).

SOLUBILITY OF CALCIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF CALCIUM CHLORIDE.

(Zahorsky — Z. anorg. Chem. 3, 41, '93; Lunge — J. Soc. Chem. Ind. 11, 882, '92.)

Concentration of $CaCl_2$ Solutions, Wt.%.	Grams CaO Dissolved per 100 cc. Solvent at: 20°.	40°.	60°.	80°.	100°.
0	0.1374	0.1162	0.1026	0.0845	0.0664
5	0.1370	0.1160	0.1020	0.0936	0.0906
10	0.1661	0.1419	0.1313	0.1328	0.1389
15	0.1993	0.1781	0.1706	0.1736	0.1842
20	0.1857*	0.2249	0.2204	0.2295	0.2325
25	0.1661*	0.3020*	0.2989	0.3261	0.3710
30	0.1630*	0.3680*	0.3664	0.4122	0.4922

OH

* Indicates cases in which a precipitate of calcium oxychloride separated and thus removed some of the $CaCl_2$ from solution.

The results in 0% $CaCl_2$ solutions, *i.e.*, in pure water, are high when compared with the average results given above.

EQUILIBRIUM IN THE SYSTEM CALCIUM OXIDE, CALCIUM IODIDE AND WATER AT 25°.

(Milikan, 1917.)

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
CaO.	CaI_2.		CaO.	CaI_2.		CaO.	CaI_2.	
0.118	0.0	$Ca(OH)_2$	0.089	31.33	1.3.16	0.047	49.70	1.3.16
0.076	9.14	"	0.075	33.00	"	0.139	59.34	"
0.089	17.42	"	0.064	40.30	"	0.587	66.72	" $+CaI_2.6H_2O$
0.087	25.80	"	0.054	46.37	"	0.553	66.65	" "
0.097	25.44	" +1.3.16	0.055	47.09	"	0.0	66.80	$CaI_2.6H_2O$

$1.3.16 = CaI_2.3CaO.16H_2O$.

SOLUBILITY OF CALCIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE AT 25°.

(Noyes and Chapin — Z. physik. Chem. 28, 520, '99.)

Millimols per Liter.		Grams per Liter of Saturated Solution.		
NH_4Cl.	$Ca(OH)_2$.	NH_4Cl.	$Ca(OH)_2$ =	CaO.
0.00	20.22	0.00	1.50	1.13
21.76	29.08	1.165	2.16	1.63
43.52	39.23	2.330	2.91	2.20
83.07	59.68	4.447	4.42	3.45

SOLUBILITY OF CALCIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF CALCIUM NITRATE AT 25° AND AT 100°.

(Bassett and Taylor, 1914; see also Cameron and Robinson, 1907a.)

Results at 25°.

Gms. per 100 Gms. Sat. Sol. CaO.	Gms. per 100 Gms. Sat. Sol. $Ca(NO_3)_2$.	Solid Phase.
0.1150	0	$Ca(OH)_2$
0.0978	4.836	"
0.1074	9.36	"
0.1193	13.77	"
0.1444	22.46	"
0.1650	27.83	"
0.1931	32.94	"
0.2579	40.66	"
0.3060	44.44	"
0.2802	45.28	$Ca_2N_2O_7.3H_2O$
0.2314	47.79	"
0.1894	51.07	"
0.1659	53.20	"
0.1486	55.25	"
0.0836	57.72	$Ca(NO_3)_2.4H_2O$
0	57.98	"

Results at 100°.

Gms. per 100 Gms. Sat. Sol. CaO.	Gms. per 100 Gms. Sat. Sol. $Ca(NO_3)_2$.	Solid Phase.
0.0561	0	$Ca(OH)_2$
0.0550	2.42	"
0.0624	4.91	"
0.1110	15.39	"
0.1200	16.10	"
0.155	21.86	"
0.269	33.03	"
0.480	42.26	"
0.973	50.94	"
1.261	53.75	"
1.477	55.40	"
1.476	55.43	"
1.491	55.65	"
1.635	56.89	" $+Ca_2N_2O_7.2H_2O$
1.686	57.03	
1.596	57.91	$Ca_2N_2O_7.2H_2O$

Results at 100° (Con.).

Gms. per 100 Gms. Sat. Sol. CaO.	Gms. per 100 Gms. Sat. Sol. $Ca(NO_3)_2$.	Solid Phase.
1.576	58.67	$Ca_2N_2O_7.2H_2O$
1.348	60.44	"
1.167	62.82	"
1.077	66.44	"
1.141	69.12	"
1.252	70.60	" + a very little $Ca_2N_2O_7.\frac{1}{2}H_2O$
1.203	70.40	$Ca_2N_2O_7.\frac{1}{2}H_2O$
1.103	71.44	"
0.937	73.85	"
0.849	75.74	"
0.815	76.94	"
0.804	77.62	$Ca(NO_3)_2$
0.412	77.74	"
0	78.43	"

Cerasine wax bottles were used and more than 6 months constant agitation allowed for attainment of equilibrium at 25° and 4–14 days at 100°.

OH

SOLUBILITY OF CALCIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF CALCIUM SULFATE AT 25°.

(Cameron and Bell, 1906.)

Gms. per 100 cc. Sat. Sol. $CaSO_4$.	Gms. per 100 cc. Sat. Sol. CaO.	Solid Phase.	Gms. per 100 cc. Sat. Sol. $CaSO_4$.	Gms. per 100 cc. Sat. Sol. CaO.	Solid Phase.
0	0.1166	$Ca(OH)_2$	0.1634	0.0939	$CaSO_4.2H_2O$
0.0391	0.1141	"	0.1722	0.0611	"
0.0666	0.1150	"	0.1853	0.0349	"
0.0955	0.1215	"	0.1918	0.0176	"
0.1214	0.1242	"	0.2030	0.0062	"
0.1588	0.1222	" $+CaSO_4.2H_2O$	0.2126	0	"

The mixtures were constantly agitated at 25° for two weeks.

SOLUBILITY OF CALCIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF AMMONIUM HYDROXIDE AT 25°.

(Kolthoff and Stenger, 1934.)

d_{25} of sat. sol.	Normality of NH_3	Gms. CaO per 100cc sat. sol.
0.998	0.0 (= H_2O)	0.1194
0.994	0.496	0.1117
0.989	0.981	0.1038
0.985	1.475	0.0953
0.982	1.955	0.0881

One liter of aqueous 5.2% NH_3 solution dissolves 0.81 gm. $Ca(OH)_2$ at about 20°. (Konowalow, 1899b.)

SOLUBILITY OF CALCIUM HYDROXIDE IN AQUEOUS SALT SOLUTIONS AT 25°.

(Johnston, and Grove, 1931.)

Definitely crystalline calcium hydroxide was used, which was prepared by allowing solutions of calcium chloride and sodium hydroxide to diffuse into each other so that the crystals were built up slowly. An apparatus was used in which the liquid flowed back and forth through a column of crystals held rigidly in place, carbon dioxide was rigidly excluded. All analyses were made on the weight basis. The $Ca(OH)_2$ was determined by simple titration with 0.05n HCl using phenolphthaleine and methyl red as indicator, except in cases where nitrite or acetate was present, when only phenolphthaleine was used.

Salt	Gm. mols. per $Kg.H_2O$		Salt	Gm. mols. per $Kg.H_2O$		Salt	Gm. mols. per $Kg.H_2O$	
	Salt	$Ca(OH)_2$		Salt	$Ca(OH)_2$		Salt	$Ca(OH)_2$
None	0.00	0.01976	LiCl	1.85	00.04239	$NaClO_4$	0.118	0.02325
NaCl	0.012	0.02065	"	2.25	0.04405	"	0.399	0.02538
"	0.064	0.02268	"	3.03	0.04643	"	0.476	0.02562
"	0.121	0.02402	"	3.81	0.04762	"	0.776	0.02566
"	0.366	0.02718	"	5.36	0.04845	"	1.16	0.02479
"	0.763	0.02911	"	10.37	0.04472	"	1.58	0.02353
"	1.21	0.02966	$BaCl_2$	0.019	0.02283	"	2.40	0.02046
"	1.75	0.02933	"	0.037	0.02470	"	3.57	0.01624
"	2.15	0.02857	"	0.066	0.02683	NaBr	0.189	0.02485
"	2.24	0.02833	"	0.111	0.02945	"	0.348	0.02641
"	2.81	0.02669	"	0.159	0.03157	"	0.721	0.02805
"	3.76	0.02410	"	0.287	0.03578	"	0.979	0.02847
KCl	0.038	0.02457	"	0.425	0.03910	"	1.30	0.02841
"	0.076	0.02473	"	0.624	0.04246	"	1.77	0.02780
"	0.264	0.02550	"	1.29	0.04916	"	2.90	0.02478
"	0.527	0.02708	"	1.44	0.04991	KBr	0.162	0.02404
"	0.989	0.02766	"	1.59	0.05022	"	0.270	0.02509
"	1.08	0.02768	$SrCl_2$	0.053	0.02624	"	0.453	0.02608
"	1.28	0.02744	"	0.120	0.03043	"	0.759	0.02669
"	1.62	0.02696	"	0.283	0.03702	"	0.930	0.02670
"	1.96	0.02610	"	0.445	0.04135	"	1.27	0.02636
"	2.87	0.02351	"	0.823	0.04819	"	1.55	0.02596
CsCl	0.073	0.02236	"	1.33	0.05336	"	2.09	0.02441
"	0.199	0.02451	"	2.19	0.05622	"	3.24	0.02058
"	0.537	0.02684	"	2.23	0.05623	NaI	0.085	0.02261
"	0.862	0.02724	"	3.18	0.05537	"	0.159	0.02410
"	1.25	0.02703	$NaClO_3$	0.189	0.02466	"	0.356	0.02590
"	1.56	0.02647	"	0.386	0.02643	"	0.605	0.02678
"	3.55	0.02056	"	0.716	0.02755	"	0.904	0.02702
LiCl	0.054	0.02266	"	0.814	0.02765	"	1.33	0.02662
"	0.115	0.02473	"	1.14	0.02776	"	1.60	0.02605
"	0.249	0.02799	"	1.59	0.02731	"	1.83	0.02541
"	0.465	0.03172	"	1.97	0.02618	"	2.11	0.02466
"	0.830	0.03573	"	2.96	0.02352	"	2.86	0.02228
"	1.37	0.03990	"	4.56	0.01899	"	4.21	0.01871

Salt	Gm. mols. per Kg. H_2O		Salt	Gm. mols. per Kg. H_2O		Salt	Gm. mols. per Kg. H_2O	
	Salt	$Ca(OH)_2$		Salt	$Ca(OH)_2$		Salt	$Ca(OH)_2$
$NaNO_3$	0.170	0.02538	$NaNO_3$	3.78	0.03079	$NaC_2H_3O_2$	0.188	0.02633
"	0.217	0.02592	"	4.72	0.02931	"	0.588	0.03243
"	0.351	0.02767	$NaNO_2$	0.252	0.02665	"	0.692	0.03295
"	0.510	0.02915	"	0.455	0.02894	"	0.972	0.03383
"	0.838	0.03098	"	0.854	0.03127	"	1.01	0.03492
"	1.35	0.03230	"	1.30	0.03255	"	1.67	0.03648
"	1.76	0.03275	"	2.03	0.03321	"	3.26	0.03718
"	2.27	0.03274	"	2.90	0.03322	"	3.64	0.03678
"	2.81	0.03231	"	4.12	0.03204	"	4.88	0.03497
			"	5.82	0.02964			

SOLUBILITY OF CALCIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AND OF SODIUM CHLORIDE.

(Cabot, 1897.)

In KCl Solutions. In NaCl Solutions.

Gms. of the Chloride per Liter.	In KCl Solutions. Gms. CaO per Liter at:			In NaCl Solutions. Gms. CaO per Liter at:		
	0°.	15°.	99°.	0°.	15°.	99°.
0	1.36	1.31	0.635	1.36	1.31	0.635
30	1.701	1.658	0.788	1.813	1.703	0.969
60	1.725	1.674	0.876	...	1.824	1.004
120	1.718	1.606	0.894	1.86	1.722	1.015
240	1.248	1.199	0.617	1.37	1.274	0.771
320	...	...	...	1.054	0.929	0.583

OH

Results in harmony with the above for the solubility of calcium hydroxide in aqueous solutions of potassium chloride at 50°, are given by Kernot, d'Agostino and Pellegrino (1908).

SOLUBILITY OF LIME IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE ALONE AND CONTAINING SODIUM HYDROXIDE.

(Maigret, 1905.)

G. NaCl per Liter.	Gms. CaO per Liter of Solution.			G. NaCl. per Liter.	Gms. CaO per Liter of Solution.		
	Without NaOH.	0.80 NaOH per Liter.	4.00 NaOH per Liter.		Without NaOH.	0.80 NaOH per Liter.	4.00 NaOH per Liter.
0	1.3	0.8	0.22	150	1.65	1.25	0.44
5	1.4	0.9	...	175	1.6	1.2	...
10	1.6	1.0	...	182	1.6	1.2	...
25	1.7	1.1	...	225	1.4	1.0	...
50	1.8	1.25	...	250	1.3	0.9	...
75	1.9	1.4	0.55	300	1.1	0.7	0.22
100	1.85	1.4	...	...	...	...	...

SOLUBILITY OF CALCIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE.

(d'Anselme — Bull. soc. chim. [3] 29, 938, '03.)

Concentration of NaOH:		Grams CaO per Liter Sat. Solution at:			
Normality.	Gms. per Liter	20°.	50°.	70°.	100°.
0	0	1.170	0.880	0.75	0.54
N/100	0.4	0.94	0.65	0.53	0.35
N/25	1.6	0.57	0.35	0.225	0.14
N/15	2.66	0.39	0.20	0.11	0.05
N/8	5.00	0.18	0.06	0.04	0.01
N/5	8.00	0.11	0.02	0.01	trace
N/2	20.00	0.02	trace	0.00	0.00

For results upon mixtures of calcium hydroxide and alkali carbonates and hydroxides, see Bodländer — Z. angew. Chem. 18, 1138, '05.

SOLUBILITY OF CALCIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF GLYCEROL AT 25°.

(Herz and Knoch — Z. anorg. Chem. 46, 193, '05; for older determinations, see Berthelot — Ann. chim phys. [3] 46, 176; and Carles — Arch. Pharm. [3] 4, 558, '74.)

Density of Solutions	Wt. per cent Glycerine in Solution.	Millimols $\frac{1}{2}Ca(OH)_2$ per 100 cc. Solution.	Gms. per 100 cc. Solution. $Ca(OH)_2$	= CaO.
1.0003	0.0	4.3	0.1593	0.1206
1.0244	7.15	8.13	0.3013	0.2281
1.0537	20.44	14.9	0.5522	0.4180
1.0842	31.55	22.5	0.8339	0.6313
1.1137	40.95	40.1	1.486	1.125
1.1356	48.7	44.0	1.631	1.234
1.2072	69.2	95.8	3.550	2.687

EQUILIBRIUM IN THE SYSTEM CALCIUM HYDROXIDE, PHENOL AND WATER AT 23°.

(Van Meurs, 1916.)

Mols. per 100 mols. sat. sol. C_6H_5OH.	$\frac{Ca(OH)_2}{2}$.	Solid Phase	Mols per 100 mols sat. sol. C_6H_5OH	$\frac{Ca(OH)_2}{2}$.	Solid Phase
0.0	0.06	$Ca(OH)_2$	16.72	6.95	1.3
0.40	0.46	"	25.19	7.79	"
1.25	1.35	"	30.26	8.67	"
2.11	2.19	"	35.56	8.30	"
2.63	2.63	" + 1.3	38.38	8.21	"
4.82	4.20	1.3	53.19	7.56	"
7.65	5.16	"	68.25	4.08	"
11.03	6.12	"	75.25	3.60	" + C_6H_5OH
12.41	6.47	"	74.06	1.38	C_6H_5OH

OH

$$1.3 = (C_6H_5O)_2Ca.3H_2O.$$

At concentrations of $Ca(OH)_2$ less than 0.55 mol. per cent two liquid layers having the following composition are formed.

Aqueous layer. Mol %, C_6H_5OH	Mol. % $\frac{Ca(OH)_2}{2}$.	Phenol layer Mol % C_6H_5OH	Mol % $\frac{Ca(OH)_2}{2}$.
1.79	0	32.33	0
2.16	0.14	23.08	0.37
2.76	0.23	18.48	0.54

SOLUBILITY OF CALCIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF GLYCEROL AND OF CANE SUGAR AT 25°.

(Cameron and Patten, 1911)

In order to obviate the uncertainties due to the presence of a large excess of the solid phase in contact with the solutions, the clear liquids, saturated at 0°, were decanted from the solid and slowly brought to 25° and constantly agitated at this temperature, until equilibrium with the finely divided solid phase, which separates at the higher temperature, was reached.

Results for Glycerol Solutions.

d_{25} of Sat. Sol.	Gms per 100 Gms Sat Sol. $Ca(OH)_2$.	$C_3H_5(OH)_3$.	Solid Phase.
0.983	0.117	0	$Ca(OH)_2$
1.008	0.178	3.50	"
...	0.413	15.59	"
1.042	0.48	17.84	"
1.088	0.88	34.32	"
1.149	1.34	55.04	"

Results for Sugar Solutions.

d_{25} of Sat. Sol.	Gms per 100 Gms Sat Sol $Ca(OH)_2$.	$C_{12}H_{22}O_{11}$	Solid Phase.
1	0.188	0.62	$Ca(OH)_2$
1.021	0.730	4.82	"
1.037	1.355	7.50	"
1.067	3.21	11.90	"
1.109	5.38	17.42	"
1.123	6.07	19.86	"

SOLUBILITY OF CALCIUM HYDROXIDE IN DILUTE AQUEOUS SOLUTIONS OF CANE SUGAR AT 20°.

(Saalmann, 1933.)

Gms. per 100cc sat. sol.		Solid Phase	Gms. per 100 cc sat. sol.		Solid Phase
$Ca(OH)_2$	$C_{12}H_{22}O_{11}$		$Ca(OH)_2$	$C_{12}H_{22}O_{11}$	
0.154	0.0	$Ca(OH)_2$	0.217	1.2	$Ca(OH)_2$
0.159	0.1	"	0.229	1.5	"
0.178	0.3	"	0.295	2.1	"
0.204	0.9	"	0.331	2.5	"

SOLUBILITY OF FRESHLY PRECIPITATED CALCIUM HYDROXIDE IN DILUTE AQUEOUS SUGAR SOLUTIONS AT 17°.

(Fuchs, 1929.)

To 25 cc portions of aqueous sugar solutions of increasing concentrations, 50 cc of 1.0 normal NaOH were added, followed by 25 cc 2.0 + normal $CaCl_2$. The mixtures were shaken frequently during 5 minutes and the precipitated $Ca(OH)_2$ removed by filtration. 50 cc portions of the clear filtrates were titrated with 1.0 normal HCl using methyl red as indicator.

OH

Gms. per 100 cc sat. sol.		Gms. per 100 cc sat. sol.		Gms. per 100 cc sat. sol.	
Sugar	$Ca(OH)_2$	Sugar	$Ca(OH)_2$	Sugar	$Ca(OH)_2$
0.0	0.304	0.5	0.871	1.5	0.882
0.1	0.452	0.6	0.915	1.6	0.900
0.2	0.545	0.7	0.943	1.7	0.904
0.3	0.671	0.9	0.926	2.1	1.193
0.4	0.785	1.2	0.911	2.5	1.559
		1.4	0.893		

THE SYSTEM CALCIUM HYDROXIDE, SACCHAROSE, WATER.

(Reinders and Van Nelder, 1932.)

To avoid the delay in reaching equilibrium when calcium oxide is added to sugar solutions, the authors used calcium hydroxide prepared by digesting calcium oxide for some weeks in a large excess of water. This suspension was added to the sugar solution and the mixture shaken for several days. The clear saturated solutions were titrated with standard HCl and the sugar determined polarimetrically.

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
Sugar	CaO		Sugar	CaO	
Results at 12°			Results at 25° (con)		
0	0.137	$Ca(OH)_2$	27.2	6.72	$Ca(OH)_2$
9.8	1.99	"	31.4	8.39	"
18.7	4.75	"	35.2	9.8	" + Saccharate
29.2	8.50	"	35.0	10.1	Saccharate
29.5	8.8	" + Saccharate	36.2	9.8	"
32.4	8.08	Saccharate	43.7	8.84	"
38.6	8.01	"	53.2	7.87	"
40.6	7.50	"	68.3	4.08	Saccharose
45.1	7.1	"	67.9	0.0	"
Results at 25°			Results at 45°		
0	0.122	$Ca(OH)_2$	0.0	0.102	$Ca(OH)_2$
2.1	0.242	"	9.93	1.02	"
4.2	0.461	"	20.0	3.19	"
6.6	0.750	"	30.6	6.10	"
8.6	1.11	"	40.8	9.50	"
11.8	1.86	"	42.0	10.0	" + Saccharate
15.4	2.76	"	45.3	9.54	Saccharate
21.1	4.53	"	58.3	8.0	"

SOLUBILITY OF CALCIUM HYDROXIDE IN AQUEOUS SUGAR SOLUTIONS IN CONTACT WITH INCREASING EXCESSES OF THE SOLID PHASE.

(Doubourg, 1951.)

Powdered and sifted slacked lime was added in variable measured excess to aqueous sugar solutions. The mixtures were each brought to a volume of 1000cc and stirred in bottles filled to the neck for 3 hours. The clear saturated solutions were titrated for alkalinity using phenolphthaleine as indicator and the sugar determined in this neutralized sample.

t°	Gms. Sugar per 1000 cc of the original mixture	Gms. CaO dissolved per liter of sat. solution when the amount of CaO originally present was: 40 gms.	60 gms.	80 gms.
15	90	18.1 (90.2)	18.5 (90.6)	19.1 (91.7)
"	140	26.6(139.8)	33.0(141.1)	34.1(142.9)
"	200	29.2(200.0)	46.8(200.3)	49.7(203.7)
40	90	7.3 (90.7)	8.2 (92.2)	8.4 (92.3
"	140	14.7(142.1)	16.9(142.6)	20.0(144.6)
"	200	22.3 —	29.5 —	31.4 —
60	90	3.6 (91.3)	3.8 (92.3)	4.2 (93.0)
"	140	7.5(141.4)	8.3(143.0)	8.9(145.2)
"	200	15.2(202.4)	16.1(204.4)	17.6(207.9)
80	90	0.18 (91.2)	0.18 (92.7)	0.18 (93.8)
"	140	2.8(142.1)	2.8(144.3)	2.8(145.9)
"	200	4.5(201.8)	5.0(204.0)	5.3 —

The figures in parentheses are the gms. sugar per liter of saturated solution. It is concluded that lime in contact with sugar solution is progressively covered with a layer of sucrate, which prevents further solution of the lime, and this process is the more rapid the higher the temperature. Hence the quantity of lime dissolved is greater at low than at high temperatures.

SOLUBILITY OF LIME IN AQUEOUS SOLUTIONS OF SUGAR.

(Weisberg — Bull. soc. chim. [3] 21, 775, '99.)

The original results were plotted on cross-section paper and the following table constructed from the curves.

1st series, t° = 16′–17°. 2d, series t° = 15°.

Gms. per 100 Gms. Solution. Sugar.	CaO.	G. CaO per 100 Gms. Sugar in Sol.	Gms. per 100 Gms. Solution. Sugar.	CaO.	G. CaO per 100 Gms. Sugar in Sol.
1	0.30	35.0	1	0.50	62.5
2	0.56	28.7	2	0.75	36.0
3	0.85	28.0	3	1.02	32.5
4	1.12	27.7	4	1.22	30.2
5	1.40	27.5	5	1.45	28.5
6	1.65	27.5	6	1.67	27.7
8	2.22	27.5	8	2.22	27.5
10	2.77	27.5	10	2.77	27.5
12	3.27	27.5	12	3.27	27.5
14	3.85	27.5	14	3.85	27.5

In the second series a very much larger excess of lime was used than in the first series. The author gives results in a subsequent paper, — Bull. soc. chim. [3] 23, 740, '00, — which show that the solubility is also affected by the condition of the calcium compound used, *i.e.*, whether the oxide, hydrate, or milk of lime is added to the sugar solutions.

A very exhaustive investigation of the factors which influence the solubility of lime in sugar solutions is described by Claasen (1911).

SOLUBILITY OF CALCIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF CANE SUGAR AT 80°.

(von Ginneken, 1911.)

Gms. per 100 Gms. Sat. Sol. CaO.	Sugar.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. CaO.	Sugar.	Solid Phase.
0.117	4.90	$Ca(OH)_2$	0.358	19.50	$Ca(OH)_2$
0.189	9.90	"	0.548	24.60	"
0.230	14.75	"	1.017	29.70	"

CALCIUM PHOSPHATE (Tribasic) $Ca_3(PO_4)_2$.

SOLUBILITY IN WATER.

PO

The determinations of the solubility of this salt in water, as stated in the literature, are found to vary within rather wide limits, due, no doubt, to the fact that so-called tribasic calcium phosphate is apparently a solid solution of the dibasic salt and calcium oxide, and therefore analyses of individual samples may show an excess of either lime or phosphoric acid. When placed in contact with water, more PO_4 ions enter solution than Ca ions, the resulting solution being acid in reaction and the solid phase richer in lime than it was, previous to being added to the water. For material having a composition approximating closely that represented by the formula $Ca_3(PO_4)_2$ the amount which is dissolved by CO_2 free water at the ordinary temperature, as calculated from the calcium determination, is 0.01 to 0.10 gram per liter, depending upon the conditions of the experiment. Water saturated with CO_2 dissolves 0.15 to 0.30 gram per liter.

A list of references to papers on this subject is given by Cameron and Hurst — J. Am. Chem. Soc., **26**, 903, 1904; see also Cameron and Bell, *Ibid.*, **27**, 1512, 1905.

THE SYSTEM TRICALCIUM PHOSPHATE AND WATER AT ABOUT 20°.

(Frohlich, 1929; Danneel and Frohlich, 1930.)

Accurately weighed amounts of tricalcium phosphate were shaken with amounts of water which varied from 200 parts to 1 part of solid to 50,000 parts to 1 of solid. The filtered solutions were analyzed for CaO and P_2O_5.

Ratio in gms. $Ca_3(PO_4)_2:H_2O$	Milligrams per liter CaO	P_2O_5	Av. Mgm. mol. per liter CaO	P_2O_5	Mgm. mol. CaO / Mgm. mol. P_2O_5
1.0 : 200	60.6-62.3	139.2-143.5	1.095	0.995	1.10
0.2 : 200	21.85	41.23	0.39	0.29	1.34
0.1 : 500	10.10-11.22	11.38-14.21	0.19	0.093	2.04
0.05 : 500	8.42-9.54	8.54-9.95	0.16	0.062	2.58
0.05 :1000	5.32	5.68	0.095	0.04	2.38
0.033:1000	4.82-5.32	4.83-5.27	0.090	0.0356	2.53
0.03 :1500	3.31-3.98	3.41-3.98	0.067	0.0264	2.54

100 gms. sat. solution of tricalcium phosphate in water contain 0.0059 gm. CaO and 0.0138 gm. P_2O_5 at 25 . (Pauli and Stenzinger, 1929.)

CALCIUM PHOSPHATE (Tribasic) $Ca_3(PO_4)_2$ and (Dibasic) $CaHPO_4.2H_2O$.

THE SOLUBILITY PRODUCT OF SECONDARY AND TERTIARY CALCIUM PHOSPHATE UNDER VARIOUS CONDITIONS. (Holt, Jr., La Mer and Chown, 1925.)

In connection with studies of bone calcification and the absorption and excretion of calcium and phosphorus from the body, these authors have made an extensive study of the solubilities of the sparingly soluble salts of calcium. They call attention to the inapplicability of procedures based upon dissolving $Ca_3 (PO_4)_2$ and $Ca H PO_4$ in water, on account of the hydrolysis of these salts. It is pointed out that for most purposes the actual molar solubility is of little importance, for the solubility of dissociable substances is defined just as accurately and even more generally in terms of the solubility product. According to this latter, the product of the molar concentrations of the ions of any insoluble salt is a constant. The principle can, therefore, be applied in systems where one or the other ion is present in excess. Thus, acid solutions in which the total calcium and total phosphate concentrations are large enough to be determined by analysis, can be used. In these cases the PO_4''' ion is only a very small fraction of the total phosphate, but this minute fraction can be accurately determined, provided the p_H of the solution and the ionization constants of $H_3 PO_4$ are known. If such a solution is in equilibrium with the solid phase, $Ca_3 (PO_4)_2$, the necessary conditions are met for evaluating the solubility product constant $K_{s.p.}$. Results are first given by the authors for a system suitable for this purpose, obtained by titrating 0.01 molar $H_3 PO_4$ solution with saturated lime water. They determined the p_H ranges over which $Ca H PO_4$ and $Ca_3 (PO_4)_2$ are stable. The solubility product in terms of activities (i. e. the stoichiometric solubility product at infinite dilution) was found to be $10^{-6.4}$ for $Ca H PO_2$ and $10^{-32.5}$ for $Ca_3(PO_4)_2$ at 38°. Data for the effect of salts in solution upon these solubility products are given, and the stoichiometric solubility product constant for $Ca_3 (PO_4)_2$ in blood serum was found to be 10^{24} at 38°. In a later paper by Holt (1925) it was shown that tertiary calcium phosphate is far less soluble in cerebrospinal fluid than in blood serum.

THE SOLUBILITY OF TERTIARY CALCIUM PHOSPHATE IN SALT SOLUTIONS AND IN BIOLOGICAL FLUIDS AT 38°. (Sendroy, Jr., and Hastings, 1926.)

In this paper the authors have developed the equations relating the second and the third dissociation constants of phosphoric acid to the ionic strength of the solution. They also give data for the solubility of $Ca_3 (PO_4)_2$ in salt solutions and in serum. The results are for cases in which only $Ca_3 (PO_4)_2$ is present as the solid phase and in which salts comparable in amount and kind to those found in serum and transudates were present.

Additional data and further discussion of the solubility of tertiary calcium phosphate and of phosphatic slags in aqueous solutions of acids and of salts are given by Aita, 1917, Cirikov, 1918 and Atkins, 1924.

CALCIUM PHOSPHATE

The Solubility Products of Calcium Phosphates.

In studies upon the chemical natures of the calcium salts of bone Logan and Taylor, 1937, found that the ion product $[Ca^{++}]^3 x [PO_4^{=}]^2$ increases as the amount of bone or tricalcium phosphate, equilibrated with solutions of their ions, decreases below 150 mgs. per liter. The solubility product of this substance expressed as $p[(Ca^{++})^3 x (PO^{=})^2]$ is 23.1 (± 0.4).

In studies upon the composition of bone, Shear and Kramer, 1928; and Shear, Washburn and Kramer, 1929, point out that previous investigations have shown that the solubility product of $Ca_3(PO_4)_2$ is not the quantity which governs the deposition of calcium phosphate, and that the mechanism of bone calcification is still obscure. They believe that if the solubility product of $CaHPO_4$ be employed instead of that of $Ca_3(PO_4)_2$, information regarding calcification may be obtained.

PO

In their experiments they use crystalline $CaHPO_4$ made by precipitation from solutions of pH not greater than 5.5. They found that with this compound equilibrium is reached very rapidly. When 0.1 gm. cryst. $CaHPO_4$ was shaken at room temperature for one hour with 20cc H_2O, the pH of the solution was 6.9 and there was present 3.6 mgs. Ca and 3.2 mgs. P per 100 cc. These quantities were not increased by longer shaking. Although the ratio of Ca to P varies with the excess of solid phase the ion product $[Ca^{++}] x [HPO_4^{=}]$ at equilibrium, does not. Using ionic strengths of "Inorganic Serum Solutions" made with Na, K, Cl and CO_2 present in the same concentration as in normal blood serum, the authors found the value of K's.p.$CaHPO_4$, the solubility product of $CaHPO_4$, to be $[Ca^{++}] x [HPO_4^{=}] = 3.2 \pm 1 x 10^{-6}$ at room temperature and $[Ca^{++}] x [HPO_4^{=}] = 3.4 \pm 1 x 10^{-6}$ at 38°.

Experiments having for their object the preparation of phosphates of calcium more basic than $Ca_3(PO_4)_2$, by Lorah, Tartar and Wood, 1929, showed that by hydrolysis with boiling water and CO_2 free NaOH solutions a final product of the composition $3Ca_3(PO_4)_2.Ca(OH)_2$ was obtained. Precipitation from alkaline phosphate solutions was tried for the preparation of basic phosphates but no evidence of their existance was obtained. Adsorption experiments were made to ascertain whether there is a reaction between basic calcium phosphate and $Ca(OH)_2$ but no such reaction was found.

Data for the solubility of natural phosphate rock in water at 15° under pressures of CO_2 up to 5kg. per sq. cm. are given by Campardou, 1933.

CALCIUM PHOSPHATE (Dibasic) $CaHPO_4.2H_2O$.

SOLUBILITY IN WATER.

(Cameron and Seidell — J. Am. Chem. Soc. 26, 1460, '04; see also Rindell — Compt. rend. 134, 112, '02; Magnanini — Gazz. chim. ital. 31, II, 544, '01.)

1 liter of CO_2 free water dissolves 0.136 gram $CaHPO_4$ at 25°.
1 liter of water sat. with CO_2 dissolves 0.561 gram $CaHPO_4$ at 25°.

SOLUBILITY OF DI CALCIUM PHOSPHATE AND OF MONO CALCIUM PHOSPHATE IN AQUEOUS SOLUTIONS OF PHOSPHORIC ACID AT 25°.

(Cameron and Seidell — J. Am. Chem. Soc. 27, 1508, '05; Causse — Compt. rend. 114, 414, '92.)

Grams per Liter of Solution.		Gms. per Liter Calc. from CaO Found.		P_2O_5 per Liter in Excess of that combined with Ca.	Solid Phase.
CaO.	P_2O_5.				
1.71	4.69	4.15	$CaHPO_4$	2.53	$CaHPO_4.2H_2O$
11.57	36.14	28.05	"	21.5	"
23.31	75.95	56.53	"	46.45	"
39.81	139.6	97.01	"	89.0	"
49.76	191.0	120.7	"	128.0	"
59.40	234.6	144.1	"	159.4	"
70.31	279.7	170.6	"	190.7	"
77.00	317.0	174.2 321.3	$CaHPO_4$ or $CaH_4(PO_4)_2$	226.0 122.2	$CaHPO_4.2H_2O+$ $CaH_4(PO_4)_2.H_2O$
72.30	351.9	301.6	$CaH_4(PO_4)_2$	169.0	$CaH_4(PO_4)_2.H_2O$
69.33	361.1	289.3	"	186.1	"
59.98	419.7	250.2	"	267.9	"
53.59	451.7	223.7	"	316.1	"
44.52	505.8	185.8	"	393.1	"
39.89	538.3	166.4	"	437.4	"

Density of the solution in contact with both salts at 25° = 1.29.

SOLUBILITY OF CALCIUM PHOSPHATES IN AQUEOUS SOLUTIONS OF PHOSPHORIC ACID AT DIFFERENT TEMPERATURES.

(Bassett, Jr., 1908, 1917.)

Results at 25°.			Results at 40°.			Results at 50.7°.		
Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
CaO.	P_2O_5.		CaO.	P_2O_5.		CaO.	P_2O_5.	
3.088	36.11	$CaH_4P_2O_8.H_2O$	1.768	42.42	$CaH_4P_2O_8.H_2O$	0.336	62.01	$CaH_4P_2O_8+$ $CaH_4P_2O_8.H_2O$
4.908	28.34	"	3.584	36.79	"			
5.809	24.20	" $+CaHPO_4$	5.755	27.25	" $+CaHPO_4$	0.635	58.08	$CaH_4P_2O_8.H_2O$
5.523	22.90	$CaHPO_4$	4.813	21.67	$CaHPO_4$	1.428	50.25	"
4.499	17.55	"	3.810	16.35	"	2.974	41.92	"
2.638	9.100	".	2.536	9.905	"	4.880	33.18	"
1.878	6.049	"	1.847	6.979	"	5.725	29.61	" $+CaHPO_4$
0.826	2.387	"	1.267	4.397	"	3.507	15.48	$CaHPO_4$
0.165	0.417	" $CaHPO_4.2H_2O$	0.576	1.819	"	2.328	9.465	"
0.07	0.166		0.156	0.426	"	1.563	6.157	"
0.06	0.140	"	0.0592	0.158	"	0.692	2.281	"
0.05	0.118	"	0.0508	0.128	$Ca_3P_2O_8.H_2O$	0.0596	0.1527	$CaHPO_4.2H_2O$
0.04	0.093	"	0.0098	0.0262	"	0.0514	0.1331	$Ca_3P_2O_8.H_2O$
0.03	0.070	More basic than $CaHPO_4.2H_2O$	0.0709	trace	$Ca_4P_2O_9.4H_2O$	0.0351	0.0942	"
0.02	0.047		0.0814	"	"	0.0106	0.0309	"
0.01	0.023		0.0840	"	"	0.0007	0.0007	"

In the case of most of the solutions 7–15 weeks constant agitation was allowed for attainment of equilibrium. For the last seven results at 25°, 18 months were required. Cerasine bottles were used in these cases. The solid phases were determined by analysis. The quintuple points were found by dilatometer experiments at 36°, 21° and 152°. (See next page.)

SOLUBILITY OF CALCIUM PHOSPHATES IN AQUEOUS SOLUTIONS OF PHOSPHORIC ACID AT TEMPERATURES ABOVE 100°.

(Bassett, Jr., 1908.)

t°.	Gms. per 100 Gms. Sat. Sol. CaO.	Gms. per 100 Gms. Sat. Sol. P_2O_5.	Solid Phase.
100	2.503	53.71	$CaH_4P_2O_8+CaH_4P_2O_8.H_2O$
115 b. pt.	5.623	43.60	$CaH_4P_2O_8.H_2O+CaHPO_4$
132 "	4.327	53.43	$CaH_4P_2O_8+CaH_4P_2O_8.H_2O$
169 "	4.489	63.95	$CaH_4P_2O_8$

The quintuple points for the system determined by dilatometer experiments are as follows:

152	5.60	53	$CaH_4P_2O_8+CaH_4P_2O_8H_2O+CaHPO_4$
21	5.81	23.5	$CaH_4P_2O_8.H_2O+CaHPO_4+CaHPO_4.2H_2O$
36	0.0514	0.14	$CaHPO_4+CaHPO_4.2H_2O+Ca_3P_2O_8.H_2O$

For additional data on the solubility of calcium phosphates in water, see Cameron and Bell, 1905 and 1910.

Data for the four component system, lime, phosphoric acid, sulfuric acid and water, the essential constituents of "superphosphates," are given by Cameron and Bell (1906).

One liter of aqueous 0.005 *n* potassium bitartrate solution sat. with calcium phosphate, contains 0.08 gm. Ca and 0.181 gm. H_3PO_4 at 25°. (Magnanini, 1901.)

PO

For the purpose of learning the best conditions for the recrystallization of Mono Calcium Phosphate, Clark, 1931, prepared mixtures corresponding to chosen points on the diagram drawn from the results of Bassett, Jr. 1908, and evaporated these solutions at fixed temperatures. The liquids in contact with the crystals thus obtained were analyzed, and the results found to fall upon the isotherms for the particular temperature of the experiment.

SOLUBILITY OF DICALCIUM PHOSPHATE (BRUSHITE, $CaHPO_4.2H_2O$) IN AQUEOUS SALT SOLUTIONS AT 40°.

(Rugg, 1931.)

Salt	Gm. mols. per liter Salt	Gm. mols. per liter [Ca]	Gm. mols. per liter [Total P]	Salt	Gm. mols. per liter Salt	Gm. mols. per liter [Ca]	Gm. mols. per liter [Total P]
None	0.0	0.00241	0.00500	KCl	0.10	0.00401	0.00826
"	0.0	0.00250	0.00672	"	0.40	0.00548	0.00904
"	0.0	0.00332	0.00852	"	1.00	0.00688	0.01160
NaCl	0.04	0.00252	0.00490	Na_2SO_4	0.095	0.00492	0.00977
"	0.10	0.00311	0.00550	"	0.190	0.00597	0.01110
"	0.20	0.00388	0.00645	"	0.381	0.00769	0.01290
"	0.40	0.00516	0.00772	$MgSO_4$	0.018	0.00507	0.00576
"	0.80	0.00641	0.00908	"	0.045	0.00780	0.00630
"	1.00	0.00711	0.00992	"	0.089	0.01350	0.00778

The pH of the solutions varied between 5.36 and 6.06.

In the case of the results for water alone, 1 gm. of brushite per 50cc of water and one days shaking in the first case, 3 gms. and 7 days shaking in the second and 3 gms. of more coarsely crystalline preparation and three days shaking in the third. For all the other experiments one gram of brushite and two days shaking was employed.

THE SOLUBILITY OF DICALCIUM PHOSPHATE ($CaHPO_4.2H_2O$) IN WATER AND IN AQUEOUS SOLUTIONS AT 19-22°. (Domontovitch and Sarubina, 1925.)

The determinations were made by precipitation and by solution experiments. The precipitation experiments were made by mixing, in different proportions, a 0.1 mol. solution of $CaCl_2$, a 0.1 mol. solution of KH_2PO_4 and a 0.2 mol. solution of $NaOH$. The mixtures were allowed to stand at room temperature (19-22°) for a long time and shaken daily. The Ca, P_2O_5 and p_H were determined. In the case of the solution experiments 1 gram per liter of freshly precipitated $CaHPO_4.2H_2O$ (made by 2 different methods) was placed in a series of different solvents and stirred by drawing purified air through the mixtures for six hours daily. The solutions were analyzed after 1, 2, 3 and 4 weeks.

Original composition of the solvent.	Composition of the saturated solution. Millimols. per liter. Ca.	P₂O₅	$\frac{Ca}{P_2O_5}$	pH.	Total ion concentration.
Water	0.723	0.514	1.410	7.15	0.0017
»	0.798	0.451	1.770	7.24	0.0017
0.001 molecular CH_3COOH	1.398	0.704	1.980	6.46	0.0028
0.003 » »	2.993	1.550	1.930	5.71	0.006
0.005 » »	3.890	2.110	1.850	5.40	0.008
0.010 » »	7.083	3.591	1.970	4.95	0.014
0.005 » H_3PO_4	5.340	5.490	0.970	5.00	0.016
0.025 » »	2.690	2.890	0.956	5.60	0.008
0.003 » Succinic Acid	4.690	2.465	1.870	5.42	0.010
0.004 » HCl	3.990	2.324	1.720	5.41	0.013
0.004 » HCl + 0.014 mol. NaCl	4.390	2.395	1.840	5.62	0.10
» » » + » »	4.190	2.392	1.750	5.67	0.10
0.016 » » + 0.026 »	15.960	8.591	1.860	4.53	0.10
» » » » »	15.760	8.591	1.840	4.57	0.10
0.08 » » 0.038 »	8.180	4.295	1.920	5.07	0.10
» » » » »	7.981	4.295	1.860	5.13	0.10
0.05 » NaCl	1.400	0.732	1.910	7.24	0.10
0.10 » »	1.600	0.916	1.750	7.22	0.20
0.034 » $CaCl_2$	34.70	0.672	51.600	5.71	0.10
0.005 » KH_2PO_4	0.648	5.920	0.110	5.89	0.017
» » »	1.100	24.00	0.045	5.30	0.10
0.0025 » $\left(\frac{4}{10}Na_2HPO_4+\frac{6}{10}NaH_2PO_4\right)$	0.299	2.250	0.133	6.86	0.008
0.005 » »	0.249	3.940	0.063	6.80	0.015

The solubility product $(Ca'')(HPO_4'')$ was $10^{-6.25}$ for distilled H_2O (not free of CO_2) at 19-22°. With smaller electrolytic concentration the value of the solubility product varied between the limits $10^{-6.25}$ and $10^{-5.75}$.

Data for the solubility of mineral phosphates in aqueous 2% citric acid solutions are given by Aita, 1916. Results for superphosphates are given by Pratolongo, 1916.

THE SOLUBILITY OF MONO CALCIUM PHOSPHATE IN WATER.

(Stollenwerk, 1926.)

In seeking to explain the variations in the solubility of mono calcium phosphate, reported by different persons, evidence was obtained, by means of specific gravity determinations upon samples of mono calcium phosphate heated to different temperatures, that isomeric forms exist. This isomerism was studied by vapor tension measurements and the variation in combining powers of different modifications for a given substance, such as ammonia. It was concluded that the present case is a hydrate isomerism resulting from the forcing of water molecules by warming into the interior of the entire molecule. This enlarges the structure and furnishes additional points of attachment for ammonia molecules.

Experiments showing the ratio of monocalcium phosphate decomposed at increasing concentrations of the salt in water at 20°, are given by Sanfourche and Focet, 1933.

SOLUBILITY OF CALCIUM PHOSPHATE IN AQUEOUS SALT SOLUTIONS UNDER 2 ATMOSPHERES PRESSURE OF CO_2 AT 14°.

(Ehlert and Hempel, 1912.)

Salt in Aq. Solvent.	Gms. Salt per 100 Gms. H_2O.	Gms. $Ca_3(PO_4)_2$ per Liter Solvent.	Salt in Aq. Solution.	Gms. Salt per 100 Gms. H_2O.	Gms. $Ca_3(PO_4)_2$ per Liter Solvent.
Water	...	0.228	$MgSO_4.K_2SO_4.MgCl_2.6H_2O$	70.95	1.777
NH_4Cl	45.74	1.371	"	conc.	2.491
"	conc.	1.293	K_2SO_4	74.5	4.904
$(NH_4)_2SO_4$	56.5	2.413	"	conc.	4.765
"	conc.	5.885	NaCl	50	1.321
$MgCl_2.6H_2O$	86.9	1.287	"	conc.	0.641
"	conc.	2.892	$NaNO_3$	72.7	1.583
$MgSO_4.7H_2O$	105.3	1.9728	"	Conc.	0.864
"	conc.	3.6001	$Na_2SO_4.10H_2O$	137.7	2.491
$MgCl_2.KCl.6H_2O$	79.2	1.577	"	conc.	3.227
"	conc.	1.154			

Data for the solubility of calcium phosphate in aqueous saturated solutions of carbon dioxide containing ammonia are given by Foster and Neville, 1910.

SOLUBILITY OF CALCIUM PHOSPHATES IN AQUEOUS SOLUTIONS OF SULFUR DIOXIDE

(Mebane, Dobbins and Cameron, 1923.)

The mixtures composed of aqueous phosphoric acid solutions and excess of calcium phosphate and calcium carbonate were stirred by means of a stream of sulfur dioxide. The time required for attainment of equilibrium was two to six weeks. Considerable difficulty was experienced in identifying the solid phases. PO

Gms. per 100 gms. sat. sol.			Solid Phase
CaO	P_2O_5	SO_2	
Results at 0°			
0.03	0.0	4.03	Ca Sulfite
1.42	0.67	0.43	"+solid sol.
1.72	1.23	1.22	" "
2.31	1.58	2.09	" "
2.40	1.63	2.36	" "
2.50	1.91	2.75	" "
4.85	3.29	7.00	" "
4.55	6.08	7.63	Di calcium + mono calcium phosphate
6.43	13.73	2.13	"
6.46	13.52	1.48	"
Results at 25°			
1.92	0.0	4.57	Ca Sulfite
1.27	1.30	1.60	" + solid sol.
1.57	1.63	2.83	" "
2.11	3.28	1.60	" "
2.62	1.10	2.18	" "
Results at 25° (con.)			
3.00	3.80	4.45	Ca Sulfite +
4.34	5.94	7.18	" solid sol.
5.40	6.11	2.75	" "
5.57	5.86	4.00	" "
6.08	7.68	2.10	Di calcium and mono calcium phosphate
5.54	9.34	1.30	"
5.22	10.64	1.45	"
5.52	11.62	0.35	"
6.12	11.45	0.40	"
6.25	16.93	2.57	"
6.75	18.11	2.20	"
6.25	22.01	0.40	"
5.76	37.77	0.0	Mono calcium phosphate
6.20	29.24	0.0	"
5.64	33.78	0.0	"
5.57	36.80	0.0	"

It is stated that the results can not have absolute value, but show only the order of magnitude and that sulfur dioxide has a maximum solubility in contact with the pairs of solid phases. It is concluded that the commercial conversion of phosphate rock to "super" phosphate by means of sulfur dioxide is impractical.

Freezing-point lowering data for mixtures of tribasic calcium phosphate $Ca_3(PO_4)_2$ and sodium tetra borate $(Na_2B_4O_7)$ are given by Ponomarev, 1921.

CALCIUM Mono Fluoro **PHOSPHATE** $CaFPO_3.2H_2O$

One liter saturated solution in water contains 0.063 gm. mols. $CaFPO_3$ at 20°. (Lange, 1929.)

CALCIUM Methyl, Ethyl etc., PHOSPHATES.

SOLUBILITY OF EACH IN WATER. (Bailly, 1919.)

Compound.	Formula.	t°.	Gms. per 100 gms. sat. sol Anhydrous compound.	Gms. per 100 gms. sat. sol Hydrated compound.
Calcium allyl phosphate...	$Ca.CH_2.CHCH_2PO_4.2H_2O$	20	--	0.28
» iso butyl » ...	$Ca.CH_2.CH(CH_3)_2.PO_4.2H_2O$	18	–	0.19
» ethyl » ...	$Ca.C_2H_5PO_4.2H_2O$	28	–	0.235
» methyl » (neutral).	$Ca.CH_3PO_4.2H_2O$	10	0.21	0.27
» » » (acid).	$Ca.[CH_3H.PO_4]_2$	17	27.42	–
» propyl » ...	$Ca.C_3H_7.PO_4.2H_2O$	18.5	–	0.251
» iso propyl » ...	$Ca.CH(CH_3)_2.PO_4.2H_2O$	24	–	0.09

CALCIUM GLYCEROPHOSPHATES α and β.

SOLUBILITY OF CALCIUM GLYCEROPHOSPHATES IN WATER.
(Bailly, 1919.)

Name of compound.	Formula.	t°.	Gms. anhydrous cmpd. per 100 gms. sat. sol.
Calcium glycero phosphate	$CaC_3H_7O_2.PO_4.H_2O$	16	4.88
» α » (amorphous)..	$CaC_3H_7O_2.PO_4H_2O$	14	5.00
» » » » ..	»	16	4.91
» » » » ..	»	20	3.63
» » » » ..	»	75	1.29
» » » (crystalline)..	»	14	3.95
» » » » ..	»	18	1.70
» » » » ..	»	20	1.36
» β » (anhydrous)..	$CaC_3H_7O_2.PO_4$	18	0.99
» » » » ..	»	12	1.15
» » » (hydrated) ..	$CaC_3H_7O_2.PO_4.1\frac{1}{4}H_2O$	18	1.16
» » » » ..	»	12	1.31
» » » (crystalline)..	$CaC_3H_5(OH)_2.PO_4?H_2O$	14	4.95
» » (neutral) ..	$CaC_2H_4(OH).PO_4.H_2O$	16	0.30*
» » (acid) ..	$Ca[H.C_2H_4(OH).PO_4]_2$	16	3.99*

* Determination by Bailly and Gaumé, 1924.

100 gms. H_2O dissolve 1.0 gm. calcium glycerophosphate at 0°, 1.68 gm. at 16° and 0.43 gm. at 60°. (H. Rogier, These, Paris, 1912.)

100 gms. glycerol ($d = 1.2326 = 86.5\%$) dissolve 4.15 gms. calcium glycero phosphate at 20°.
» » ($d = 1.2645 = 98.5\%$) » 3.98 » » » » »
(Holm, 1921, 1922.)

CALCIUM GLYCEROPHOSPHATES α = $OH.CH_2.CH(OH)CH_2.OPO_3Ca$, β = $OH.CH_2.CH.OPO_3Ca.CH_2OH$.

SOLUBILITY OF CALCIUM α GLYCEROPHOSPHATE IN WATER.
(Power and Tutin, 1905; Couch, 1917.)

t°.	Gms. $CaC_3H_7O_6P$ per 100 Gms. Sat. Sol.	t°.	Gms. $CaC_3H_7O_6P$ per 100 Gms. Sat. Sol.
0	5	40	3.5
10	4.6	60	2.7
20	5.2	80	1.8
25	5	100	0.9

Results varying from 1.7 to 5.4 gms. per 100 gms. sat. solution at or near 18° are given by Rogier and Fiore (1913), Willstaetter (1904) and King and Pyman (1914). It is pointed out by Couch, however, that since the solubilities of the α and β isomer differ, and also that the commercial product contains both isomers, variable results will be obtained, depending on the composition of the product and the method used for determining the solubility. These authors also show that increasing amounts of alcohol in the solvent decrease the solubility of calcium glycerophosphate.

100 grams H_2O dissolve 1.66 grams calcium β glycerophosphate at 20°. (Couch, 1917.)

The results of King and Pyman (1914) are: 1.4 gms. at 12° and 1 gm. at 15°.

CALCIUM SULFIDE CaS.

SOLUBILITY OF CALCIUM SULFIDE IN WATER IN THE ABSENCE OF AIR.

(Foerster and Kubel, 1924.)

The sample was prepared by heating calcium sulfite for 1 hour at 700-750°. It contained 12.1 % Ca S.

t°.	Minutes digested with H_2O.	Gms. sample digested per 100 gms. H_2O	Gms. Ca S dissolved per 100 cc. sat. sol.	Per cent of the used Ca S dissolved.
15	15	2.5414	0.0090	2.9
15	15	2.3759	0.0100	3.5
15	60	2.4707	0.0121	4.0
100	15	3.2079	0.1450	37.4
100	60	5.3080	0.4614	71.8

SOLUBILITY OF CALCIUM SULFIDE IN WATER AND IN AQUEOUS SOLUTIONS OF HYDROGEN SULFIDE AT 20°.

(Riesenfeld and Feld, 1921)

The sample of calcium sulfide contained Ca SO_4, Ca O and C. Water saturated with the sample at 20° contained 0.2120 gms. Ca S, 0.3881 gms. Ca SO_4 and 0.1786 gm. CaO per liter. For the solubility in presence of H_2S an apparatus constructed entirely of glass was used. The air was completely displaced with H_2S to insure that only this gas was present. The equilibrium was approached from below and from above by changing the pressure of the H_2S. The influence of time upon the attainment of equilibrium was found to be considerable, but the rate was shown to be a reaction of the first order and from it the final equilibrium could be estimated. The manometer was read in the beginning and after the solution had been shaken and from this it was known whether equilibrium was being approached from above or below. The results of the analyses in grams of S per 100 cc. were plotted and from the curves and the calculations from Henry's law on the proportion of the S in the form of H_2S, the difference gave that present as calcium sulfhydrate and calcium sulfide.

Pressure of H_2S in mm. Hg	Gms. $Ca(HS)_2$ per 100 cc. sat. sol. at 0°.	20°.	40°.	Pressure of H_2S in mm Hg	Gms. $Ca(HS)_2$ per 100 cc. sat. sol. at 0°.	20°.	40°
100	26.61	24.87	21.97	500	31.17	28.76	26.61
150	28.76	25.78	23.47	550	31.42	29.09	27.02
200	29.45	26.19	24.24	600	31.66	29.43	27.35
250	29.92	26.86	24.79	650	31.83	29.65	27.69
300	30.09	27.35	25.20	700	32.08	30.09	28.04
350	30.43	27.69	25.50	750	32.33	30.34	28.35
400	30.67	28.10	25.94	760	32.41	30.42	28.44
450	30.92	28.31	26.25				

From the result at 20° and 760 mm. pressure it was calculated that 206.5 gms. of Ca S are present per liter. The corresponding figure for Ca S in H_2O alone at 20° and 760 mm. pressure of air is 0.212 gms. per liter. Hence H_2S increases the solubility of Ca S in water almost 1000 times.

SOLUBILITY OF CALCIUM SULFIDE IN AQUROUS SUGAR SOLUTIONS.

(Stolle, 1900.)

Per cent Concentration of Sugar Solutions.	Grams CaS Dissolved per Liter of the Sugar Solutions at: 30°.	40°.	50°.	60°.	70°.	80°.	90°.
0	1.982	2.123	1.235	1.390	1.696	2.032	2.496
10	1.866	1.316	1.441	1.673	1.560	1.634	1.544
20	2.187	1.696	1.802	1.905	1.879	1.892	1.930
27	2.522	2.097	2.059	2.226	2.342	2.304	2.357
35	2.689	2.265	2.304	2.406	2.342	2.857	2.947
42	2.342	2.136	2.226	2.522	2.574	2.509	2.689
49	2.445	2.290	2.458	2.638	2.728	2.818	3.063
55	2.509	2.226	2.340	2.882	2.766	2.972	3.616

CALCIUM SULFITE $CaSO_3.2H_2O$.

SOLUBILITY IN WATER AND IN AQUEOUS SUGAR SOLUTIONS AT 18°.

(Weisberg, 1896.)

Solvent.	Grams $CaSO_3$ per 100 cc. Solution.	
	At 18°.	After Boiling Solution 2 Hours.
Water	0.0043	....
10 Per cent Sugar	0.0083	0.0066
30 Per cent Sugar	0.0080	0.0069

RESULTS AT HIGHER TEMPERATURES.

(Van der Linden, 1916.)

Solvent.	Gms. $CaSO_3.2H_2O$ per 1000 gms. Sat. Solution at.							
	30°.	40°.	50°.	60°.	70°.	80°.	90°.	b. pt.
Water	0.064	0.063	0.057	0.061	0.045	0.031	0.027	0.011
Aq. Sucrose of 15 gms. per 100 cc.	0.103	0.083	0.073	0.080	0.059	0.041	0.036	0.041
Aq. Sucrose, 15 gms.+1.5 gms. Glucose per 100 cc.	0.104	0.081	0.085	0.071	0.060	0.047	0.040	0.029
Water+Excess $CaSO_4$	0.031	0.029	0.025	0.019	0.012	0.009	0.008	0.006
Aq. Sucrose, 15 gms. per 100 cc. +Excess $CaSO_4$	0.035	0.032	0.022	0.019	0.021	0.017	0.020	0.021
Aq. Sucrose, 15 gms.+1.5 gms. Glucose per 100 cc.+Excess $CaSO_4$	0.032	0.027	0.022	0.020	0.019	0.019	0.019	0.023

EQUILIBRIUM IN THE SYSTEM CALCIUM OXIDE, SULFUR DIOXIDE AND WATER.

(Conrad and Benschlein, 1934.)

Total pressure in mm Hg.	Results at 15°			Results at 25°		
	Gms. per 100 gms. H_2O			Gms. per 100 gms. H_2O		
	Total SO_2	Free SO_2	$CaSO_3$	Total SO_2	Free SO_2	$CaSO_3$
50	4.1	2.2	3.56	2.7	1.4	2.44
100	6.8	3.9	5.44	4.7	2.6	3.94
150	8.6	5.1	6.56	6.2	3.6	4.87
200	9.8	5.9	7.31	7.3	4.4	5.44
250	10.9	6.7	7.87	8.3	5.2	5.80
300	11.8	7.4	8.25	9.1	5.7	6.38
350	12.8	8.1	8.81	9.9	6.3	6.75
400	13.8	8.9	9.19	10.6	6.8	7.12
450	14.7	9.6	9.56	11.3	7.3	7.50
500	15.5	10.2	9.94	12.0	7.8	7.87
550	16.3	10.9	10.13	12.7	8.3	8.25
600	17.1	11.5	10.50	13.3	8.7	8.61
650	17.8	12.1	10.69	14.0	9.2	9.00
700	18.4	12.6	10.87	14.6	9.7	9.19
750	19.1	13.2	11.06	15.2	10.2	9.38
761	12.02	7.99	7.55	at 35°		

Solid phase in all cases was $CaSO_3.\frac{1}{2}H_2O$.

The author's figures for combined SO_2 have been calculated to $CaSO_3$. A few determinations of sulfate indicated that oxidation of SO_2 to SO_3 during the solubility determinations was negligible.

CALCIUM SULFATE $CaSO_4.2H_2O$.

SOLUBILITY IN WATER.

(Hulett and Allen, 1902; for references to other determinations see Hulett and Allen, also Euler, 1904. For data by the electrolytic conductivity method, see Holleman, Kohlrausch and Rose, 1893, 1908.)

t°.	Gms. $CaSO_4$ per 100 cc. Solution.	Millimols per Liter.	Density of Solutions.	t°.	Gms. $CaSO_4$ per 100 cc. Solution.	Millimols per Liter.	Density of Solution•
0	0.1759	12.926	1.00197	40	0.2097	15.413	0.99439
10	0.1928	14.177	1.00173	55	0.2009	14.765	0.98796
18	0.2016	14.817	1.00059	65.3	0.1932	14.200	0.98256
25	0.2080	15 295	0.99911	75	0.1847	13.575	0.97772
30	0.2090	15.361	0.99789	100	0.1619	11.900	...
35	0.2096	15.405	0.99612	107	...	11.390	...

Data for the solubility of calcium sulfate in sea water are given by Manuelli, 1916.

SOLUBILITY OF UNSTABLE CALCIUM SULFATE HEMI-HYDRATE IN WATER.

(Chassevent, 1926.)

t°	Gms. $CaSO_4$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $CaSO_4$ per 100 gms. sat. sol.	Solid Phase
0.9	0.956	$CaSO_4.\frac{1}{2}H_2O$	44.8	0.523	$CaSO_4.\frac{1}{2}H_2O$
5.2	0.946	"	60.	0.389	"
14.5	0.924	"	70.5	0.336	"
21.7	0.811	"	79.5	0.286	"
29.3	0.688	"	81	0.272	"
34.5	0.640	"	95.5	0.213	"
42.4	0.555	"	96.5	0.201	"

SO

The saturated solutions were prepared by actively agitating with water, calcium sulfate previously heated to a temperature above 300°. The solutions were filtered before crystallization of the dihydrate. Since this crystallization occurs more rapidly at the lower temperatures, these results are the less accurate.

SOLUBILITY OF CALCIUM SULFATE ANHYDRITE IN WATER AND IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE.

(Hill, 1937.)

The transition temperature of gypsum to anhydrite was established by Van't Hoff and co-workers (Z. physik Chem. 45, 257, 1903) as 63°.5. Since subsequent experiments indicated that this temperature is to high, the following determinations were made to fix this transition temperature exactly.

The anhydrite was prepared by boiling a suspension of gypsum in 20% sulfuric acid for three days. It corresponded in properties with natural anhydrite. About 10-20 gm. portions of it were rotated with 250 cc. portions of solvent in closed bottles for periods up to 5 months. Equilibrium was approached both from above and below.

t°	Solubility in Water	Solubility in Aqueous Solutions of K_2SO_4		
	Gms. $CaSO_4$ per 100 gms. sat. sol.	Gms. K_2SO_4 100 gms. aq. solvent	Gms. $CaSO_4$ per 100 gms. sat. solution at:	
			35°	45°
20	0.298			
25	0.274	0.04	0.230	—
35	0.242	0.08	0.218	—
45	0.201	0.10	—	0.183
65	0.136	0.12	0.207	—
75	0.114	0.50	—	0.192
100	0.067			

When plotted these results show the exact transition point to be at 42°.

SOLUBILITY OF CALCIUM SULFATE IN WATER AT TEMPERATURES ABOVE 100°.

(Partridge and White, 1929.)

Above 100° the only stable phase of calcium sulfate is anhydrite. The transition temperature of gypsum into anhydrite is at 42°. Hemi-hydrate is the only other form of calcium sulfate which has existence in the range 0° to 200°. So-called "soluble anhydrite" is identical in crystal form with hemi-hydrate and the solubility curve formerly given as that of "soluble anhydrite is a prolongation of and coincides above 100° with the curve for hemi-hydrate. Hemi-hydrate is metastable for periods up to 48 hours in the approximate range 90°-130° being increasingly unstable below and above this range. The trans. temp. of gypsum to hemi-hydrate is at 98°. Incomplete experiments indicate that gypsum is converted to hemi-hydrate in less than one day in contact with water at 100°, and that the hemi-hydrate is subsequently transformed into anhydrite over longer periods of time.

t°	Gms. $CaSO_4$ per 100 gms. sat. solution in contact with:		t°	Gms. $CaSO_4$ per 100 gms. sat. solution in contact with:	
	Hemi-hydrate $CaSO\cdot\frac{1}{2}H_2O$	Anhydrite $CaSO_4$		Hemi-hydrate $CaSO\cdot\frac{1}{2}H_2O$	Anhydrite $CaSO_4$
100	0.1645	0.0650	170	0.0325	0.0140
110	0.1290	0.0535	180	0.0255	0.0112
120	0.1030	0.0435	190	0.0205	0.0092
130	0.0830	0.0350	200	0.0165	0.0076
140	0.0665	0.0230	210	—	0.0064
150	0.0530	0.0222	220	—	0.0055
160	0.0415	0.0176			

80

Previous results by Boyer-Guillon, 1900, Melcher, 1910, and Hall, Robb and Coleman, 1926, for "soluble anhydrite""agree fairly well with the above values for hemi-hydrate. Results by Hall, Robb and Coleman, 1926, for anhydrite do not agree with the above.

THE SOLUBILITY OF CALCIUM SULFATE IN WATER AT VERY HIGH TEMPERATURES.

(Straub, 1932.)

The determinations were made in small steel bombs. Equilibrium was reached in 6 to 10 hours. The analyses of the solutions showed in each case a smaller number of millimols of SO_4 than of Ca. The explanation is considered to be that a small amount of $Fe(OH)SO_4$ was formed by reaction with the bomb at the high temperatures.

t°	Millimols per liter sat. sol.	
	Ca	SO_4
182	0.90	0.81
207	0.52	0.44
244	0.34	0.20
316	0.23	0.08

Results are also given for the solubility of calcium sulfate in aqueous solutions of sodium sulfate at the above temperatures. They show that the amount of Ca decreases with increasing concentration of sodium sulfate.

Data for the solubilities in water at 20° of samples of gypsum burned for gradually increasing lengths of time at selected fixed temperatures, varying from 200° to 800°, are given by Budnikoff and Syrkin, 1922. Results are also given showing the rate of solution of two samples of gypsum burned respectively at 115° and 125°.

Data are given by Sworykin, 1927, for the rate of solution of natural calcium sulfate hemi-hydrate which had been previously heated to temperature varying from 100° to 1000°.

SOLUBILITY OF MIXTURES OF CALCIUM SULFATE AND SILVER SULFATE IN WATER.

(Euler, 1904.)

t°.		Per Liter of Solution. Gms. Salt.	Per Liter of Solution. Gms. Equiv. Salt.	Total Salt per 100 Gms. Solution	Sp. Gr. of Solutions.
17°	$CaSO_4$	2.31	0.034	0.9473	1.0083
	Ag_2SO_4	7.235	0.0464		
25°	$CaSO_4$	2.61	0.0383	1.062	1.010
	Ag_2SO_4	8.11	0.0520		

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF CALCIUM SALTS AT 25°

(Cameron and Seidell — J. Physic Chem. 5, 643, '01; Seidell and Smith — *Ibid.* 8, 493, '04; Cameron and Bell — J. Am. Chem. Soc. 28, 1220, '06.)

In Calcium Chloride. Grams per Liter Sol. $CaCl_2$.	In Calcium Chloride. Grams per Liter Sol. $CaSO_4$.	In Calcium Nitrate. Gms. per Liter Sol. $Ca(NO_3)_2$.	In Calcium Nitrate. Gms. per Liter Sol. $CaSO_4$.	In Calcium Nitrate. Wt. of 1 cc. Sol.	In Calcium Hydroxide and *vice versa.* Gms. per Liter Sol. CaO.	In Calcium Hydroxide and *vice versa.* Gms. per Liter Sol. $CaSO_4$.	Solid Phase.
0.00	2.06	0.0	2.08	0.998	0.0	2.126	$CaSO_4.2H_2O$
7.49	1.24	25	1.24	1.014	0.062	2.030	"
11.96	1.18	50	1.20	1.032	0.176	1.918	"
25.77	1.10	100	1.13	1.067	0.349	1.853	"
32.05	1.08	200	0.93	1.137	0.61	1.722	"
51.53	1.02	300	0.76	1.204	0.939	1.634	"
97.02	0.84	400	0.57	1.265	1.222	1.588	$CaSO_4.2H_2O+Ca(OH)_2$
192.71	0.47	500	0.40	1.328	1.242	1.214	$Ca(OH)_2$
280.30	0.20	544	0.35	1.352	1.150	0.666	"
367.85	0.03	...	...	...	1.166	0.00	"

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF SALTS AND ACIDS AT 25°.

(van Veldhuizen, 1929.)

Results for aqueous solutions of:

Calcium Chloride Gm. mols. per liter $CaCl_2$	Calcium Chloride Gm. mols. per liter $CaSO_4$	Potassium Chloride Gm. mols. per liter KCl	Potassium Chloride Gm. mols. per liter $CaSO_4$	Hydrochloric Acid Gm. mols. per liter HCl	Hydrochloric Acid Gm. mols. per liter $CaSO_4$	Sulfuric Acid Gm. mols. per liter H_2SO_4	Sulfuric Acid Gm. mols. per liter $CaSO_4$
0.005	0.0137	0.01	0.0330	0.01	0.0360	0.01	0.0308
0.010	0.0126	0.02	0.0350	0.02	0.0407	0.02	0.0305
0.015	0.0118	0.03	0.0370	0.03	0.0453	0.03	0.0303
0.020	0.0112	0.04	0.0393	0.04	0.0494	0.04	0.0301
0.025	0.0103	0.06	0.0431	0.05	0.0531	0.05	0.0303
0.030	0.0104	0.07	0.0451	0.06	0.0565	0.06	0.0303
0.040	0.0097	0.08	0.0469	0.07	0.0602	0.07	0.0303
0.050	0.0093	0.12	0.0551	0.08	0.0634	0.08	0.0303

Luteo Cobaltic Chloride Gm. mols. per liter $Co(NH_3)_6Cl_3$	Luteo Cobaltic Chloride Gm. mols. per liter $CaSO_4$	Potassium Ferricyanide Gm. mols. per liter $K_3Fe(CN)_6$	Potassium Ferricyanide Gm. mols. per liter $CaSO_4$	Potassium Ferrocyanide Gm. mols. per liter $K_4Fe(CN)_6$	Potassium Ferrocyanide Gm. mols. per liter $CaSO_4$
0.00333	0.0175	0.00167	0.0163	0.001269	0.0167
0.00667	0.0201	0.00333	0.0172	0.002538	0.0176
0.01000	0.0222	0.00667	0.0188	0.005075	0.0197

Potassium Sulfate		Magnesium Chloride		Sodium Thiosulfate	
Gm. mols. per liter		Gm. mols. per liter		Gm. mols. per liter	
K_2SO_4	$CaSO_4$	$MgCl_2$	$CaSO_4$	$Na_2S_2O_3$	$CaSO_4$
0.005	0.0139	0.00498	0.0170	0.005	0.0170
0.010	0.0128	0.00996	0.0184	0.010	0.0185
0.015	0.0122	0.01494	0.0197	0.015	0.0198
0.025	0.0115	0.01992	0.0208	0.0200	0.0210

SOLUBILITY OF MIXTURES OF CALCIUM SULFATE AND CAESIUM SULFATE IN WATER.

(D'Ans, 1908.)

t°.	Mols. $Cs_2SO_4.CaSO_4$ per 1000 Gms. Sat. Sol.	=	Gms. $Cs_2SO_4.CaSO_4$ per 1000 Gms. Sat. Sol	Solid Phase.
25	0.667		352	Dicalcium Sulfate + Gypsum
60	0.607		320	" "

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF COPPER SULFATE AT 25°.

(Bell and Taber, 1907.)

Gms. per Liter Sat. Sol.		d_{25} Sat. Sol.	Gms. per Liter Sat. Sol		d_{25} Sat. Sol.
$CuSO_4$.	$CaSO_4$.		$CuSO_4$.	$CaSO_4$.	
1.144	2.068	1.002	39.407	1.718	1.041
3.564	1.986	1.005	49.382	1.744	1.051
6.048	1.944	1.007	58.880	1.782	1.061
7.279	1.858	1.009	97.950	1.931	1.098
14.814	1.760	1.016	146.725	2.048	1.146
19.729	1.736	1.021	196.021	2.076	1.192
29.543	1.688	1.030	224.916	2.088	1.218

SO

SOLUBILITY OF CALCIUM SULFATE AT 25° IN AQUEOUS SOLUTIONS OF :

(Harkins and Palme, 1919.).

Copper Sulfate.			Potassium Nitrate.		
	Gms per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.	
$d_{\frac{25}{4}}$ of sat. sol	$CuSO_4$	$CaSO_4$.	$d_{\frac{25}{4}}$ of sat. sol.	KNO_3.	$CaSO_4$.
1.0010	0.1996	0.18435	0.99911	0.0	0.20854
1.0069	0.7922	0.1671	1.0013	0.27824	0.2454
1.0149	1.5842	0.1661	1.0029	0.53106	0.27268
1.0324	3.267	0.17468	1.0088	1.0330	0.2862
1.1486	13.465	0.1944			

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF ARSENIC ACID AT 25°.

(Zieler, 1927.)

Ten mixtures were shaken for 3 hours and the calcium in the saturated solutions precipitated as oxalate.

Gms. H_3AsO_4 per 100 gms. aq. solvent	Gms. $CaSO_4$ per 100cc sat. sol.	Gms. H_3AsO_4 per 100 gms. aq. solvent	Gms. $CaSO_4$ per 100cc sat. sol.
0.0 (= H_2O)	0.216	50.0	0.561
8.0	0.445	64.0	0.375
16.0	0.544	30.0	0.194
32.0	0.650		

SOLUBILITY OF CALCIUM SULPHATE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC, NITRIC, CHLOR ACETIC, AND FORMIC ACIDS.

(Banthisch — J. pr. Chem. 29, 52, '84; Lunge — J. Soc. Chem. Ind. 4, 32, '85.)

	In Hydrochloric.		In Nitric.	In Chlor Acetic.	In Formic.
Grams Acid per 100 cc. Solution.	Grams $CaSO_4$ per 100 cc. Sol. at 25°.	Grams $CaSO_4$ per 100 cc. Sol. at 102°.	Gms. $CaSO_4$ per 100 cc. Solution at 25°.	Gms. $CaSO_4$ per 100 cc. Sol. at 25°.	Gms. $CaSO_4$ per 100 cc. Sol. at 25°.
0	0.208	0.160	0.208	0.208	0.208
1	0.72	1.38	0.56	...	...
2	1.02	2.38	0.82	...	...
3	1.25	3.20	1.02	...	...
4	1.42	3.64	1.20	0.22	0.24
6	1.65	4.65	1.48	...	...
8	1.74	...	1.70	...	...
10	...	...	1.84	0.25	...
12	...	...	1.98	...	...

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF PHOSPHORIC ACID AT 25°.

(Taber, 1906.)

SO

Gms. per Liter. P_2O_5.	Gms. per Liter. $CaSO_4$.	Sp. Gr. of Solutions at $\frac{25}{25}$	Gms. per Liter. P_2O_5.	Gms. per Liter. $CaSO_4$.	Sp. Gr. of Solutions at $\frac{25}{25}$.
0	2.126	0.9991	145.1	7.920	1.106
5	3.143	1.002	205	8.383	1.145
10.5	3.734	1.007	311.5	7.965	1.221
21.4	4.456	1.016	395.8	6.848	1.280
46.3	5.760	1.035	494.6	5.572	1.344
105.3	7.318	1.075			

SOLUBILITY OF CALCIUM SULFATE (GYPSUM, ANHYDRITE AND HEMIHYDRATE) IN AQUEOUS SOLUTIONS OF PHOSPHORIC ACID AT 25° AND AT 83°.

(D'Ans and Hofer, 1937.)

The mixtures were rotated constantly and samples removed from time to time for analysis. Gypsum, anhydrite and hemi-hydrate were used as solid phases and the changes which occurred in them were observed microscopically.

Results at 25°

Gms. per 100 gms. H_2O H_3PO_4	Gms. per 100 gms. H_2O $CaSO_4$	Solid Phase
0.0	0.25	$CaSO_4.2H_2O$
44.3	1.08	"
69.3	1.10	"
104.9	1.04	" + $CaSO_4$
137.0	0.80	$CaSO_4.2H_2O$
0.0	(0.55)	$CaSO_4$ (anhydrite)
44.6	1.31	"
58.0	1.20	"
69.2	1.20	"
101.4	1.01	"
113.2	0.95	"
137.0	0.80	"

Results at 83°

Gms. per 100 gms. H_2O H_3PO_4	Gms. per 100 gms. H_2O $CaSO_4$	Solid Phase
0.0	(0.18)	$CaSO_4.2H_2O$
21.0	1.85	"
44.5	2.55	"
47.2	2.62	"
69.6	2.83	"
0.0	(0.12)	$CaSO_4$
28.5	1.64	"
70.4	1.95	"
98.8	1.83	"
115.7	1.72	"
0.0	(0.28)	$CaSO_4.\frac{1}{2}H_2O$
40.0	2.50	"
68.6	2.54	"

THE SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF PHOSPHORIC ACID.

(Sanfourche and Krapivine, 1928.)

The mixtures composed of 50cc of aqueous phosphoric acid and excess of gypsum were agitated three times per hour for 24 hours at the several temperatures. A water bath was used at 15° and an air bath controlled to 1°. at the higher temperatures. The analyses were made upon weighed portions of the solutions, since on account of viscosity the volumes could not be measured accurately. The authors do not give densities of the solutions or explain how they converted the results to the terms of volume given in their table. At the higher temperatures where a decomposition of the calcium sulfate begins, the values calculated from the SO_4 are higher than those calculated from the Ca. The latter was accordingly chosen for the results given. At a temperature sufficiently high the reaction $2H_3PO_4 + CaSO_4 \rightleftharpoons CaH_4(PO_4)_2 + H_2SO_4$ goes in the sense of precipitation of mono calcium phosphate.

Gms. H_3PO_4 per 100 cc of solvent	Gms. $CaSO_4$ per 100 cc of sat. sol.	Solid Phase
Results at 15°		
13.74	0.600	$CaSO_4.2H_2O$
27.65	0.756	"
41.55	0.740	"
55.3	0.598	"
82.7	0.398	"
110.7	0.308	"
138.0	0.357	"
Results at 30°		
13.74	0.800	$CaSO_4.2H_2O$
27.65	0.960	"
41.55	0.895	"
55.3	0.758	"
82.7	0.518	"
110.7	0.392	"
138.0	0.112	CaP + Ca½
Results at 50°		
13.74	0.932	$CaSO_4.2H_2O$
27.65	1.304	"
41.55	1.219	"
55.3	1.098	"
82.7	0.825	"
110.7	0.443	CaP + Ca½
138.0	0.237	"
Results at 70°		
13.70	1.130	$CaSO_4.2H_2O$
27.65	1.484	"
41.55	1.462	"
55.3	1.299	"
82.7	1.002	"
Results at 70° (Con.)		
110.7	0.498	CaP + Ca½
138.0	0.231	" "
Results at 80°		
13.74	1.124	$CaSO_4.2H_2O$
27.65	1.598	"
41.55	1.576	"
55.3	1.454	"
82.7	1.147	" + CaP + Ca½
110.7	0.558	CaP + Ca½
138.0	0.318	" + Ca
Results at 90°		
13.74	1.234	$CaSO_4.2H_2O$
27.65	1.655	"
41.55	1.802	"
55.3	1.749	Ca½
82.7	1.165	" + CaP + $CaSO_4.2H_2O$
110.7	0.558	CaP + Ca½
138.0	0.318	CaP + Ca
Results at 100°		
41.55	2.015	CaP + Ca½
Results at 105°		
41.5	2.070	CaP + Ca½
Results at 110°		
82.7	1.345	CaP + Ca½ + Ca
110.7	0.479	CaP + Ca
130.8	0.126	CaP + Ca

CaP = $CaH_4(PO_4)_2.H_2O$, Ca½ = $CaSO_4.½H_2O$, Ca = $CaSO_4$

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID.

(Cameron and Breazeale, 1903.)

Grams H_2SO_4 per Liter of Solution.	Results at 25°.		Results at 35°. Gms. $CaSO_4$ per Liter.	Results at 43° Gms. $CaSO_4$ per Liter.
	Gms. $CaSO_4$ per Liter.	Wt. of 1 cc. Sol.		
0.00	2.126	0.9991 grams	...	2.145
0.48	2.128	1.0025 "	2.209	2.236
4.87	2.144	1.0026 "	2.451	2.456
8.11	2.203	1.0051 "	...	2.760
16.22	2.382	1.0098 "	...	3.116
48.67	2.727	1.0302 "	3.397	3.843
75.00	2.841	1.0435 "	...	4.146
97.35	2.779	1.0756 "	3.606	...
146.01	2.571	... "	3.150	4.139
194.70	2.313	1.1134 "	...	3.551
243.35	1.901	1.1418 "	...	2.959
292.02	1.541	1.1681 "	...	2.481

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE, BROMIDE, AND IODIDE AT 21°.

(Ditte, 1898.)

SO

Grams of the Potassium Salt per Liter.	In KCl Solutions. Gms. $CaSO_4$ per Liter.	In KBr Solutions. Gms. $CaSO_4$ per Liter.	In KI Solutions. Gms. $CaSO_4$ per Liter.
0	2.05	2.05	2.05
10	3.6	3.1	2.8
20	4.5	3.6	3.2
40	5.8	4.5	3.9
60	6.6	5.2	4.5
80	7.2	5.9	4.85
100	7.5	6.3	5.1
125	double salt	6.7	5.45
150	...	7.0	5.8
200	...	7.3	5.95
250	...	double salt	6.00
300	...	...	double salt

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE AND OF POTASSIUM SULFATE AT 25°.

(Seidell and Smith, 1904; Cameron and Breazeale, 1904.)

In Potassium Nitrate.			In Potassium Sulphate.		
Gms. per Liter Solution.		Wt. of 1 cc. Solution.	Gms. per Liter Solution.		Wt. of 1 cc. Solution.
KNO_3.	$CaSO_4$.		K_2SO_4.	$CaSO_4$.	
0.0	2.08	0.9981	0.0	2.08	0.9981
12.5	3.28	1.0081	4.88	1.60	1.0036
25.0	4.08	1.0154	5.09	1.56	1.0038
50.0	5.26	1.0321	9.85	1.45	1.0075
100.0	6.86	1.0625	19.57	1.49	1.0151
150	7.91	1.0924	28.35	1.55	1.0229
200	8.69	1.1224	30.66	1.57	1.0236
260	syngenite	1.1539	32.47	1.58*	...

* Solid phase syngenite. Results for the solubility of syngenite in solutions of potassium sulphate are also given in the original paper.

Data for the solubility of syngenite, $K_2Ca(SO_4)_2.H_2O$, and of potassium pentacalcium sulfate, $K_2Ca_5(SO_4)_6.H_2O$, in water at various temperatures, are given by D'Ans (1909). This author also gives results for the effect of the following salts upon the concentration of the boundary solution for gypsum-potassium syngenite at 25°: KCl, KBr, KI, $KClO_3$, $KClO_4$, KNO_3, CH_3COOK, KOH, $K_4Fe(CN)_6$, $K_3Fe(CN)_6$, NaCl, NaI, $NaNO_3$, CH_3COONa, HCl, HNO_3, H_3PO_4, CH_3COOH, H_2SO_4, Ag_2SO_4 and cane sugar.

Data for the solubility of mixtures of $CaSO_4.K_2SO_4.H_2O + CaSO_4.2H_2O$ and $CaSO_4.K_2SO_4.H_2O + K_2SO_4$ in water at temperatures between 0° and 99°, are given by Barre (1909, 1911).

Data for mixtures of gypsum-rubidium syngenite and of dicalcium salt-syngenite, at temperatures between 0° and 40°, are given by D'Ans (1909).

THE SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE AND VICE VERSA.

(Hill, 1934.)

The mixtures used for the solubility determinations were made by careful weighing of the components, gypsum being used sometimes and dehydrated calcium sulfate at other times, and at still others syngenite or penta salt. The potassium sulfate was always brought into solution and the temperature adjusted before any calcium salt was added, to prevent the initiation of undersired phases by temporary conditions of wrong temperature or concentration.

d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	K_2SO_4	$CaSO_4$	
Results at 40°			
0.9960	0.0	0.212	Ca2
—	1.027	0.149	"
1.0108	2.066	0.147	"
1.0152	2.596	0.154	"
1.0187	2.917	0.155	" + Ca_5K
1.0192	3.123	0.159*	Ca2
1.0210	3.526	0.163*	"
—	3.710	0.165*	" + CaK
1.0252	3.956	0.143	Ca_5K + CaK
1.0258	4.061	0.134	CaK
1.031	4.666	0.101	"
1.032	4.797	0.094	"
1.039	5.754	0.070	"
1.056	7.763	0.040	"
1.069	9.376	0.029	"
1.086	11.284	0.020	"
1.099	12.895	0.014	" + K_2SO_4
1.099	12.897	0.010	K_2SO_4
1.099	12.86	0.0	"
Results at 60°			
	0.0	0.2015*	Ca2
	0.518	0.155*	"
	1.239	0.148*	"
	1.660	0.150*	" + Ca_5K
	1.854	0.151*	Ca2
	2.449	0.156*	"
	3.599	0.169*	"
	4.440	0.176*	" + CaK
	5.178	0.134*	CaK
	5.429	0.118*	"
	5.660	0.106	" + Ca_5K
	6.172	0.099	CaK
	10.044	0.041	"
	15.40	0.019	" + K_2SO_4
	15.40	0.00	K_2SO_4
Results at 60° (Con.)			
	0.0	0.160	Ca
	1.007	0.101	"
	2.013	0.107	"
	3.000	0.111	"
	3.562	0.114	"
	4.10	0.116	" + Ca_5K
	4.745	0.119*	Ca
	5.32	0.121*	Ca + CaK
	4.035	0.117	Ca_5K
	2.840	0.123*	"
Results at 100°			
	0.0	0.167	Ca2
	0.260	0.135	"
	0.787	0.133	"
	1.090	0.136	Ca2 + Ca_5K
	1.521	0.140*	Ca2
	2.016	0.148*	"
	2.962	0.162*	"
	4.522	0.184*	"
	5.312	0.198*	"
	5.37	0.199*	Ca2 + CaK
	5.523	0.200*	Ca2
	5.322	0.203*	CaK
	5.511	0.191*	"
	5.547	0.186*	"
	5.719	0.177*	"
	6.019	0.163*	"
	7.030	0.127*	"
	8.019	0.102*	"
	8.110	0.100*	"
	9.1	0.084*	CaK + Ca
	9.851	0.076*	CaK
	10.62	0.066	CaK + Ca_5K
	11.62	0.055	CaK
	13.608	0.042	"

* = metastable equilibrium; Ca2 = Gypsum, $CaSO_4.2H_2O$; Ca½ = Hemihydrate $CaSO_4.\frac{1}{2}H_2O$; Ca = Anhydrite, $CaSO_4$; CaK = Syngenite, $CaSO_4.K_2SO_4.H_2O$; Ca_5K = Pentacalcium potassium sulfate, $(CaSO_4)_5.K_2SO_4.H_2O$.

SO

THE SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE AND VICE VERSA. (Con.)

(Hill, 1934.)

Gms. per 100 gms. sat. sol. K_2SO_4	Gms. per 100 gms. sat. sol. $CaSO_4$	Solid Phase		Gms. per 100 gms. sat. sol. K_2SO_4	Gms. per 100 gms. sat. sol. $CaSO_4$	Solid Phase
Results at 100° (Con.)				Results at 100° (Con.)		
14.150	0.039	CaK		8.10	0.086*	Ca
14.375	0.038	"		8.50	0.085*	"
16.221	0.033	"		8.43	0.079*	"
19.317	0.026	" + K_2SO_4		2.558	0.090*	Ca_5K
19.366	0.0	K_2SO_4		4.021	0.082*	"
0.0	0.067	Ca		5.221	0.069*	"
0.448	0.051	"		6.817	0.064	"
0.728	0.047	"		8.336	0.064	"
1.932	0.051	"		9.958	0.063	"
2.953	0.055	"	t°	Results at Other temperatures		
4.500	0.060	"				
5.46	0.067	" + Ca_5K	25	3.067	0.148	Ca2 + CaK
6.52	0.071*	Ca	31.8	3.363	0.155	"
7.323	0.084*	"	83.	8.505	0.076	Ca_5K + CaK

SO * = metastable equilibrium; Ca2 = Gypsum, $CaSO_4.2H_2O$; Ca = Anhydrite, $CaSO_4$; CaK = Syngenite, $CaSO_4.K_2SO_4.H_2O$; Ca_5K = Pentacalcium potassium sulfate, $(CaSO_4)_5.K_2SO_4.H_2O$.

CALCIUM Potassium **SULFATES** $5CaSO_4.K_2SO_4.H_2O$ and (Syngenite). $CaSO_4.K_2SO_4.H_2O$

SOLUBILITY OF CALCIUM POTASSIUM DOUBLE SULFATES IN WATER AT 100°.

(Anderson and Nestell, 1920.)

The mixtures were constantly agitated at 100° for 7 to 23 days.

Gms. per 100 gms. H_2O. K_2SO_4	Gms. per 100 gms. H_2O. $CaSO_4$.	Mols. per 1000 mols. H_2O. K_2SO_4.	Mols. per 1000 mols. H_2O. $CaSO_4$.	Solid Phase.
1.02	0.180	1.05	0.24	$5CaSO_4.K_2SO_4.H_2O + CaSO_4.2H_2O$
8.95	0.107	9.26	0.142	" $+ CaSO_4.K_2SO_4.H_2O$

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF MAGNESIUM CHLORIDE AND OF MAGNESIUM NITRATE AT 25°.

(Cameron, Seidell, and Smith.)

In Magnesium Chloride. Grams per Liter of Sat. Solution. $MgCl_2$.	$CaSO_4$.	H_2O.	In Magnesium Nitrate. Grams per Liter Solution. $Mg(NO_3)_2$.	$CaSO_4$.	Wt. of 1 cc. Solution.
0	2.08	997.9	0	2.08	0.9981
8.50	4.26	996.5	25	5.77	1.0205
19.18	5.69	994.5	50	7.88	1.0398
46.64	7.59	989.1	100	9.92	1.0786
121.38	8.62	972.2	200	13.34	1.1498
206.98	6.57	949.9	300	14	1.2190
337	2.77	908.7	400	14.68	1.2821
441.1	1.39	878.6	514	15.04	1.3553

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF MAGNESIUM SULFATE AT 25°.

(Cameron and Bell, 1906a.)

Grams per Liter Solution.		Sp. Gr. of Solutions at $\frac{25}{25}$°.	Grams per Liter Solution.		Sp. Gr. of Solutions at $\frac{25}{25}$°.
$MgSO_4$.	$CaSO_4$.		$MgSO_4$.	$CaSO_4$.	
0	2.046	1.0032	149.67	1.597	1.1377
3.20	1.620	1.0055	165.7	1.549	1.1479
6.39	1.507	1.0090	171.2	1.474	1.1537
10.64	1.471	1.0118	198.8	1.422	1.1813
21.36	1.478	7.0226	232.1	1.254	1.2095
42.68	1.558	1.0419	265.6	1.070	1.2382
64.14	1.608	1.0626	298	0.860	1:2624
85.67	1.617	1.0833	330.6	0.647	1.2877
128.28	1.627	1.1190	355	0.501	1.3023

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF MAGNESIUM SULFATE AT 25°. (Harkins and Paine, 1919.)

80

Solid Phase $CaSO_4.2H_2O$.

d_{4}^{25} of sat. sol.	Gms. per 100 gms. sat. sol. $MgSO_4$.	Gms. per 100 gms. sat. sol. $CaSO_4$.
0.99911	0.0	0.20854
0.99960	0.060294	0.19565
1.0001	0.12167	0.1848
1.00067	0.18339	0.1777

Solid Phase Selenite Plates.

d_{4}^{25} of sat. sol.	Gms. per 100 gms. sat. sol. $MgSO_4$.	Gms. per 100 gms. sat. sol. $CaSO_4$.
0.99905	0.0	0.20658
1.0004	0.13413	0.17886
1.0018	0.33161	0.16469
1.0044	0.63148	0.15592
1.0099	1.2385	0.15912

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF AMMONIUM SALTS.

(In NH_4Cl and NH_4NO_3, Cameron and Brown — J. Physic. Chem. 9, 210, '05; In $(NH_4)_2SO_4$ at 25°, Sullivan — J. Am. Chem. Soc. 27, 529, '05; In $(NH_4)_2SO_4$ at 50°, Bell and Tabor — J. Physic. Chem. 10, 119, '06.)

Gms. Ammonium Salt per Liter.	In NH_4Cl at 25°. G. $CaSO_4$ Dissolved per Liter.	In NH_4NO_3 at 25°. G. $CaSO_4$ Dissolved per Liter	Gms. Ammonium Salt per Liter.	In NH_4Cl at 25°. G. $CaSO_4$ Dissolved per Liter.	In NH_4NO_3 at 25°. G. $CaSO_4$ Dissolved per Liter.
0	2.08	2.08	300	10.10	10.80
20	5.00	3.70	375	7.40	...
40	7.00	5.10	400	...	11.40
60	8.00	6.05	600	...	12.15
80	8.50	7.00	800	...	12.10
100	9.10	7.65	1000	...	11.81
150	10.30	8.88	1400	...	10.02
200	10.85	9.85	sat.	...	7.55

In $(NH_4)_2SO_4$ at 25°.

Grams per Liter Sol. $(NH_4)_2SO_4$.	Grams per Liter Sol. $CaSO_4$.	Wt. of 100 cc. Sat. Sol.
0	2.08	99.91
0.129	2.04	99.91
0.258	1.99	99.92
0.821	1.81	99.95
1.643	1.66	99.99
3.287	1 54	100.10
6.575	1.44	100.34
13.15	1.46	100.82
26.30	1.62	101.76
84.9	2.33	105.34
169.8	3.33	110.32
339.6	4.50	119.15

In $(NH_4)_2SO_4$ at 50°.

Grams per Liter Sol. $(NH_4)_2SO_4$.	Grams per Liter Sol. $CaSO_4$.	Sp. Gr. of Solutions.
0	2.168	...
15.65	1.609	1.0026
30.67	1.750	1.0113
91.6	2.542	1.0440
160.4	3.402	1.0819
221.6	4.068	1.1108
340.6	5.084	1.1653
416.5	5.354	1.1964
428.4	4.632	1.2043
530.8	2.152	1.2437
566	1.08	1.2508
566.7	0	1.2510

The 25° and 50° isotherms for the solubility of calcium sulfate in aqueous solutions of ammonium sulfate have been more completely and accurately determined by Hill and Yanick, 1935, with the following results.

SO

Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$	Gms. per 100 gms. sat. sol. $CaSO_4$	Solid Phase
Results at 25°		
0.0	0.21	Ca2
0.16	0.172	"
1.12	0.146	"
3.33	0.162	"
5.51	0.183	"
11.09	0.242	"
22.22	0.335	"
28.66	0.373	"
34.85	0.386	" + CaN
36.12	0.386	" + Ca_5N
43.29	0.378	" + Am
35.06	0.379	CaN
35.74	0.347	"
36.67	0.310	"
39.41	0.224	"
40.70	0.200	"
41.20	0.191	"
43.24	0.142	" + Am
34.77	0.429	Ca_5N
38.52	0.337	"
Results at 25° (Con.		
41.47	0.300	Ca_5N
43.24	0.259	" + Am
43.46	0.0	"
Results at 50°		
0.0	0.210	Ca2
0.53	0.155	"
1.15	0.154	"
2.21	0.162	"
6.43	0.210	"
8.32	0.233	"
10.69	0.260	"
16.57	0.321	"
19.16	0.345	"
24.15	0.390	" + Ca_5N
25.47	0.400	Ca2
30.96	0.432	"
34.90	0.449	" + CaN
45.39	0.468*	" + Am
Results at 50° (Con.		
36.44	0.381	CaN
38.55	0.313	"
39.12	0.294	CaN + Ca_5N
40.22	0.267	CaN
42.91	0.201	"
43.88	0.180	"
45.31	0.157	" + Am
23.14	0.394*	Ca_5N
29.80	0.361	"
34.40	0.331	"
36.50	0.315	"
38.54	0.298	"
43.65	0.246	"
45.61	0.222	" + Am
36.54	0.485*	Ca_2N
37.54	0.452	" + Ca_2
39.54	0.399	"
43.22	0.310	"
45.51	0.244	" + Am
45.65	0.0	Am

* = metastable equilibrium; Ca2 = CaSO .$2H_2O$; CaN = Syngenite $CaSO_4.(NH_4)_2SO_4.H_2O$; Ca_5N = Penta calcium salt, $5CaSO_4.(NH_4)_2SO_4.H_2O$; **$Ca_2N$:** Dicalcium Salt, $2CaSO_4.(NH_4)_2SO_4.H_2O$; Ca = Anhydrite, $CaSO_4$. Am = $(NH_4)_2SO_4$.

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF AMMONIUM SULFATE AT 75° AND AT 100°.

(Hill and Yanick, 1935.)

The previous results of D'Ans 1909 and of Barre, 1909, 1911, are incomplete or erroneous.

Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$	Gms. per 100 gms. sat. sol. $CaSO_4$	Solid Phase	Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$	Gms. per 100 gms. sat. sol. $CaSO_4$	Solid Phase	Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$	Gms. per 100 gms. sat. sol. $CaSO_4$	Solid Phase
Results at 75°			Results at 75° (Con.)			Results at 100° (Con.)		
0.0	0.194	Ca2	47.93	0.243	Ca_2N + Am	22.98	0.505	Ca_2N
0.53	0.147	"	0.0	0.114	Ca	27.90	0.441	"
2.12	0.162	"	0.52	0.074	"	33.37	0.372	"
5.29	0.208	"	2.07	0.082	"	39.36	0.300	"
7.16	0.235	"	10.35	0.133	"	45.68	0.229	"
11.33	0.294	" + Ca_5N	23.62	0.212	"	48.44	0.212	"
18.93	0.391	"	30.86	0.212	"	50.40	0.204	" + Am
26.26	0.486	"	42.20	0.221	"	9.76	0,214	Ca_5N
32.22	0.539	" + Ca_2N	47.95	0.180	" + Am	18.53	0.236	"
33.58	0.545	"	48:00	0.0	Am	24.68	0.254	"
32.28	0.568	" + CaN				28.55	0.252	"
35.72	0.522	CaN	Results at 100°			32.15	0.248	"
37.90	0.438	"				37.48	0.244	"
39.88	0.371	" + Ca_2N	0.0	0.167	Ca2	41.03	0.237	"
42.01	0.308	"	0.56	0.152	"	44.64	0.223	"
42.82	0.289	"	1.63	0.152	"	47.74	0.212	"
45.94	0.224	"	9.24	0.200	" + Ca_5N	50.37	0.201	" + Am
48.00	0.185	" Am	5.69	0.226	"	0.0	0.066	Ca
11.94	0.295	Ca_5N	11.40	0.327	"	0.53	0.042	"
17.04	0.303	"	16.07	0.404	"	1.09	0.047	"
27.24	0.300	"	21.81	0.518	"	3.61	0.058	"
34.38	0.276	"	24.21	0.555	"	8.52	0.085	"
37.21	0.267	"	28.79	0.630	"	15.61	0.125	"
43.55	0.229	"	35.77	0.715	" + CaN	22.02	0.145	"
47.96	0.181	" +Am	36.46	0.657	CaN	26.56	0.155	"
32.71	0.530	Ca_2N	39.12	0.532	"	36.52	0.177	"
34.62	0.482	"	41.09	0.461	"	46.59	0.193	"
35.91	0.442	"	43.26	0.392	"	50.41	0.198	" + Am
39.17	0.380	"	48.51	0.280	"	50.45	0.0	Am
45.35	0.279	"	50.41	0.245	" + Am			

SO

Ca2 = Gypsum, $CaSO_4.2H_2O$; CaN = Syngenite, $CaSO_4(NH_4)_2SO_4.H_2O$; Ca_2N = Di calcium Salt, $2CaSO_4.(NH_4)_2SO_4.H_2O$; Ca_5N = Penta calcium Salt $5CaSO_4.(NH_4)_2SO_4.H_2O$; Ca = Anhydrite $CaSO_4$; Am = $(NH_4)_2SO_4$.

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF AMMONIUM ACETATE AT 25°. (Marden, 1916.)

Gms. CH_3COONH_4 per 100 Gms. Solution.	d_{25}.	Gms. $CaSO_4$ per 100 Gms. Sat. Solution.
0	1	0.2085
2.13	1.005	0.454
5.34	1.012	0.752
10.68	1.024	1.146
21.37	1.045	1.755

Solubility of Calcium Sulfate in Aqueous Solutions of Sodium Chloride at 26°.

(Cameron, 1901; also Orloff, 1902; Cloes, 1903; d'Anselme, 1903.)

Grams per 100 cc Solution.		Wt. of 1 cc. Solution.	Grams per 100 cc. Solution.		Wt. of 1 cc. Solution.
NaCl.	$CaSO_4$.		NaCl.	$CaSO_4$.	
0	0.2121	0.9998	17.650	0.712	1.1196
9.115	0.666	1.0644	22.876	0.679	1.1488
14.399	0.718	1.0981	26.417	0.650	1.1707
14.834	0.716	1.1012	32.049	0.572	1.2034

Solubility of Mixtures of Calcium Sulfate and Calcium Carbonate in Aqueous Solutions of Sodium Chloride at 23°.

(Cameron and Seidell, 1901a.)

Grams per Liter Solution.			Grams per Liter Solution.		
NaCl.	$Ca(HCO_3)_2$.	$CaSO_4$.	NaCl.	$Ca(HCO_3)_2$.	$CaSO_4$.
0	0.060	1.930	79.52	0.060	6.424
3.63	0.072	2.720	121.90	0.056	5.272
11.49	0.089	3.446	193.80	0.048	4.786
39.62	0.101	5.156	267.60	0.040	4.462

SO

Data for the solubility of mixtures of calcium sulfate and sodium chloride at 0°-99° are given by Arth and Cretien (1906).

Data for the equilibrium $CaSO_4 + Na_2CO_3 \rightleftarrows CaCO_3 + Na_2SO_4$ at 25° are given by Herz (1911a).

Solubility of Calcium Sulfate in Aqueous Solutions of Sodium Nitrate and of Sodium Sulfate at 25°.

(Seidell, Smith, Cameron, Brearcale.)

In Sodium Nitrate.			In Sodium Sulfate.		
Gms. per Liter Solution.		Wt. of 1 cc. Solution.	Gms. per Liter Solution.		Wt. of 1 cc. Solution.
$NaNO_3$.	$CaSO_4$.		Na_2SO_4.	$CaSO_4$.	
0	2.08	0.9981	2.39	1.65	1.0013
25	4.25	1.0163	9.54	1.45	1.0076
50	5.50	1.0340	14.13	1.39	1.0115
100	7.10	1.0684	24.37	1.47	1.0205
200	8.79	1.1336	46.15	1.65	1.0391
300	9.28	1.1916	115.08	2.10	1.0965
600	7.89	1.3639	146.61	2.23	1.1427
655	7.24	1.3904	257.10	2.65	1.2120

Data for the solubility of calcium sulfate, sodium sulfate glauberite, sodium sulfate syngenite, separately and mixed, in water at various temperatures, are given by D'Ans (1909) and Barre (1911).

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE AT 25° AND AT 35°.

(Hill and Wills, 1938.)

Accurately weighed mixtures of the constituents were rotated in stoppered bottles for appropriate periods and the saturated solutions analyzed by evaporating a part to constant weight at 100° and then at 200° and precipitating the calcium in another part as oxalate and weighing as oxide.

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
Na_2SO_4	$CaSO_4$		Na_2SO_4	$CaSO_4$		Na_2SO_4	$CaSO_4$	
Results at 25°			Results at 25° (Con.)			Results at 35° (Con.)		
0.0	0.209	Ca2	34.13	0.055	CaNa + Na	32.85	0.178	Ca2 + Na
0.595	0.148	"	32.72	0.070	"	32.90	0.0	Na
1.601	0.139	"	32.49	0.070	"	32.89	0.046	Na + CaNa
3.200	0.144	"	31.41	0.094	"	29.31	0.084	CaNa
6.251	0.161	"	31.05	0.123	"	28.34	0.099	"
10.93	0.181	"	30.47	0.115	"	25.17	0.146	"
15.23	0.194	"	30.34	0.141	"	23.06	0.199	"
18.09	0.197	"	34.00	0.0	Na	22.65	0.206	" + Ca2
20.15	0.198	"				32.85	0.065	Ca2Na + Na
21.75	0.197	" + Na10	Results at 35°			31.66	0.078	"
25.87	0.188*	" + CaNa				31.18	0.088	"
27.98	0.180*	"	0.0	0.214	Ca2	30.48	0.102	"
29.78	0.174*	" + Ca2Na	0.503	0.150	"	27.25	0.176	"
33.85	0.155*	" + Na	0.988	0.142	"	26.70	0.200	" + Ca2
21.70	0.0	Na10	1.896	0.142	"	27.93	0.217	Ca_5Na
21.72	0.120	"	5.968	0.164	"	30.06	0.189	" + Ca2
33.91	0.049	CaNa + Na	13.97	0.198	"	31.01	0.179	"
32.61	0.065	"	25.16	0.204	"	31.4	0.166	"
29.31	0.113	"	27.93	0.199	"	32.5	0.144	"
26.60	0.175	"	29.89	0.190	"	32.88	0.135	" + Na

Ca2 = Gypsum, $CaSO_4.2H_2O$; CaNa = Glauberite, $CaSO_4.Na_2SO_4$; Ca2Na = Labile Salt, $CaSO_4.2Na_2SO_4.2H_2O$; Ca_5Na = Penta salt, $5CaSO_4.Na_2SO_4.3H_2O$; Ca = Anhydrite $CaSO_4$; Na = Thenardite, Na_2SO_4; Na10 = Mirobilite $Na_2SO_4.10H_2O$.

THE SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE AT 50°

(Hill and Wills, 1938.)

Gms. per 100 gms.		Solid Phase	Gms. per 100 gms.		Solid Phase	Gms. per 100 gms.		Solid Phase
Na_2SO_4	$CaSO_4$		Na_2SO_4	$CaSO_4$		Na_2SO_4	$CaSO_4$	
0.0	0.210	Ca2	1.236	0.135	Ca	31.67	0.060	Ca2Na+Na
0.521	0.154	"	1.529	0.135	"	26.61	0.124	"
0.989	0.149	"	1.942	0.138	"	25.51	0.163	"
1.521	0.148	"	8.923	0.162	"	24.8	0.230	"+Ca2
1.981	0.149	"	31.70	0.040	CaNa+Na	24.51	0.277	"
3.908	0.164	"	29.08	0.058	"	31.7	0.147	Ca5Na + Na
7.496	0.185	"	25.49	0.102	"	31.3	0.153	Ca5Na
14.05	0.214	"	23.93	0.115	"	29.4	0.165	"
18.28	0.224	"	22.53	0.136	"	27.0	0.182	"
20.07	0.228	"	20.24	0.182	"	25.2	0.202	"+Ca2Na
24.40	0.230	"	19.68	0.197	"	23.6	0.213	"
26.93	0.230	"	19.66	0.203	"+Ca	22.8	0.217	"
29.75	0.224	"	18.71	0.227	"+Ca2	21.6	0.226	"
31.77	0.216	"+Na	18.44	0.233	"	21.4	0.229	"+Ca2
31.73	0.0	Na	17.88	0.252	"			

Solubility of Calcium Sulfate in Aqueous Solutions of Sodium Sulfate at 75°.

(Hill and Wills, 1938.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
Na_2SO_4	$CaSO_4$		Na_2SO_4	$CaSO_4$		Na_2SO_4	$CaSO_4$	
0.0	0.192	Ca2	9.95	0.113	Ca	28.46	0.110	Ca2Na
0.506	0.142	"	14.47	0.117	"	26.17	0.154	"
1.009	0.143	"	18.92	0.128	" + CaNa	25.94	0.169	"
1.505	0.145	"	19.95	0.129	"	25.20	0.210	"
1.996	0.148	"	30.32	0.042	CaNa + Na	24.20	0.292	"
4.036	0.168	"	27.14	0.052	"	24.0	0.302	" + Ca2
8.046	0.199	"	26.76	0.054	"	10.2	0.221	Ca$_5$Na + Ca2
10.38	0.224	"	26.35	0.056	"	10.81	0.217	"
12.06	0.238	"	25.78	0.060	"	11.05	0.201	"
17.20	0.270	"	22.45	0.086	"	12.10	0.208	"
23.15	0.300	"	19.20	0.123	"	13.06	0.207	"
29.62	0.308	"	18.16	0.138	"	13.60	0.200	"
30.32	0.308	" +Na	16.30	0.175	"	14.25	0.197	"
30.38	0.0	Na	15.12	0.198	"	15.07	0.201	"
1.002	0.070	Ca	14.16	0.225	"	15.10	0.198	" + CaNa
5.017	0.086	"	13.85	0.247	" + Ca2	17.03	0.189	"
8.93	0.113	"	30.38	0.081	Ca2Na + Na	19.08	0.185	"
9.205	0.103	"	29.06	0.103	"	26.2	0.160	" + Ca2Na
						30.28	0.146	" + Na

Ca2 = Gypsum, $CaSO_4.2H_2O$; CaNa = Glauberite, $CaSO_4.Na_2SO_4$; Ca2Na = Labile Salt, $CaSO_4.2Na_2SO_4.2H_2O$; Ca$_5$Na = Penta Salt $5CaSO_4.Na_2SO_4.3H_2O$; Ca = Anhydrite $CaSO_4$; Na = Thenardite, Na_2SO_4.

Solubility of Calcium Sulfate in Aqueous Solutions of Nickel Sulfate.

(Campbell and Yanick, 1932.)

t°	Gms. per 100 gms. sat. sol.		t°	Gms. per 100 gms. sat. sol.		t°	Gms. per 100 gms. sat. sol.	
	$NiSO_4$	$CaSO_4$		$NiSO_4$	$CaSO_4$		$NiSO_4$	$CaSO_4$
45	0.00	0.211	75	24.36	0.287	90	29.72	0.359
"	6.23	0.220	"	33.32	0.294	"	31.09	0.350
"	10.61	0.223	"	40.16	0.321	"	31.36	0.345
"	20.42	0.243	"	40.88	0.315	"	34.16	0.340
"	23.5	0.236	"	44.59	0.302	"	37.24	0.337
"	25.45	0.246	"	49.70	0.276	"	40.06	0.335
"	26.62	0.246	"	58.81	0.240	"	43.12	0.327
"	29.43	0.255	"	61.25	0.220*	"	44.58	0.330
"	35.03	0.252	"	60.30	0.0	"	46.61	0.325
"	37.99	0.257	90	0.0	0.177	"	48.95	0.291
"	43.54	0.242	"	7.38	0.222	"	49.56	0.299
"	49.31	0.200*	"	11.15	0.268	"	53.91	0.280
"	48.36	0.0	"	16.23	0.309	"	57.88	0.265
75	0.0	0.199	"	21.63	0.332	"	61.34	0.246
"	7.69	0.226	"	23.76	0.348	"	72.40	0.186
"	19.60	0.273	"	24.93	0.351	"	72.54	0.183
						"	68.70	0.0

The solid phase was $CaSO .2H_2O$ in all cases except at the tr. pts. marked * when both $CaSO_4.2H_2O$ and $Ni SO_4.6H_2O$ were present and for solutions saturated only with $NiSO_4.6H_2O$.

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF METHYL, ETHYL AND n PROPYL ALCOHOL AT 25°.

(Yamamoto, 1930.)

Results for :

Methyl Alcohol		Ethyl Alcohol		n Propyl Alcohol	
Wt. percent CH_3OH in solvent	Gms. $CaSO_4$ per 100 gms. sat. sol.	Wt. percent C_2H_5OH in solvent	Gms. $CaSO_4$ per 100 gms. sat. sol.	Wt. percent C_3H_7OH in solvent	Gms. $CaSO_4$ per 100 gms. sat. sol.
5.116	0.1304	0.0 (=H_2O)	0.2084	5.13	0.1174
10.25	0.0781	3.906	0.1314	10.21	0.0648
15.25	0.0496	6.221	0.0998	15.56	0.0379
20.5	0.0306	13.58	0.0436	20.52	0.0246
23.0	0.0236	19.78	0.0209	25.71	0.0173
25.42	0.0190	20.89	0.0185	30.57	0.0127
29.12	0.0136	23.77	0.0139	36.52	0.0081
30.94	0.0118	27.29	0.0093	40.76	0.0063
36.0	0.0080	28.66	0.0082	45.73	0.0044
41.89	0.0049	32.97	0.0052		
45.05	0.0035	35.69	0.0044		
46.52	0.0030	40.97	0.0029		

SOLUBILITY OF CALCIUM SULFATE IN WATER IN PRESENCE OF EXCESS OF CALCIUM BENZENE SULFONATE [$Ca(C_6H_5SO_3)_2$]. (Mameli, 1922.)

t°.	0°.	25°.	37°.	50°.	70°.	90°.
Gms. $CaSO_4$ per 100 cc. sat. sol...	0.3011	0.3429	0.3660	0.3700	0.3575	0.3406

SO

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF SODIUM BENZENE SULFONATE AT 25°. (Mameli, 1922.)

Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.	
$C_6H_5SO_3Na$.	$CaSO_4$.	$C_6H_5SO_3Na$.	$CaSO_4$.
0.2312	0.3144	1.0814	0.4930
0.3301	0.3430	1.7315	0.4930
0.7012	0.4350	2.3196	0.4930

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF CALCIUM BENZENE SULFONATE. (Mameli, 1922.)

Results at 0°.		Results at 25°.		Results at 50°.	
Gms. per 100 cc. sat. sol.		Gms. per 100 cc. sat. sol.		Gms. per 100 cc. sat. sol.	
$Ca(C_6H_5SO_3)_2$.	$CaSO_4$	$Ca(C_6H_5SO_3)_2$.	$CaSO_4$.	$Ca(C_6H_5SO_3)_2$.	$CaSO_4$.
0.6001	0.2351	0.3571	0.2665	0.2008	0.2580
0.9501	0.2701	0.6473	0.3186	0.6504	0.3302
1.3001	0.3011	1.0168	0.3321	1.0007	0.3610
1.6789	0.3011	1.3301	0.3429	1.3102	0.3700
2.0213	0.3011	2.7493	0.3429	2.4101	0.3700

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS AND ALCOHOLIC MONOPOTASSIUM TARTRATE SOLUTIONS AT 20°.

(Magnanini, 1901.)

Solvent.	Gms. $CaSO_4$ per 100 Gms. Solution.	Solvent.	Gms. $CaSO_4$ per 100 Gms. Solution.
Water	0.2238	10% alcoholic N/200 $KHC_2H_4O_6$	0.0866
Aq. N/200 $KHC_4H_4O_6$	0.2323	Aq. N/200 $KHC_2H_4O_6$+5% tartaric acid	0.2506
10% alcohol	0.0970	10% alc. N/400 $KHC_2H_4O_6$+5% tartaric acid	0.1086

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SUGAR SOLUTIONS.

(Stolle, 1900.)

Per cent Concentration of Sugar Solutions.	Gms. $CaSO_4$ Dissolved by 1000 cc. of the Sugar Solutions at:					
	30°.	40°.	50°.	60°.	70°.	80°.
0	...	*2.157	1.730	1.730	1.652	1.710
10	2.041	1.730	1.730	1.574	1.574	1.613
20	1.808	1.652	1.419	1.380	1.419	1.263
27	1.550	1.438	1.361	1.283	1.283	0.972
35	1.263	1.050	1.088	1.108	0.914	...
42	1.030	...	0.777	0 816	0.855	0.729
49	...	0.564	0.739	0.564	0.603	0.486
55	...	0.486	0.505	0.486	0.369	0.330

100 gms. glycerol of d_{15} 1.256 dissolve 5.17 gms. $CaSO_4$ at 15°-16°. (Ossendowski, 1907.)
100 gms. glycerol of *d* 1.114 dissolve 0.95 gm. $CaSO_4$ at ord. temp. (Asselin, 1873.)

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF ALBUMIN AND GLOBULIN AT 25°

(Pauli and Stansinger, 1929.)

Solvent	Gms. $CaSO_4$ per 100 gms. sat. sol.
Water	0.2094
Aq. 5% Seralbumin	0.2119
Aq. 5% Pseudoglobulin	0.2180
Aq. 5% Hemoglobulin	0.2196

SO

FUSION-POINT DATA ARE GIVEN FOR THE FOLLOWING MIXTURES OF CALCIUM SULFATE AND OTHER SALTS:

Calcium Sulfate + Lithium Sulfate	(Müller, 1910.)
" " + Potassium Sulfate	(Müller, 1910; Grahmann, 1913.)
" " + Rubidium Sulfate	(Müller, 1910.)
" " + Sodium Sulfate	(Müller, 1910; Calcagni and Mancini, 1910.)

CALCIUM THIOSULFATE $CaS_2O_3.6H_2O$.

SOLUBILITY OF CALCIUM THIOSULFATE IN AQUEOUS SOLUTIONS OF SODIUM THIOSULFATE AT 9° AND 25° AND VICE VERSA.

(Kremann and Rodemund, 1914.)

Results at 9°.

Gms. per 100 Gms. Sat. Sol.		Solid Phase.
$Na_2S_2O_3$.	CaS_2O_3.	
0	29.4	$CaS_2O_3.6H_2O$
11.04	22.64	"
25.21	15.84	" + $Na_2S_2O_3.5H_2O$
31.01	7.70	$Na_2S_2O_3.5H_2O$

Results at 25°.

Gms. per 100 Gms. Sat. Sol.		Solid Phase.
$Na_2S_2O_3$.	CaS_2O_3.	
0	34.7	$CaS_2O_3.6H_2O$
9.24	29.69	"
15.67	21.41	"
18.34	25.18	"
28.24	21.14	"
30.19	20.33	" + $Na_2S_2O_3.5H_2O$
31.24	18.43	$Na_2S_2O_3.5H_2O$
35.04	11.61	"

Data are also given for the quaternary systems, $CaS_2O_3 + Na_2S_2O_3 + NaNO_3 + H_2O$ and $CaS_2O_3 + Ca(NO_3)_2 + NaNO_3 + H_2O$ at 9° and 25°. A triple salt of the composition $CaNa_2(S_2O_3)_2NO_3.11H_2O$ was obtained.

CALCIUM Di THIONATE $CaS_2O_6.4H_2O$.

SOLUBILITY OF CALCIUM DI THIONATE IN : (de Baat, 1926.)

Water.

t°.	Gms. CaS_2O_6 per 100 gms. sat. sol.	Solid Phase.
0	13.80	$CaS_2O_6.4H_2O$
12	17.63	»
20	20.25	»
30	23.29	»

Aq. ethyl alcohol at 30°.

Gms. per 100 gms. sat. sol. CaS_2O_6.	Gms. per 100 gms. sat. sol. C_2H_5OH.	Solid Phase.
12.55	16.50	$CaS_2O_6.4H_2O$
3.31	40.39	»
1.39	50.96	»
0.11	73.08	»
0.059	92.47	»

CALCIUM SELENATE $CaSeO_4.2H_2O$

SeO

SOLUBILITY OF CALCIUM SELENATE IN WATER.
(Meyer and Aulich, 1928.)

t°	Gms. $CaSeO_4$ per 100 gms. sat. sol.	Gm. mols. $CaSeO_4$ per 100 mols. H_2O	Solid Phase	t°	Gms. $CaSeO_4$ per 100 gms. sat. sol.	Gm. mols. $CaSeO_4$ per 1000 mols. H_2O	Solid Phase
0	7.52	7.99	$CaSeO_4.2H_2O$	30	6.84	7.22	$CaSeO_4.2H_2O$
10	7.55	8.03	"	35	6.81	7.18	"
15	7.63	8.12	"	40	6.26	6.57	"
18	7.65	8.15	"	50	5.89	6.15	"
21	7.15	7.57	"	60	5.63	5.85	"
25	6.88	7.26	"	100.5 (b.pt.)	—		"

Although there is a sharp break in the curve at 18°, no change in the solid phase was detected. A hemi-hydrate of calcium selenate was prepared by boiling the dihydrate with glacial acetic acid for 6 hours.

SOLUBILITY OF CALCIUM SELENATE IN AQUEOUS SOLUTIONS
OF POTASSIUM SELENATE AT 25° AND VICE VERSA.
(Meyer and Aulich, 1928.)

Gms. per 100 gms. sat. sol. K_2SeO_4	Gms. per 100 gms. sat. sol. $CaSeO_4$	Solid Phase	Gms. per 100 gms. sat. sol. K_2SeO_4	Gms. per 100 gms. sat. sol. $CaSeO_4$	Solid Phase
0.0	6.88	$CaSeO_4.H_2O$	26.18	5.78	$CaSeO_4.2H_2O$
13.62	6.67	"	31.52	5.26	" + $CaK_2(SeO_4)_2.2H_2O$
16.43	6.42	"	35.42	3.24	$CaK_2(SeO_4)_2.2H_2O$
17.90	6.22	"	43.05	1.12	" + K_2SeO_4
19.29	5.56	"	53.3	0.0	K_2SeO_4

SOLUBILITY OF CALCIUM SELENATE IN AQUEOUS
SOLUTIONS OF AMMONIUM SELENATE AT 30° AND VICE VERSA.
(Welton and King, 1939.)

Gms. per 100 gms. sat. sol. $(NH_4)_2SeO_4$	Gms. per 100 gms. sat. sol. $CaSeO_4$	Solid Phase	Gms. per 100 gms. sat. sol. $(NH_4)_2SeO_4$	Gms. per 100 gms. sat. sol. $CaSeO_4$	Solid Phase
0.0	6.84	$CaSeO_4.2H_2O$	39.89	3.53	$CaSeO_4.2H_2O$
4.59	6.70	"	45.21	2.95	"
10.45	6.26	"	49.17	2.74	"
12.39	6.17	"	50.99	2.37	"
16.50	5.33	"	52.31	2.28	"
20.64	5.51	"	53.74	2.10	" + $(NH_4)_2SeO_4$
25.09	5.22	"	54.47	1.06	$(NH_4)_2SeO_4$
23.07	4.94	"	54.69	0.36	"
34.51	4.14	"	55.18	0.0	

CALCIUM SELENATE

SOLUBILITY OF CALCIUM SELENATE IN AQUEOUS SOLUTIONS OF SODIUM SELENATE AT 25° AND VICE VERSA.

(Meyer and Aulich, 1928.)

Gms. per 100 gms. sat. sol.		Solid	Gms. per 100 gms. sat. sol.		Solid
Na_2SeO_4	$CaSeO_4$	Phase	Na_2SeO_4	$CaSeO_4$	Phase
0.0	6.88	$CaSeO_4.2H_2O$	27.98	3.33	$CaSeO_4.2H_2O$ + $CaNa_2(SeO_4)_2.2H_2O$
10.55	5.77	"			
16.17	4.94	"	30.01	2.86	$CaNa_2(SeO_4)_2.2H_2O$
17.51	4.79	"	33.62	2.32	" "
20.59	4.25	"	35.61	2.17	" + Na_2SeO_4
			36.4	0.0	Na_2SeO_4

SiO

CALCIUM SILICATE $CaSiO_3$

A STUDY OF THE SYSTEM CALCIUM OXIDE, SILICA AND WATER AT 30°.

(Flint and Wells, 1934.)

Silica gel was purified by boiling in concentrated HNO_3, followed by washing and electrolysis. An excess of it boiled with dilute solutions of calcium hydroxide for several days, produced solutions generally containing 0.4 to 0.5 gm. SiO_2 and 0.02 to 0.05 gm. CaO per liter. On cooling, they assume a light blue color, evidently due to a decreased solubility of silica at the lower temperature. Such sols are very stable. Precipitation of this colloidal silica can be very readily accomplished by addition of a small quantity of saturated calcium hydroxide solution. Although the initial sol containing solutions, when examined under the microscope contain myriads of particles in Brownian movement, no trace of such movement can be detected in the clear solution after precipitation. It was assumed, therefore, that the latter are true solutions saturated with respect to silica at definite concentrations of calcium hydroxide. To investigate the solubility relationships of silica to lime, a large quantity of the sol containing solution was prepared and this mixed in various proportions with calcium hydroxide solution. The mixtures were placed in a thermostat at 30°. After one month the solutions were filtered and analyzed for silica and lime. The proportion of the lime to the silica in the precipitates was calculated by difference. The table of results shows the composition of the original mixtures and the ratio of CaO to SiO_2 in the precipitates and solutions with which they were in contact. Electrometric and analytical determinations showed the solid phases to be hydrated calcium salts of ortho silicic acid. Their solubilities are represented graphically. From the hydrolysis constants of these salts, ionization in the four steps in the dissociation of ortho silicic acid were calculated. Mono calcium silicate differs from the more basic calcium silicates in that it forms stable solutions and hence is nonhydraulic. The authors also studied the reaction of water upon portland cement and the reaction between diatomaceous silica and lime solution.

CALCIUM SILICATE $CaSiO_3$.

SOLUBILITY IN WATER AND IN AQUEOUS SUGAR SOLUTIONS AT 17°.

(Weisberg — Bull. soc. chim. [3] 15, 1097, '96.)

The sample of calcium silicate was air dried.

Solvent.	Grams per 100 cc. Saturated Solution. At 17°. CaO(det.)	At 17°. $CaSiO_3$(calc.)	After Boiling and Filtering Hot. CaO(det.)	After Boiling and Filtering Hot. $CaSiO_3$(calc.)
Water	0.0046	0.0095	...	...
10% sugar sol.	0.0065	0.0135	0.0094	0.0195
20% sugar sol.	0.0076	0.0157	0.0120	0.0249

FUSION-POINT DATA ARE GIVEN FOR THE FOLLOWING MIXTURES OF CALCIUM SILICATE AND OTHER COMPOUNDS.

$CaSiO_3 + CaS$	(Lebedew, 1911.)
" $+ CaTiO_3$	(Smolensky, 1911–12.)
" $+ Li_2SiO_3$	(Wallace, 1909.)
" $+ MgSiO_3$	(Allen and White, 1911; Ginsberg, 1906.)
" $+ MnSiO_3$	(Ginsberg, 1908, 1909.)
" $+ Na_2SiO_3$	(Wallace, 1909; Kultascheff, 1903.)

CALCIUM TUNGSTATE $CaWO_4$

One liter sat. solution in water contains 0.93×10^{-4} gm. mols. $CaWO_4$ at 18°, determined by electrolyte conductivity.

CADMIUM BROMIDE $CdBr_2.4H_2O$

SOLUBILITY OF CADMIUM BROMIDE IN WATER.

(Hering, 1936; above 100° Benrath, Gjedebo, Schiffers and Wunderlich, 1937.)

t°	d. of sat. sol.	Gms. $CdBr_2$ per 100 gms. sat. sol.	Solid Phase	t°	d. of sat. sol.	Gms. $CdBr_2$ per 100 gms. sat. sol.	Solid Phase
-4.4	—	32.9	Ice + $CdBr_2.4H_2O$	38	1.971	60.3	$CaBr_2$
0	1.444	36.0	$CdBr_2.4H_2O$	45	—	60.35	"
+5	—	39.8	"	60	1.949	60.45	"
10	—	43.0	"	75	1.938	60.8	"
15	—	46.4	"	100	1.928	61.65	"
18	1.683	48.9	"	153	—	64.6	"
20	—	49.7	"	174	—	66.5	"
25	1.775	52.9	"	237	—	71.8	"
30	—	56.3	"	206	—	74.8	"
32.5	1.904	57.85	"	312	—	79.2	"
36.0	1.974	60.3	" + $CaBr_2$	419	—	89.2	"

Previous results in fair agreement with the above are given by Dietz, 1899, 1900, and by Ishikawa and Ueda, 1930, 1933.

Cryoscopic determinations upon aqueous solutions of mixtures of cadmium bromide and alkali bromides and of cadmium chloride and alkali chlorides are given by Cornec and Urbain, 1919.

EQUILIBRIUM IN THE SYSTEM CADMIUM BROMIDE, POTASSIUM BROMIDE AND WATER.

(Hering, 1936.)

The author determined a large number of isotherms and by plotting these results ascertained the limits of existence of the several double salts.

t^o	Gms. per 100 gms. sat. sol.		Solid Phase	t^o	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase.
	$CdBr_2$	KBr				$CdBr_2$	KBr	
-2.7	13.9	6.1	Ice	0	1.585	37.9	7.7	$CdBr_2.4H_2O$
-3.7	12.4	10.9	"	0	1.708	34.1	20.2	1.1.1
-4.5	12.0	13.7	"	0	1.989	33.5	35.1	"
-5.1	24.4	10.6	"	0	1.669	21.0	34.6	KBr
-7.6	22.4	19.5	"	0	1.502	12.25	34.45	"
-9.2	34.8	15.2	"	-9.4	—	35.5	14.8	Ice + $CdBr_2.4H_2O$ + 1.1.1
-10.1	21.8	24.7	"	0	1.744	40.0	14.1	$CdBr_2.4H_2O$ + 1.1.1
-12.0	29.0	25.4	"	-18.1	—	29.0	33.0	Ice + KBr + 1.1.1
-16.8	28.1	32.0	"	0	2.011	33.7	35.7	KBr + 1.1.1

Br 1.1.1 = $CaBr_2.KBr.H_2O$

EQUILIBRIUM IN THE SYSTEM CADMIUM BROMIDE, POTASSIUM BROMIDE AND WATER. (Con.)

(Hering, 1936.)

t^o	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
		$CdBr_2$	KBr	
6.5	1.805	43.2	13.45	Cd4 + 1.1.1
12.	2.108	36.0	37.1	KBr + 1.1.1
13.0	1.872	46.4	12.75	Cd4 + 1.1.1
15.2	1.896	47.5	12.6	Cd4 + 3.1.4 + 1.1.1
18.	1.901	48.8	11.05	Cd4 + 3.1.4
18.	1.911	47.8	12.9	3.1.4 + 1.1.1
20.	2.163	37.5	37.6	KBr + 1.1.1
22.9	2.185	38.3	37.7	" + " + 1.1
25.0	2.194	38.3	37.9	" " "
25.	1.892	52.6	6.0	Cd4
25	1.928	51.0	9.7	3.1.4
25	1.936	49.7	11.8	"
25	1.869	37.8	25.0	1.1.1
25	2.093	37.3	35.5	"
25	1.717	21.4	37.9	KBr
25	1.527	10.65	39.05	"
25	1.929	52.7	7.5	Cd4 + 3.1.4
25	1.947	48.7	13.7	3.1.4 + 1.1.1
32.5	2.001	57.6	4.5	Cd4 + 3.1.4
35.	2.031	59.2	3.7	Cd4 + Cd + 3.1.4
35	2.007	50.0	15.0	3.1.4 + 1.1.1
37	2.035	58.9	4.3	Cd4 + 3.1.4
45	2.056	57.7	7.05	" "
45	2.067	51.5	15.9	3.1.4 + 1.1.1
50	2.291	40.5	39.2	KBr + 1.1
50	2.099	52.2	16.4	3.1.4 + 1.1.1
52.1	2.111	52.5	16.6	" + " + 2.1.1

EQUILIBRIUM IN THE SYSTEM CADMIUM BROMIDE, POTASSIUM BROMIDE AND WATER. (Con.)

(Hering, 1936.)

t°	d. of sat. sol.	Gms. per 100 gms. sat. sol. CdBr$_2$	Gms. per 100 gms. sat. sol. KBr	Solid Phase
52.5	2.092	56.6	10.35	Cd4 + 3.1.4
54.5	2.088	56.8	10.2	Cd
56	2.119	52.6	16.9	2.1.1
56	2.116	55.8	12.5	Cd + 3.1.4
56	2.123	54.6	14.4	3.1.4 + 2.1.1
56	2.117	51.8	18.0	2.1.1 + 1.1.1
56.7	2.118	51.7	18.25	" " + 1.1
57.6	2.132	55.5	13.5	Cd + 3.1.4 + 2.1.1
60	2.138	55.2	14.3	Cd + 2.1.1
60	2.165	52.5	19.6	2.1.1 + 1.1
70	2.148	54.8	15.9	Cd
70	2.163	53.4	18.2	2.1.1
70	2.144	50.9	21.0	1.1.0
70	2.166	54.4	17.0	Cd + 2.1.1
70	2.165	52.5	19.6	2.1.1 + 1.1
75	2.373	42.4	40.1	KBr + 1.1
80	2.200	53.7	19.65	Cd + 2.1.1
86	2.224	53.5	21.1	" + " + 1.1
90	2.232	53.5	21.6	" + 1.1
100	2.257	53.4	23.1	" + "
100	1.998	58.3	7.0	Cd
100	2.106	55.3	15.2	Cd
100	2.446	44.1	40.9	KBr + 1.1.1
100	2.200	48.8	27.6	1.1
100	2.190	46.5	30.3	1.1
100	2.207	44.7	33.3	1.1
100	2.321	43.6	36.1	"
100	2.324	41.4	40.8	KBr
100	1.949	29.6	42.2	"
100	1.636	12.8	47.0	"
110	2.237	53.5	24.35	Cd + 1.1.1

Cd4 = $CdBr_2.4H_2O$; Cd = $CdBr_2$; 1.1.1 = $CdBr_2.KBr.H_2O$; 3.1.4 = $3CdBr_2.KBr.4H_2O$; 2.1.1 = $2CdBr_2.KBr.H_2O$; 1.1 = $CdBr_2.KBr$.

Br

SOLUBILITY OF CADMIUM BROMIDE IN ALCOHOL, ETHER, ETC.

100 gms. sat. solution of $CdBr_2.4H_2O$ in abs. alcohol contain 20.93 gms. $CdBr_2$ at 15°. (Eder.)

100 gms. sat. solution of $CdBr_2.4H_2O$ in abs. ether contain 0.4 gm. $CdBr_2$ at 15°. (Eder.)

100 gms. absolute acetone dissolve 1.559 gms. $CdBr_2$ at 18°. d_{18} sat. sol. = 0.8073. (Naumann, 1904.)

100 gms. benzonitrile dissolve 0.857 gm. $CdBr_2$ at 18°. (Naumann, 1914.)

100 gms. anhydrous hydrazine dissolve 40 gm. $CdBr_2$ at room temp. (Welsh and Broderson, 1915.)

SOLUBILITY OF CADMIUM POTASSIUM BROMIDES IN WATER.
(Hering, 1936a)

t°	d. of sat. sol.	Gms. anhydrous double salt per 100 gms. sat. sol.	Solid Phase	t°	d. of sat. sol.	Gms. anhydrous double salt per 100 gms. sat. sol.	Solid Phase
25	—	60.25	3.1.4	45	2.003	66.75	1.1.1
35	1.968	63.2	"	55	2.064	69.15	"
45	2.001	64.9	"	57.3	2.077	69.6	" + 1.1
-9.3	—	50.2	Ice + 1.1.1	65	2.111	71.0	1.1
0	1.720	53.8	1.1.1	75	2.151	72.65	"
25	1.881	61.5	"	80	2.172	73.4	"
35	1.942	64.2	"	100	2.254	76.45	"

3.1.4 = $3CdBr_2.KBr.4H_2O$; 1.1.1 = $CdBr_2.KBr.H_2O$; 1.1 = $CdBr_2.KBr$

Previous results for the compound 1.1.1 are given by Rimbach, 1905.

CADMIUM (Mono)AMMONIUM BROMIDE $CdBr_2.NH_4Br$

SOLUBILITY IN WATER.
(Rimbach, 1905; Eder.)

t°.	100 Grams Solution contain Gms.			Atomic Relation			G. $CdBr_2.NH_4Br$ per 100 Gms. Solution.
	Cd.	Br.	NH_4.	Cd	: Br	: NH_4.	
1.0	16.33	34.87	2.63	1	3	1	53.82
14.8	17.40	37.15	2.80	1	3	1	58.01
52.2	19.79	42.38	3.21	1	3	1	65.31
110.1	22.99	49.17	3.72	1	3	1	75.98

100 gms. sat. solution of $CdBr_2.NH_4Br$ in abs. alcohol contain 15.8 **gms.** double salt at 15° (Eder).

100 gms. sat. solution of $CdBr_2.NH_4Br$ in abs. ether contain 0.36 gm. **double** salt at 15° (Eder).

100 gms. H_2O saturated with $CdBr_2.NH_4Br.H_2O$ dissolve 137 gms. of the salt; 100 gms. alcohol dissolve 18 gms. and 100 gms. ether dissolve 0.36 gm. (Eder, 1876.)

CADMIUM (Tetra) AMMONIUM BROMIDE $CdBr_2.4NH_4Br$.

SOLUBILITY IN WATER,
(Rimbach.)

The double salt is decomposed by water at temperatures below 160°.

t°.	100 Gms. Solution contain Gms.			Atomic Relation in Sol.			Atomic Relation in Solid.		
	Cd.	Br.	NH_4.	Cd	: Br	: NH_4.	Cd	: Br	: NH_4
0.8	14.72	50.46	6.67	1	4.82	2.82	1	10.02	8.02
13.0	14.95	51.48	6.85	1	4.85	2.85	1	11.57	9.57
44.0	15.01	53.85	7.35	1	5.04	3.04	1	6.84	4.84
76.4	14.6	55.28	7.80	1	5.32	3.32	1	6.63	4.63
123.5	15.5	59.50	8.45	1	5.38	3.38	1	7.40	5.40
160.0	14.7	62.67	9.43	1	5.99	3.99	1	6.03	4.03

CADMIUM (Mono)**RUBIDIUM BROMIDE** $CdBr_2.RbBr$.

SOLUBILITY IN WATER.
(Rimbach.)

t°.	100 Gms. Solution contain Gms.			Atomic Relation in Sol.			Gms. $CdBr_2.RbBr$ per 100 Gms. Solution.
	Cd.	Br.	Rb.	Cd :	Br :	Rb.	
0.4	8.37	17.93	6.43	1	3	1.01	32.65
14.5	10.72	23.02	8.30	0.99	3	1.01	41.87
49.2	15.01	32.13	11.51	1	3	1	58.54
107.5	19.65	41.12	14.06	1.02	3	0.96	75.77

CADMIUM (Tetra)**RUBIDIUM BROMIDE** $CdBr_2.4RbBr$.

SOLUBILITY IN WATER.
(Rimbach.)

t°.	100 Gms. Solution contain Gms.			Atomic Relation in Sol.			Gms. $CdBr_2.4RbBr$ per 100 Gms. Solution.
	Cd	Br	Rb.	Cd :	Br :	Rb.	
0.5	5.70	24.94	17.97	0.98	6	4.05	47.95
13.5	6.55	28.74	20.74	0.97	6	4.05	55.17
51.5	8.25	35.51	25.39	0.99	6	4.02	68.82
114.5	9.50	40.67	29.00	1.00	6	4.0	79.04

CADMIUM (Mono) **SODIUM BROMIDE** $CdBr_2.NaBr2\frac{1}{2}H_2O$.

SOLUBILITY IN WATER, ETC., AT 15°.
(Eder — Ding. polyt. J. 221, 189, '76.)

Solvent.	Gms. $CdBr_2.NaBr$ per 100 Gms.		Solid Phase.
	Solution.	Solvent.	
Water	49.0	96.1	$CdBr_2.NaBr.2\frac{1}{2}H_2O$
Absolute Alcohol	21.2	27.0	"
Absolute Ether	0.52	0.53	"

SOLUBILITY OF ANHYDROUS CADMIUM BROMIDE IN PURE METHYL AND ETHYL ALCOHOLS.
(Lloyd, Brown, Glynwyn, Bonnel and Jones, 1928.)

Results for CH_3OH			Results for C_2H_5OH		
t°	Gms. $CdBr_2$ per 100 gms. CH_3OH	Solid Phase	t°	Gms. $CdBr_2$ per 100 gms. C_2H_5OH	Solid Phase
0	9.9	$CdBr_2.3CH_3OH$	10	26.9	$CdBr_2.1\frac{1}{2}C_2H_5OH$
15	13.5	"	20	30.0	"
20	16.2	"	30	33.5	"
25	18.4	"	40	37.8	"
30	21.1	$CdBr_2.2CH_3OH$	45	39.3	$CdBr_2$
40	24.5	"	50	38.1	"
50	31.0	"	60	30.3	"
60	43.9	"	70	22.3	

RECIPROCAL SOLUBILITIES, DETERMINED BY THE METHOD OF LOWERING OF THE FREEZING-POINT (see footnote, p. 1), ARE GIVEN FOR THE FOLLOWING MIXTURES:

Cadmium Bromide + Cadmium Chloride	(Nacken, 1907; Ruff and Plato, 1903.)	
" " + Cadmium Iodide	(Nacken, 1907.)	
" " + Calcium Fluoride	(Ruff and Plato, 1903.)	
" " + Cuprous Bromide	(Herrmann, 1911.)	
" " + Potassium Bromide		(Brand, 1913.)
" " + Sodium Bromide		"
" " + " " + Potassium Bromide		"
" " + Thallium Nitrate	(Bergmann, 1926.)	

CADMIUM FORMATE $Cd(HCOO)_2.2H_2O$

SOLUBILITY OF CADMIUM FORMATE IN WATER.

(Ashton, Houston and Saylor, 1933.)

CH

t°	Gms. $Cd(HCOO)_2$ per 100 gms. H_2O	Solid Phase	t°	Gms. $Cd(HCOO)_2$ per 100 gms. H_2O	Solid Phase
0	8.4	$Cd(HCOO)_2.2H_2O$	60	59.5	$Cd(HCOO)_2.2H_2O$
10	11.1	"	66	75.5	"
20	14.4	"	70	77.0	$Cd(HCOO)_2$
30	18.6	"	80	80.5	"
40	25.4	"	90	85.2	"
50	38.5	"	100	94.6	"

CADMIUM ACETATE $Cd(CH_3COO)_2.2H_2O$

SOLUBILITY OF CADMIUM ACETATE IN AQUEOUS SOLUTIONS OF ACETIC ACID AT 25°.

(Cagle and Vosburgh, 1935.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
CH_3COOH	$Cd(CH_3COO)_2$		CH_3COOH	$Cd(CH_3COO)_2$	
1.88	61.07	$Cd(CH_3COO)_2.2H_2O$	30.17	51.84	3.4.4
2.15	61.55	"	37.43	45.23	"
3.59	60.71	"	43.29	39.99	"
7.28	59.74	"	48.59	35.98	"
9.76	58.99	"	54.12	31.89	"
11.99	58.77	"	65.86	23.69	"
13.55	57.98	"	69.42	21.09	"
17.99	56.84	"	79.54	17.09	" + ?
23.35	55.50	"	90.22	7.87	?
25.48	55.31	"	95.04	4.20	?
27.34	55.26	" + 3.4.4	97.54	1.70	?

3.4.4 = $3Cd(CH_3COO)_2.4CH_3COOH.4H_2O$.

100 gms. methyl alcohol dissolve 21.08 gms. anhydrous $Cd(CH_3COO)_2$ at 15° and 39.47 gms. at 68.9 (b.pt.). (Henstock, 1934.)

CADMIUM FUMARATE $CdC_4H_2O_4$.

100 gms. H_2O dissolve 0.09 gms. $CdC_4H_2O_4$ at 30°. (Weiss and Downes, 1923.)

CADMIUM MALEATE $CdC_4H_2O_4.2H_2O$.

100 gms. H_2O dissolve 0.66 gms. $CdC_4H_2O_4$ at 30°. (Weiss and Downs, 1923.)

CADMIUM BENZOATE etc.

SOLUBILITY OF EACH IN WATER AT 20°. (Ephraim and Pfister, 1925.)

Salt.	Formula.	Gms. anhydrous salt per 100 gms. sat. sol.
Cadmium Benzoate	$(C_6H_5COO)_2Cd.2H_2O$	3.340
" -4 Nitro Benzoate	$(C_7H_4O_4N)_2Cd\ 2H_2O$	0.445
" -4 Chloro Benzoate	$(C_7H_4O_2Cl)_2Cd.2H_2O$	0.779
" -4 Methoxy Benzoate	$(C_8H_7O_3)_2Cd.H_2O$	0.402
" Cinnamate	$C_{18}H_4O_4Cd.2H_2O$	0.0374

CADMIUM CINNAMATES $(C_6H_5CH{:}CH.COO)_2Cd$.

100 gms. water dissolve 0.070 gm. cadmium cinnamate at 26°. (de Jong, 1909.)
100 " " " 0.56 " cadmium isocinnamate at 20°. (Michael, 1903.)
100 " " " 0.10 " cadmium allocinnamate at 20°. "

CADMIUM Anthracene SULFONATE etc.

SOLUBILITY OF EACH IN WATER.
(Ephraim and Pfister, 1925; Ephraim and Seger, 1925.)

Compound.	Formula.	t°.	Gms. anhydrous cmpd. per 100 cc. sat. sol.
Cadmium anthracene-2-sulfonate	$Cd(C_{14}H_9SO_3)_2.6H_2O$	20	0.00925
" benzene sulfonate	$Cd(C_6H_5SO_3)_2.7H_2O$	20	31.239
" " "	$Cd(C_6H_5SO_3)_2.6H_2O$	18	27.969
" " "	"	34	35.511
" " "	"	49.5	44.936
" " "	"	64.5	55.764
" " "	"	80.5	69.200

SOLUBILITY OF CADMIUM NAPHTHALENE SULFONATES IN WATER.
(Ephraim and Pfister, 1924; Ephraim and Seger, 1925.)

Compound.	Formula.	t°.	Gms. Anhydrous cmpd. per 100 gms. sat. sol
Cadmium naphthalene-1-sulfonate	$Cd(C_{10}H_7SO_3)_2.6H_2O$	17	4.508
" " -2- "	"	16.5	0.872
" " 2- "	"	20.0	0.696
" " " "	"	32.0	1.033
" " " "	"	45.0	1.550
" " " "	"	54.5	2.085
" " " "	"	65	2.925
" " " "	"	69	3.407
" " " "	"	78	5.061
" " " "	"	82	5.799
Cadmium naphthalene 6-oxy-2-sulfonate	$Cd(C_{10}H_7SO_4)_2.6\text{-}7H_2O$	20	1.651

CADMIUM Anthraquinone SULFONATES

SOLUBILITY OF EACH IN WATER AT 18°.
(Fierz-David, 1927.)

Compound	Formula	Gms. anhydrous salt per 100 cc H_2O
Cadmium Anthraquinone 1.5 DiSulfonate	$Cd[C_{14}H_6O_2(SO_3)_2]_2.7H_2O$	3.0
" " 1.8 "	$Cd[C_{14}H_6O_2(SO_3)_2]_2.5H_2O$	0.44

CADMIUM HELIANTHATE $(C_{14}H_{14}N_3SO_3)_2Cd.4H_2O$

1000 cc. H_2O dissolve 0.07 gms. $C_{14}H_{14}N_3SO_3$ in the form of cadmium helianthate at 20-25°. (Stark and Dohn, 1918.)

CADMIUM Nitroso β Phenyl HYDROXYLAMINE. $Cd[C_6H_5.N(NO).O]_2$.

One liter sat. solution of $Cd[C_6H_5.N(NO)O]_2$ in water at 18° contains 0.00036 gm. atoms Cd (= 0.040 gm. Cd). (Pinkus and Martin, 1927.)

CADMIUM CYANIDE $Cd(CN)_2$

One liter sat. solution in water contains 1.51×10^{-5} gm. mols. (= 0.247 gm.) $Cd(CN)_2$ at 18° determined by the potentiometric method. (Masaki, 1931.)

SOLUBILITY OF POTASSIUM CYANIDE IN AQUEOUS SOLUTIONS OF CADMIUM CYANIDE AT 25° AND VICE VERSA.

(Corbet, 1926.)

NOTE. — Saturation was secured by constant rotation in wax bottles for 1 or 2 days and then thoroughly grinding the solid and continuing the rotation for a further 4 or 5 days.

CN

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
KCN	$Cd(CN)_2$		KCN.	$Cd(CN)_2$.	
41.7	0.0	KCN	11.65	16.15	$K_2Cd(CN)_4$
40.67	0.82	$K_2Cd(CN)_4$	9.47	19.14	» + $Cd(CN)_2$
28.62	4.65	»	7.82	15.73	$Cd(CN)_2$*
17.79	10.70	»	4.68	10.21	» *
15.16	12.53	»	trace	0.36	» *

* The solid phase in these cases was undoubtedly a basic cadmium cyanide.

CADMIUM THIOCYANATE $Cd(SCN)_2$

One liter sat. solution in water contains 2.51×10^{-5} gm. mols. $Cd(SCN)_2$ at 18° determined by the potentiometric method. (Masaki, 1931.)

CADMIUM NITROPRUSSIDE $CdFe(CN)_5NO.2H_2O$

One liter of sat. solution in water contains 0.0003 gm. mol. $CdFe(CN)_5NO$ at 18°. (Tomicek and Kubik, 1937.)

CO

CADMIUM OXALATE $CdC_2O_4 \cdot 3H_2O$

One liter sat. solution in water contains 0.033 gm. CdC_2O_4 at 13°, (Kohlrausch, 1908); 0.050gm. CaC_2O_4 at 18°. (Scholder, Gadenne and Niemann, 1927.)

SOLUBILITY OF CADMIUM OXALATE IN AQUEOUS SOLUTIONS OF POTASSIUM OXALATED AT 20° TO 30°.

(Vosburgh, Newlin, Puette, Peck and Mick, 1936.)

The small amounts (about 0.15%) of cadmium oxalate in the solutions are not given since they are subject to a large relative error. The results show the concentrations of potassium oxalate at which double salts exist.

Gms. $K_2C_2O_4$ per 100 gms. sat. sol.	Solid Phase	Gms. $K_2C_2O_4$ per 100 gms. sat. sol.	Solid Phase	Gms. $K_2C_2O_4$ per 100 gms. sat. sol.	Solid Phase
2.28	$CdC_2O_4 \cdot 3H_2O$	6.87	B	26.25	C
2.25	"	7.08	" + C	26.66	"
2.27	" + B	8.59	C	26.79	"
2.35	B	12.29	"	28.20	" + D
3.80	"	15.73	"	28.73	" "
4.89	"	24.75	"		
5.89	"				

B - $Cd_3K_2(C_2O_4)_4.XH_2O$; C = $CdK_2(C_2O_4)_2.yH_2O$; D = $K_2C_2O_4.H_2O$.
The solubility of both of the double salts is small.

The Solubility of Cadmium Oxalate in Aqueous Solutions of Cadmium Sulfate and of Potassium Oxalate at 25°.

(Clayton, and Vosburgh, 1937.)

Mixtures of Cadmium oxalate and aqueous solution were constantly stirred for one and one-half hour in an air bath. Then dissolved cadmium oxalate was determined by titration of 200 to 400 gms. of solution with 0.01n $KMnO_4$.

Results for Aq. Cd Sulfate

Mols $CdSO_4$ per 1000 gms. H_2O	Mols. $CdC_2O_4 x 10^3$ per 1000 gms. H_2O
0.0	0.300
0.005	0.171
0.010	0.188
0.020	0.226
0.040	0.294
0.080	0.410

Results for Aq. K Oxalate

Mols. total oxalate per 1000 gms. H_2O	Mols. $CdC_2O_4 x 10^3$ per 1000 gms. H_2O
0.00576	0.194
0.009485	0.230
0.02456	0.374
0.02700	0.396
0.02860	0.412
0.04863	0.627
0.09751	1.077

CADMIUM CHLORIDE $CdCl_2.2\frac{1}{2}H_2O$

Cl

Solubility of Cadmium Chloride in Water.

(Dietz, 1900; Hering, 1936; above 100° Benrath, Gjedebo, Schiffers and Wunderlich, 1937

t°	d. of sat. sol.	Gms. $CdCl_2$ per 100 gms. sat. sol.	Solid Phase	t°	d. of sat. sol.	Gms. $CdCl_2$ per 100 gms. sat. sol.	Solid Phase
-10.2	—	43.0	Ice + $CdCl_2.4H_2O$	10	—	57.47	$CdCl_2.H_2O$
- 9	—	43.58	$CdCl_2.4H_2O$	20	—	57.35	"
- 7.2	—	44.7	"	37.5	1.836	57.4	"
- 5.6	—	45.75	" + $CdCl_2.2\frac{1}{2}H_2O$	45	1.830	57.5	"
0.0	—	49.39	$CdCl_2.4H_2O$	60	1.820	57.7	"
+10.0	—	55.12	"	80	1.816	58.35	"
15	—	59.12	"	100	1.821	59.55	"
-10	—	44.35	$CaCl_2.2\frac{1}{2}H_2O$	141	—	62.6	"
-33	—	46.3	"	196	—	70.5	"
0	1.635	47.3	"	227	—	76.6	"
12.5	1.699	50.75	"	261	—	50.0	$CdCl_2$
18.0	1.741	52.53	"	330	—	84.5	"
25	1.778	54.65	"	383	—	87.5	"
30	—	56.91	"	433	—	91.4	"
32.5	1.829	56.95	"	481	—	94.6	"
33.8	1.837	57.[illegible]	" + $CaCl_2H_2O$	564	m. pt.	100.0	"

SOLUBILITY OF CADMIUM CHLORIDE IN AQUEOUS SOLUTIONS OF COBALT CHLORIDE AT 25° AND VICE VERSA.

(Bassett, Henshall, Sergent and Shipley, 19[illegible].)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$CoCl_2$	$CdCl_2$		$CoCl_2$	$CdCl_2$		$CoCl_2$	$CdCl_2$	
0.0	54.62	Cd2½	15.16	42.43	4.1.10	24.33	30.02	2.1.12
7.38	48.73	"	16.01	41.30*	"	25.00	29.61	"
11.71	45.40	"	19.72	37.07*	"	31.96	29.21*	1.2.12
0.0	58.10*	Cd1	21.62	35.10*	"	37.11	24.15*	"
4.71	51.78*	"	22.43	34.51*	"	27.75	28.22	2.1.12+Co6
6.77	49.66*	"	24.00	33.24*	"	28.66	23.71	Co6
9.30	47.36*	"	28.63	29.82*	"	31.00	17.99	"
12.23	45.20	" + Cd2½	15.80	41.57	" + 2.1.12	32.45	11.20	"
13.74	44.25	" + 4.1.10	19.26	35.95	2.1.12	34.06	5.39	"
14.01	43.95	4.1.10	19.26	35.95	"	35.87	0.0	"
15.02	42.57	"	22.33	32.10	"			

* Metastable

Cd2½ = $CdCl_2.2\frac{1}{2}H_2O$; Cd1 = $CdCl_2.H_2O$; 4.1.10 = $4CdCl_2.CoCl_2.10H_2O$; 2.1.12 = $2CdCl_2.CoCl_2.12H_2O$; 1.2.12 = $CdCl_2.2CoCl_2.12H_2O$; Co6 = $CoCl_2.6H_2O$.

Cl

SOLUBILITY OF CADMIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT SEVERAL TEMPERATURES AND VICE VERSA.

(Sudhaus, 1914.)

Gms. per 100 gms. H_2O.		Solid Phase.
$CdCl_2$.	KCl.	
Results at 19.3°.		
111.3	0.0	$CdCl_2.2\frac{1}{2}H_2O$
59.59	6.7	" + $D_{1\cdot1\cdot1}$
*26.98	11.09	$D_{1\cdot1\cdot1}$
11.61	30.04	" + $D_{1\cdot4}$
1.44	34.76	$D_{1\cdot4}$ + KCl
0.0	33.94	KCl
Results at 29.7°.		
129.65	0.0	$CdCl_2.2\frac{1}{2}H_2O$
97.62	0.70	"
68.23	7.08	" + $D_{1\cdot1\cdot1}$
47.12	9.89	$D_{1\cdot1\cdot1}$
*32.67	13.06	"
24.26	16.10	"
15.99	25.97	"
15.47	33.58	" + $D_{1\cdot4}$
2.42	37.66	$D_{1\cdot4}$ + KCl
0.0	37.21	KCl

Gms. per 100 gms. H_2O.		Solid Phase.
$CdCl_2$.	KCl.	
Results at 40.1°.		
133.85	0.0	$CdCl_2.H_2O$
92.15	2.70	" + $D_{1\cdot1\cdot1}$
51.90	11.50	$D_{1\cdot1\cdot1}$
*37.91	15.21	"
24.45	21.73	"
18.97	35.51	"
19.92	37.63	" + $D_{1\cdot4}$
2.98	40.45	$D_{1\cdot4}$ + KCl
0.0	40.36	KCl
Results at 54.5.		
133.9	0.0	$CdCl_2.H_2O$
102.15	2.32	" + $D_{1\cdot1\cdot1}$
*44.01	18.39	$D_{1\cdot1\cdot1}$
26.13	43.78	" + $D_{1\cdot4}$
4.20	45.52	$D_{1\cdot4}$ + KCl
0.0	43.00	KCl

$D_{1\cdot1\cdot1}$ = $CdCl_2.KCl.H_2O$, $D_{1\cdot4}$ = $CdCl_2.4KCl$.

* Shows the solubility of the double salt in water.

SOLUBILITY OF THE DOUBLE SALT. $CdCl_2.4KCl$ IN WATER.

(Sudhaus, 1914.)

t°.	Gms. $CdCl_2.4KCl$ per 100 gms. H_2O.	Mol. Ratio in Solution.
19.3	41.65	$1CdCl_2$: 6.37 KCl
23.6	45.35	" : 5.85 "
29.7	49.05	" : 5.34 "
40.1	57.55	" : 4.60 "
50.2	68.89	" : 4.30 "
54.5	69.91	" : 4.12 "

Equilibrium in the System Cadmium Chloride, Potassium Chloride and Water.

(Hering, 1936.)

The author completed and corrected the results of Sudhaus, 1914, by determing numerous isotherms. By plotting these results he obtained the limiting values of temperature and concentration for the several double compounds formed.

t°	d. of sat. sol.	Gms. per 100 gms. sat. sol. CdCl₂	Gms. per 100 gms. sat. sol. KCl	Solid Phase	t°	d. of sa. sol.	Gms. per 100 gms. sat. sol. CdCl₂	Gms. per 100 gms. sat. sol. KCl	Solid Phase
-7.8	—	41.6	0.35	3.1.4	25	1.457	35.3	4.96	1.1.1
-6.2	—	0.9	19.15	1.4	"	1.240	9.67	20.6	1.1
-5.7	—	4.4	15.15	1.1.1	50	1.579	42.8	5.6	1.1
-3.7	—	28.5	3.05	"	"	1.312	13.0	26.1	1.4
0	1.603	45.5	0.2	3.1.4	"	1.151	3.3	29.55	"
"	1.433	35.25	1.57	"	100	—	58.8	3.55	3.1.4
"	1.352	28.65	3.45	1.1.1	"	1.881	58.6	5.0	"
"	1.337	27.25	3.75	"	"	1.878	58.3	5.5	"
"	1.268	21.8	4.5	"	"	—	51.45	7.8	1.1
"	1.167	7.85	10.05	"	"	—	39.4	12.75	"
"	1.169	5.15	16.5	"	"	—	27.5	21.7	"
"	1.172	4.75	17.6	1.4	"	—	25.25	29.8	"
"	1.154	1.9	19.3	"	"	—	23.7	30.7	1.4
25	1.722	52.1	0.29	3.1.4	"	1.415	19.55	31.6	"
"	1.571	44.05	1.33	"	"	—	10.15	34.45	KCl
"	1.496	38.5	3.65	"	"	1.275	6.4	35.25	"

Cl

CADMIUM Potassium CHLORIDES

Solubility of Cadmium Potassium Double Chlorides in Water.

(Hering, 1936.)

t°	d of sat. sol.	Gms. anhy. double salt per 100 gms. sat. sol.	Solid Phase	t°	d of sat. sol.	Gms. anhy. double salt per 100 gms. sat. sol.	Solid Phase
-4.1	—	19.6	Ice + 1.1.1	45	1.349	36.2	1.1
0	1.196	21.0	1.1.1	60	1.391	40.3	"
12.5	1.238	25.2	"	80	1.444	45.45	"
25	1.283	29.7	"	100	1.494	50.3	"
32.5	1.309	32.3	"	60.5	—	43.7	1.4
33.5	1.313	32.65	"	75	—	46.4	"
36.6	1.324	33.5	" + 1.1	85	—	48.3	"
37.5	1.328	34.05	1.1	100	—	51.1	"

1.1 = $CdCl_2.KCl$; 1.1.1 = $CdCl_2.KCl.H_2O$; 1.4 = $CdCl_2.4KCl$.

The above amplify the previous determinations of Rimbach, 1897.

EQUILIBRIUM IN THE SYSTEM CADMIUM CHLORIDE, POTASSIUM CHLORIDE AND WATER. (INVARIANT POINTS)

(Hering, 19[illegible].)

t°	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
		$CdCl_2$	KCl	
-10.3	—	43.2	0.26	Cd4 + 3.1.4 + Ice
-7.2	—	44.9	0.20	" "
-3.3	—	47.0	0.24*	" "
-5.7	—	45.8	0.18	" + Cd2½ + 3.1.4
0	1.639	47.4	0.19	Cd2½ + 3.1.4
25	1.783	54.7	0.19	" "
32	1.830	56.9	0.16	" "
33.7	1.843	57.4	0.15	" " + Cd4
35	1.841	57.5	0.18	Cd4 + 3.1.4
50	1.834	57.6	0.43	" "
75	1.844	58.3	1.45	" "
90	1.869	59.2	2.75	" "
100	1.901	59.9	4.1	" "
-5.8	—	30.05	2.75	3.1.4 + 1.1.1 + Ice
0	1.391	31.5	3.1	" "
11	1.434	34.15	3.7	" "
25	1.488	37.45	4.45	" "
28.8	1.503	38.3	4.8	3.1.4 + 1.1.1 + 1.1
32	1.516	39.05	4.9	3.1.4 + 1.1
50	1.593	43.6	5.45	" "
75	1.715	50.3	5.85	" "
100	1.874	57.8	5.9	" "
-8.1	—	4.0	15.7	Ice + 1.1.1 + 1.4
0	1.176	5.05	17.5	1.1.1 + 1.4
11	1.206	6.8	19.6	" "
12.4	1.212	7.0	20.0	1.1.1 + 1.4 + 1.1
14	1.215	7.3	20.25	1.1 + 1.4
25	1.250	9.35	22.1	" "
31	1.268	10.45	23.1	" "
50	1.328	14.35	25.8	" "
65	1.377	17.5	27.6	" "
75	1.410	19.8	28.6	" "
85	1.443	22.0	29.45	" "
100	1.491	25.2	30.2	" "
-10.7	—	0.45	19.65	Ice + 1.4 + KCl
0	1.161	0.6	21.95	1.4 + KCl
25	1.193	1.3	26.5	" "
50	1.223	2.7	30.15	" "
75	1.259	5.1	32.95	" "
100	1.303	8.6	35.35	" "

Cl

Cd4 = $CdCl_2.4H_2O$; Cd2½ = $CdCl_2.2½H_2O$; 3.1.4 = $3CdCl_2.KCl.4H_2O$
1.4 = $CdCl_2.4KCl$; 1.1.1 = $CdCl_2.KCl.H_2O$; 1.1 = $CaCl_2.KCl$.

CADMIUM (Tetra) **POTASSIUM CHLORIDE** $CdCl_2.4KCl$.

IN CONTACT WITH WATER.

(Rimbach.)

The double salt is decomposed when dissolved in water at ordinary temperature.

t°.	100 Grams Solution contain Gms.		
	Cd.	Cl.	K.
4	3.64	9.84	8.31
23.6	5.66	14.02	11.52
50.2	9.10	18.09	13.60
108.9	11.94	23.11	17.16

NOTE. — The effect of the presence of certain chlorides upon the decomposition of cadmium tetra potàssium chloride by water at 16° was investigated by Rimbach in a manner similar to that used in the case of cadmium tetra rhubidium chloride. The results, which show the extent to which increasing amounts of the several chlorides force back the decomposition of the double salt, were plotted on cross-section paper, and the points at which the decomposition was prevented, were determined by interpolation. These values which show the minimum amount of the added chlorides which must be present to insure the crystallization of the pure double salt are shown in the following table.

Added Chloride.	Mols. per 100 Mols. H_2O. $CdCl_2$.	KCl.	Added Chloride.	Density of Solutions.	Mols. per Liter of Solution. $CdCl_2$.	KCl.	Added Chloride.
HCl	0.074	0.296	19.80	1.1403	0.033	0.132	8.828
LiCl	0.344	1.376	9.30	1.1380	0.166	0.663	4.483
$CaCl_2$	0.544	2.176	3.80	1.2333	0.270	1.080	1.887
KCl	1.034	6.514*	2.378	1.214	0.507	3.195*	1.167

* Total.

Cl

CADMIUM CHLORIDE

EQUILIBRIUM IN THE SYSTEM CADMIUM CHLORIDE COBALT CHLORIDE AND WATER AT 25°.

(Benrath, 1927.)

Mols. $CdCl_2$ per 1.0 Mols. $CdCl_2$ + $CoCl_2$	Mols. H_2O to dissolve 1.0 mol. $Cd\ Cl_2$+ $CoCl_2$	Mols. $CdCl_2$ per 1.0 mol. $CdCl_2$ + $CoCl_2$	Mols. H_2O to dissolve 1.0 mol $CdCl_2$ + $CoCl_2$
0.000	12.66	0.437	6.44
0.0514	11.92	0.578	6.86
0.1166	10.90	0.654	6.52
0.2185	9.37	0.704	6.37
0.3261	7.64	0.803	6.93
0.402	6.38	1.000	7.94
0.411	6.25		

CADMIUM MAGNESIUM CHLORIDE $2(CdCl_2)MgCl_2.12H_2O$.

SOLUBILITY IN WATER.

(Rimbach)

t°.	100 Gms. Solution contain Gms. Cd.	Cl.	Mg.	Gms. $2(CdCl_2).MgCl_2$ per 100 Gms. Solution.	Water.
2.4	22.14	21.06	2.41	45.61	83.86
20.8	24.30	22.80	2.55	49.69	98.77
45.5	26.24	24.55	2.72	53.51	115.10
67.2	28.45	26.71	2.98	58.14	138.90
121.8	31.84	30.20	3.44	65.48	189.69

CADMIUM AMMONIUM CHLORIDE $CdCl_2.NH_4Cl$.

SOLUBILITY IN WATER.

(Rimbach — Ber. 30, 3075, 1897.)

t°.	100 Gms. Solution contain Gms.			Gms. $CdCl_2.NH_4Cl$ per 100 Gms.	
	Cd.	Cl.	NH .	Solution.	Water.
2.4	14.26	13.44	2.24	29.94	42.74
16.0	15.82	15.07	2.56	33.45	50.26
41.2	18.61	17.46	2.89	38.96	63.83
63.8	20.92	19.73	3.34	43.99	78.54
105.9	24.70	23.52	4.01	52.23	109.33

CADMIUM (Tetra) AMMONIUM CHLORIDE $CdCl_2.4NH_4Cl$.

IN CONTACT WITH WATER.

The salt is decomposed in aqueous solution.

(Rimbach.)

t°.	100 Gms. Solution contain Gms.			Atomic Relation in Solution.		
	Cd.	Cl.	NH_4.	Cd	: Cl	: NH_4.
3.9	5.75	18.17	7.37	1	9.96	7.96
16.1	6.96	20.26	7.97	1	9.20	7.13
40.2	9.91	23.84	8.92	1	7.61	5.61
58.5	12.50	26.53	9.35	1	6.71	4.66
112.9	16.66	31.79	10.78	1	6.02	4.02
113.9	16.51	32.71	11.30	1	6.26	4.26

Cl

SOLUBILITY OF MIXTURES OF CADMIUM TETRA AMMONIUM CHLORIDE AND CADMIUM AMMONIUM CHLORIDE IN WATER.

(Rimbach — Ber. 35, 1300, '02.)

t°.	100 Gms. Solution contain Gms.			Atomic Relation.			Solid Phase, Mol. per cent of:	
	Cd.	Cl.	NH_4.	Cd	: Cl	: NH_4.	$CdCl_2.NH_4Cl$.	$CdCl_2.4NH_4Cl$.
1.1	5.34	17.62	7.27	1	10.47	8.50	49.6	50.4
14.0	7.12	19.86	7.84	1	8.84	6.87	47.0	53.0
40.7	10.24	23.82	8.85	1	7.37	5.37	77.0	23.0
58.5	12.50	26.53	9.35	1	6.71	4.66	...	...

SOLUBILITY OF MIXTURES OF CADMIUM TETRA AMMONIUM CHLORIDE AND AMMONIUM CHLORIDE IN WATER.

(Rimbach.)

t°	100 Gms. Solution contain Gms.			Atomic Relation.			Solid Phase, Mol. per cent of:	
	Cd.	Cl.	NH.	Cd	: Cl	: NH_4.	NH_4Cl.	$CdCl_2.4NH_4Cl$.
1.0	2.82	17.11	7.82	1	19.21	17.28	59.0	41.0
13.2	2.76	18.84	8.71	1	21.62	19.62	74.0	26.0
40.1	3.16	22.56	10.49	1	22.65	20.74	71.0	29.0
58.2	3.51	25.21	11.72	1	22.79	20.89	69.0	31.0

CADMIUM (Mono)RUBIDIUM CHLORIDE $CdCl_2.RbCl$.

SOLUBILITY OF CADMIUM MONORUBIDIUM CHLORIDE IN WATER.

(Rimbach, 1902.)

t°.	100 Gms. Solution contain Gms. Cd.	Cl.	Rb.	Gms. $CdCl_2.RbCl$ per 100 Gms. Solution.	Water.
1.2	4.80	4.53	3.63	12.97	14.90
14.5	6.20	5.88	4.75	16.80	20.19
41.4	9.34	8.86	7.14	25.31	33.89
57.6	11.40	10.78	8.63	30.83	44.58
103.9	17.14	16.37	13.39	46.62	87.36

CADMIUM (Tetra)RUBIDIUM CHLORIDE $CdCl_2.4RbCl$.

IN CONTACT WITH WATER.

(Rimbach.)

The double salt decomposes to $CdCl_2.RbCl$ and RbCl.

t°.	100 Gms. Solution contain Gms. Cd.	Cl.	Rb.	Atomic Relation. Cd	: Cl	: Rb.	Solid Phase. Mol. per cent of: $CdCl_2.RbCl$.	$CdCl_2.4RbCl$.
0.7	0.65	6.52	14.73	1	31.88	29.88	30	70
8.8	1.07	7.37	16.13	1	21.89	19.89	24	76
13.8	1.32	7.86	16.93	1	18.88	16.83	16	84
42.4	3.21	11.35	22.45	1	11.21	9.21	14	86
59.0	4.61	13.41	25.31	1	9.23	7.23	33	67
108.4	8.94	18.57	31.15	1	6.57	4.59	..	..

SOLUBILITY OF MIXTURES OF $CdCl_2.4RbCl$ AND RbCl IN WATER.

(Rimbach.)

t°.	100 Gms. Solution contain Gms. Cd.	Cl.	Rb.	Atomic Relation. Cd	: Cl	: Rb.	Solid Phase. Mol. per cent of: $CdCl_2.4RbCl$	RbCl.
0.4	..	12.86	30.97	..	1	1	55	45
14.8	..	13.62	32.81	..	1	1	67	33
17.9	..	14.0	33.71	..	1	1	80	20

THE EFFECT OF THE PRESENCE OF HCl, $CaCl_2$ AND OF LiCl UPON THE DECOMPOSITION OF CADMIUM TETRARUBIDIUM CHLORIDE BY WATER AT 16°.

(Rimbach, 1905.)

100 Gms. Solution contain Gms. Total Cl.	Cl.	HCl.	Cd.	Rb.	Mols. per 100 Mols. H_2O. $CdCl_2$.	RbCl.	HCl.	Molecular Ratio. $CdCl_2$	: RbCl.
36.44	0.84	36.61	0.41	1.39	0.109	0.483	29.76	1	4.43
28.45	0.80	28.44	0.35	1.38	0.082	0.422	20.35	1	5.15
12.09	3.24	9.11	0.69	6.74	0.139	1.772	5.60	1	12.75
	Ca.	$CaCl_2$.					$CaCl_2$.		
14.98	7.56	20.91	0.73	2.80	0.159	0.799	4.59	1	5.04
12.70	5.77	15.96	0.77	4.87	0.163	1.353	3.41	1	8.31
10.85	3.78	14.47	1.00	8.51	0.211	2.365	2.24	1	11.22
9.08	1.84	5.10	1.24	12.14	0.262	3.385	1.09	1	12.92
	Li.	LiCl.					LiCl.		
26.49	4.87	29.40	0.56	3.871	0.139	1.271	19.40	1	9.13
20.37	3.33	20.11	0.52	7.84	0.122	2.433	12.54	1	19.88

See Note in connection with Cadmium Tetra Potassium Chloride.

SOLUBILITY OF CADMIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AT SEVERAL TEMPERATURES AND VICE VERSA. (Sudhaus, 1914.)

Gms. per 100 gms. H_2O.		Solid Phase.	Gms. per 100 gms. H_2O.		Solid Phase.
$CdCl_2$.	NaCl.		$CdCl_2$.	NaCl.	
Results at 19.3°.			Results at 29.7° (con.).		
111.30	0.0	$CdCl_2.2\frac{1}{2}H_2O$	*43.74	27.46	$D_{1.2.3}$
116.64	7.52	" $+D_{1.2.3}$	9.43	37.54	" +NaCl
85.15	12.19	$D_{1.2.3}$	Results at 40.1°.		
*40.01	25.67	"	137.03	15.14	$CdCl_2.H_2O+D_{1.2.3}$
5.96	36.76	" +NaCl	*48.17	29.50	$D_{1.2.3}$
0.0	35.84	NaCl	13.31	38.16	" +NaCl
Results at 29.7°.			Results at 54.5°.		
132.67	9.63	$CdCl_2.2\frac{1}{2}H_2O+D_{1.2.3}$	140.42	19.10	$CdCl_2.H_2O+D_{1.2.3}$
123.54	10.10	$D_{1.2.3}$	*52.76	32.97	$D_{1.2.3}$
106.16	12.92	"	22.53	39.07	" +NaCl
91.10	15.41	"	0.0	36.82	NaCl

$D_{1.2.3} = CdCl_2.2NaCl.3H_2O$.

* Shows the solubility of the double salt in water.

Additional determinations upon this system at temperatures between 10° and 60° are given by Adolff and Hering, 1934, in the form of a diagram showing the areas in which the several double salts exist. Numerical results are not given. Two new double salts of the composition $5CdCl_2.4NaCl.17H_2O$ and $CdCl_2.NaCl.H_2O$ were identified.

Cl

SOLUBILITY OF CADMIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AND VICE VERSA AT 25

(Bassett, Henshall and Sergeant, 1930.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
NaCl	$CdCl_2$		NaCl	$CdCl_2$	
0.0	58.10*	$CdCl_2.H_2O$	12.62	33.32*	1.2.3
2.18	55.93*	"	13.78	31.76	" + 4.3.14
0.0	54.62	$CdCl_2.2\frac{1}{2}H_2O$	14.46	30.55	"
2.61	53.55	"	15.37	27.34	"
3.44	55.52*	$CdCl_2.H_2O$ + 4.3.14	16.97	22.26	"
3.95	53.71	$CdCl_2.2\frac{1}{2}H_2O$ + "	18.36	17.37	"
4.68	50.93	4.3.14	19.95	14.42	"
6.72	45.09	"	23.14	8.62	"
8.65	40.75	"	25.50	5.25	" + NaCl
12.82	33.32	"	25.90	0.0	NaCl

* = metastable

4.3.14 = $4CdCl_2.3NaCl.14H_2O$; 1.2.3 = $CdCl_2.2NaCl.3H_2O$.

It is stated that the conclusions of Sudhaus, 1914, in regard to this system are erroneous due to inadequacy of the analytical data.

In addition to the above results the authors have also studied the formation of solid solutions in the systems $CdCl_2 + NaCl + NiCl_2 + H_2O$ and $CdCl_2 + NaCl + CoCl_2 + H_2O$.

SOLUBILITY OF CADMIUM CHLORIDE IN AQUEOUS SOLUTIONS OF NICKEL CHLORIDE AT 25° AND VICE VERSA.

(Bassett, Henshall, Sergeant and Shipley, 1939.)

This is a very complex system with three hydrates of simple salts and six double salts of which two at least must be regarded as representing series of solid solutions.

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$NiCl_2$	$CdCl_2$		$NiCl_2$	$CdCl_2$		$NiCl_2$	$CoCl_2$	
0.0	54.62	Cd2½	16.83	39.85	4.1.10	24.04	36.64•	ss + 1.2.12
7.61	46.98	"	18.09	38.35	"	23.55	35.94•	1.2.12
0.0	58.10•	Cd1	23.18	33.21•	"	24.47	33.28•	"
3.97	52.64•	"	19.13	37.83•	2.1.12	25.02	31.81•	" + 4.1.10
8.56	47.68	"	21.69	34.51•	"	25.01	31.37	" + 2.1.12
11.37	45.85•	"	22.3	33.8	" + 4.1.10	25.72	30.30	"
11.84	44.91	" + Cd2½	24.23	32.05	"	25.93	29.40	"
17.52	42.54•	ss	23.91	36.30•	ss + 2.1.6	28.55	23.35	"
19.00	40.62•	"	24.85	35.07•	2.1.6	34.91	11.01	"
20.41	40.05•	"	25.96	33.52•	"	43.31	2.47•	"
22.68	37.69•	"	29.10	29.84•	"	35.56	9.96	" + Ni6
29.13	32.20•	"	29.23	29.54•	"	35.73	9.44	Ni6
12.7	45.2	Cd1 + 4.1.10	31.11	27.70•	3.2.14	35.39	4.55	"
13.26	44.51	4.1.10	31.82	26.72•	"	39.58	0.0	"
13.99	43.45	"	34.50	24.09•	"			

• = metastable

Cd2½ = $CaCl_2.2\frac{1}{2}H_2O$; Cd1 = $CdCl_2H_2O$; ss = Solid Solution, $(Cd,Ni)Cl_2.2\frac{1}{2}H_2O$; 4.1.10 = $4CdCl_2.NiCl_2.10H_2O$; 2.1.12 = $2CdCl_2.NiCl_2.12H_2O$; 2.1.6 = $2CdCl_2.NiCl_2.6H_2O$; 3.2.14 = $3CdCl_2.2NiCl_2.14H_2O$; 1.2.12 = $CdCl_2.2NiCl_2.12H_2O$; Ni6 = $NiCl_2.6H_2O$

SOLUBILITY OF ANHYDROUS CADMIUM CHLORIDE IN PURE METHYL ALCOHOL.

(Lloyd, Brown, Glynwyn, Bonnel and Jones, 1928.)

t°	Gms. $CdCl_2$ per 100 gms. CH_3OH	Solid Phase
20	2.15	$CdCl_2.3CH_3OH$
30	2.66	$CdCl_2.2CH_3OH$
40	3.44	"
50	4.44	$CdCl_2.2CH_3OH$ (?)

SOLUBILITY OF ANHYDROUS CADMIUM CHLORIDE IN PURE ETHYL ALCOHOL.

(Lloyd, Brown, Glynwyn, Bonnel and Jones, 1928.)

t°	Gms. $CdCl_2$ per 100 gms. C_2H_5OH	Solid Phase	t°	Gms. $CdCl_2$ per 100 gms. C_2H_5OH	Solid Phase
10	1.30	$CdCl_2.1\frac{1}{2}C_2H_5OH$	50	2.28	$CdCl_2.1\frac{1}{2}C_2H_5OH$
20	1.48	"	60	2.78	"
30	1.66	"	65	2.86	$CdCl_2$
40	1.91	"	70	2.53	"

100 gms. abs. ethyl alcohol dissolve 1.52 gms. $CdCl_2$ at 15°.5.

100 gms. abs. methyl alcohol dissolve 1.71 gms. $CdCl_2$ at 15°.5. (de Bruyn, 1892.)

100 gms. abs. methyl alcohol dissolve 1.5 gms. $CdCl_2$ at the crit. temp. (Centnerszwer, 1910.)

100 gms. benzonitrile dissolve 0.063 gm. $CdCl_2$ at 18°. (Naumann, 1914.)

SOLUBILITY OF CADMIUM CHLORIDE IN PYRIDINE. (Mason and Mathews, 1925.)

t°.	Gms. $CdCl_2$ per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. $CdCl_2$ per 100 gms. sat. sol.	Solid Phase.
0	0.46	$CdCl_2.6C_5H_5N$	25	0.70	$CdCl_2.2C_5H_5N$
5	0.78	"	30	0.67	"
7.3	0.91	"	40	0.61	"
9.0 tr. pt.	0.97	" $+CdCl_2.2C_5H_5N$	60	0.54	"
10.0	0.93	$CdCl_2.2C_5H_5N$	80	0.49	"
15.0	0.80	"	100	0.50	"

100 gms. sat. sol. of $CdCl_2$ in selenium oxychloride ($SeOCl_2$) contain 0.15 gms. $CdCl_2$ at 25°. (Wise, 1923.)

CADMIUM Pyridine **CHLORIDE** $CdCl_2.2C_5H_5N$

SOLUBILITY OF CADMIUM PYRIDINE CHLORIDE IN SEVERAL SOLVENTS. (Kragen, 1916.)

Cl

Solvent	t°	Gms. $CdCl_2.2C_5H_5N$ per 100 gms. sat. sol.
Water	20	0.2893
Alcohol	18	0.0295
"	25	0.0351
Ether	27	0.0037
50% alcohol + 50% water	18	0.2265
" "	27	0.2343
75% " + 25% Ether	28	0.0265
50% " + 50%	28	0.0171
Pyridine	22	1.347

A method for the determination of pyridine based upon the time of appearance of a precipitate produced by CdCl or HgCl in aqueous solutions of pyridine is described by Ionescu and Slusauschi, 1933.

CADMIUM Thiourea **CHLORIDE** $CdCl_2.2Cs(NH_2)_2$

One liter sat. solution in water contains 29.33 gm. $CdCl_2.2Cs(NH_2)_2$ at room temperature. (Walter, Adler and Reimer, 1934.)

RECIPROCAL SOLUBILITIES, DETERMINED BY THE METHOD OF LOWERING OF THE FREEZING-POINT (see footnote, p. 1), ARE GIVEN FOR THE FOLLOWING MIXTURES:

Cadmium Chloride + Cadmium Iodide (Nacken, 1907 (c); Ruff and Plato, 1903.)
" " + Cadmium Fluoride (Ruff and Plato, 1903)
" " + Cadmium Sulfate " "
" " + Calcium Chloride (Sandonnini, 1911, 1914; Menge, 1911.)
" " + Cuprous Chloride (Herrmann, 1911.)
" " + Lead Chloride (Sandonnini, 1912, 1914; Herrmann, 1911.)
" " + Magnesium Chloride (Menge, 1911.)
" " + Manganese Chloride (Sandonnini, 1914; Sandonnini and Scarpa, 1911.)
" " + Mercuric Iodide (Sandonnini, 1912.)
" " + Potassium Chloride (Brand, 1911.)
" " + Sodium Chloride "
" " + " " + Potassium Chloride (Brand, 1911.)
" " + Strontium Chloride (Sandonnini, 1911; 1914.)
" " + Thallium Chloride (Korreng, 1914; Sandonnini, 1913.)
" " + Tin (ous) Chloride (Herrmann, 1911; Sandonnini, 1914.)
" " + Zinc Chloride (Herrmann, 1911.)
" " + Lithium Chloride (Ferrari-Baroni, 1928.)
" " + Rubidium Chloride (Hoffmann, 1927.)

CADMIUM CHLORATE $Cd(ClO_3)_2.2H_2O$.

SOLUBILITY IN WATER.

(Meusser, 1902.)

t°.	Gms. $Cd(ClO_3)_2$ per 100 Gms. Solution.	Mols. $Cd(ClO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Cd(ClO_3)_2$ per 100 Gms. Solution.	Mols. $Cd(ClO_3)_2$ per 100 Mols. H_2O.	Solid Phase.
− 6.5	26.18	3.07	Ice	± 0	74.95	25.92	$Cd(ClO_3)_2.2H_2O$
−13.0	52.36	9.52	"	18	76.36	27.98	"
−20.0	72.10	22.47	$Cd(ClO_3)_2.2H_2O$	49	80.08	34.82	"
−15.0	72.53	22.87	"	65	82.95	42.14	"

Density of the sat. solution at 18° = 2.284.

CADMIUM Per CHLORATE $Cd(ClO_4)_2.6H_2O$

SOLUBILITY OF CADMIUM PER CHLORATE IN SEVERAL SOLVENTS.

(Chaney and Mann, 1931.)

The determinations were made by adding , at room temperature, successive small amounts of the solvent to a weighed amount of the salt, until upon vigorous shaking the last trace of perchlorate just disappeared.

C10

Solvent	Gms. $Cd(ClO_4)_2$ per 100 cc solvent	
Water	478.	(Salvadori, 1912)
Fufural (C_4H_3OCHO) $d\frac{25}{4}$ = 1.1550	80.	
Cellosolve (mono ethyl ether of ethylene glycol)	145.	

CADMIUM Hexa Antipyrine Per CHLORATE $[Cd(COC_{10}H_{12}N_2)_6](ClO_4)_2$

100 cc sat. solution in water contain 7.54 gm. $[Cd(COC_{10}H_{12}N_2)_6](ClO_4)_2$ at 20°. (Wilke-Dorfurt and Schliephake, 1929.)

CADMIUM FLUORIDE CdF_2

SOLUBILITY OF CADMIUM FLUORIDE IN WATER.

t°	Gms. CdF_2 per 100 cc sat. solution	Authority
20	4.06	(Kurtenacker, Finger and Hey, 1933.)
25	4.35	(Jaeger, 1901.)
25	0.622	(Carter, 1928.)
100	1.8	(Nuka, 1929.)

SOLUBILITY OF CADMIUM FLUORIDE IN AQUEOUS SOLUTIONS OF HYDROFLUORIC ACID AT 20°.

(Kurtenacker, Finger and Hey, 1933.)

Gms. per 100 gms. sat. sol.		Solid Phase
H F	Cd F_2	
0.9	5.0	CdF_2
24.4	11.2	"
38.6	3.0	"

100 cc of sat. solution in 1.08 normal HF contain 5.62 gms. CaF_2 at 25°. (Jaeger, 1901.)

Equilibrium in the Systems:

$CdF_2 + NH_4F + H_2O$ at 20°. $CdF_2 + KF + H_2O$ at 20°.

(Kurtenacker, Finger and Hey, 1933.)

Gms. per 100 gms. sat. sol. CdF_2	Gms. per 100 gms. sat. sol. NH_4F	Solid Phase	Gms. per 100 gms. sat. sol. CdF_2	Gms. per 100 gms. sat. sol. NH_4F	Solid Phase
4.0	1.6	CdF_2	2.4	3.4	Mixed Crystal
2.4	5.4	"	0.6	13.6	"
1.8	12.3	"	0.18	24.1	"
0.4	20.8	$CdF_2.2NH_4F.2H_2O$	0.05	32.5	"
0.87	28.9	"	0.024	33.1	"
0.57	40.9	"	—	41.2	"

Fusion-point data have been determined for:

F $CdF_2 + CdI_2$ (Ruff and Plato, 1903.)
" $+ NaF$ (Puschin and Baskov, 1913.)

CADMIUM Hexa Antipyrine Boro **FLUORIDE** $[Cd(COC_{10}H_{12}N_2)_6](BF_4)_2$

100 cc sat. solution in water contain 9.9 gm. $[Cd(COC_{10}H_{12}N_2)_6](BF_4)_2$ at 20°. (Wilke-Dorfurt and Mureck, 1929.)

CADMIUM IODIDE CdI_2

I

SOLUBILITY OF CADMIUM IODIDE IN WATER.

(Cohen, Helterschij and Moesveld, 1920; Hering, 1936; results for the ice curve Quempel, 1929; results above 100° Benrath, Gjedebo, Schiffers and Wunderlich, 1937.)

t°	d. of sat. sol.	Gms. CdI_2 per 100 gms. sat. solution	Solid Phase	t°	d. of sat. sol.	Gms. CdI_2 per 100 gms. sat. solution	Solid Phase
-0.2	—	5.37	Ice	25	—	46.295	CdI_2
-0.8	—	15.0	"	27.5	—	46.540	"
-1.3	—	20.11	"	30.0	—	46.793	"
-2.0	—	25.50	"	32.5	—	47.039	"
-3.4	—	33.0	"	35.0	—	47.296	"
-4.0	—	36.8	"	37.5	—	47.573	"
-4.7	—	39.66	"	40.0	1.619	47.95	"
-5.45	—	42.19	"	60.	1.646	50.1	"
-6.4	—	45.60	"	80	1.682	52.6	"
-5.3	—	42.05	" + $CdI_2.4H_2O$	100	1.726	55.55	"
-3.5	—	43.35	$CdI_2.4H_2O$	128	—	59.1	"
-2.0	—	44.4	"	179	—	66.7	"
-2.9	—	43.75	" + CdI_2	211	—	73.3	"
-1.8	—	43.85	CdI_2	243	—	79.5	"
0	1.567	44.05	"	269	—	85.4	"
+15	—	45.363	"	293	—	90.5	"
20	1.590	45.85	"	318	—	94.8	"
22.5	—	46.053	"	385 (m.pt.)	—	100.0	"

EQUILIBRIUM IN THE SYSTEM CADMIUM IODIDE, POTASSIUM IODIDE AND WATER.

(Hering, 1936.)

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	CdI_2	KI				CdI_2	KI	
-26.8	33.0	40.3	Ice	20	1.810.	42.3	15.8	CdI_2
-23.2	39.3	35.7	"	"	2.353	45.1	31.95	"
-17.5	29.2	35.8	"	"	2.719	46.95	38.2	1.1.1
-16.7	41.0	27.9	"	"	2.624	41.05	43.0	KI
-11.4	36.2	24.6	"	"	2.164	26.65	47.25	"
-10.9	24.2	29.5	"	"	1.986	18.1	50.8	"
-7.1	29.8	20.3	"	82	3.168	52.05	41.2	1.2.½
-5.0	21.0	19.1	"	95	—	54.75	39.25	1.1.1
-4.8	15.8	19.2	"	100	1.927	49.2	16.5	CdI_2
-2.5	18.5	12.6	"	"	2.335	50.4	28.5	"
-26.7	33.5	41.25	KI	"	—	55.5	35.8	"
-24.4	41.95	36.15	2.3.4	"	3.191	56.2	37.4	1.1.1
-20.7	39.2	40.05	1.2.3	"	3.235	56.0	38.25	"
-20.1	42.25	35.2	1.1.1	"	—	54.95	39.75	1.2.½
-14.4	42.15	28.9	$CdI_2.4H_2O$	"	—	53.1	41.1	"
-8.3	40.5	18.0	CdI_2	"	2.417	34.8	47.7	KI
0.0	44.75	36.45	1.1.1	"	2.009	14.35	58.8	"

2.3.4 = $2CdI_2.3KS.4H_2O$; 1.2.3 = $CdI_2.2KI.3H_2O$; 1.1.1 = $CdI_2.KI.H_2O$;
1.2.½ = $CdI_2.2KI.\frac{1}{2}H_2O$.

I

CADMIUM Potassinm IODIDES

SOLUBILITY OF EACH IN WATER.

(Hering, 1936.)

t°	Gms. anhydrous double salt per 100 gms. sat. sol.	Solid Phase	t°	d of sat. sol.	Gms. anhydrous double salt per 100 gms. sat. sol.	Solid Phase
-27.5	77.9	Ice + 1.2.3	0	2.638	83.45	1.2.2
-23.3	79.2	1.2.3	20	2.736	85.75	"
-15.3	81.3	" + 1.2.2	40	2.825	87.8	"
-29.3	78.8	Ice + 1.2.2	60	2.928	89.9	"
-19.1	80.65	1.2.2	70	3.000	91.7	"
-44.3	81.45	"				

1.2.3 = $CdI_2.2KCl.3H_2O$; 1.2.2 = $CdI_2.2KCl.2H_2O$.

100 gms. abs. ethyl alcohol dissolve 41.7 gms. $CdI_2.2KI$ at 15°. (Eder, 1876)
" " " ether " 3.9 " " " " " "

CADMIUM IODIDE

EQUILIBRIUM IN THE SYSTEM CADMIUM IODIDE, POTASSIUM IODIDE AND WATER (Con.)

(Hering, 1936.)

	t°	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
			CdI_2	KI	
	-19.3	—	42.4	29.75	Ice + $CdI_2.4H_2O$ + 1.1.1
	-14.3	—	42.6	30.6	$CdI_2.4H_2O$ + 1.1.1
	-11.7	—	43.2	31.25	" "
	-10.9	—	43.35	31.4	" + CdI_2 + 1.1.1
	- 9.85	—	43.5	31.05	CdI_2 + 1.1.1
	- 5.1	—	44.05	32.45	" "
	0	2.420	44.7	33.4	" "
	+20	2.575	47.1	35.0	" "
	40	2.706	49.4	35.7	" "
	60	2.836	51.4	36.25	" "
	80	2.982	53.9	36.5	" "
	100	—	56.4	36.6	" "
	-25.3	—	41.7	35.25	Ice + 1.1.1 + 2.3.4
	-24.1	—	41.9	35.4	1.1.1 + 2.3.4
	-11.8	—	43.7	37.0	" "
	0	2.644	45.15	38.2	" "
	-27.7	—	41.55	36.6	Ice + 2.3.4 + 1.2.3
	-27.0	—	41.75	36.7	2.3.4 + 1.2.3
	-26.6	—	41.8	36.95	" "
	-24.4	—	42.0	37.2	" "
I	-18.6	—	43.0	38.0	" "
	-15.8	—	43.3	38.35	" "
	-14.2	—	43.3	38.45	" + 1.2.2
	0.0	2.672	45.05	38.9	" "
	10	2.738	46.25	39.15	" "
	10	2.740	46.3	39.15	1.1.1 + 2.3.4 + 1.2.2
	20	2.793	47.15	39.45	1.1.1 + 1.2.2
	40	2.899	48.7	40.05	" "
	60	3.022	50.4	40.5	" "
	75	3.153	51.9	41.0	" "
	76.3	3.165	52.1	41.05	" " + 1.2.½
	78	3.172	52.4	40.9	" + 1.2.½
	90	3.235	53.9	40.15	" "
	100	3.307	55.75	39.2	" "
	-30.2	—	35.15	40.8	Ice + 1.2.3 + KI
	-28.0	—	35.7	41.0	1.2.3 + KI
	-23.4	—	36.85	41.25	" "
	-18.9	—	37.95	41.5	" "
	-17.3	—	38.35	41.6	1.2.3 + 1.2.2 + KI
	-24.3	—	37.4	41.25	1.2.2 + KI
	-13.8	—	38.7	41.8	" "
	0	2.583	40.4	42.3	" "
	20	2.693	42.5	42.8	" "
	40	2.795	44.35	43.2	" "
	60	2.907	46.2	43.5	" "
	80	—	48.6	43.6	" "
	81.4	—	48.9	43.65	" + 1.2.½ + KI
	83	—	48.95	43.65	1.2.½ + KI
	100	3.120	49.65	43.7	" "

1.1.1 = $CdI_2.KI.H_2O$; 2.3.4 = $2CdI_2.3KI.4H_2O$; 1.2.3 = $CdI_2.2KCl.3H_2O$;
1.2.2 = $CdI_2.2KI.2H_2O$; 1.2.½ = $CdI_2.2KI.\frac{1}{2}H_2O$.

CADMIUM AMMONIUM IODIDES (Mono and Di).

SOLUBILITY OF EACH SEPARATELY IN WATER, ETC.

(Rimbach, 1905; Eder, 1876.)

Solvent.	Cd. Mono Ammonium Iodide. t°.	Gms. $CdI_2.NH_4I$ per 100 Gms. Solution.	Gms. $CdI_2.NH_4I$ per 100 Gms. Solvent.	Cd. Diammonium Iodide. t°.	Gms. $CdI_2.2NH_4I$ per 100 Gms. Solution.	Gms. $CdI_2.2NH_4I$ per 100 Gms. Solvent.
Water	15	52.6	111	14.5	85.97	611.6
Abs. Alcohol	15	53	113	15	59	143
Abs. Ether	15	29.4	41.7	15	10	11

CADMIUM Sodium **IODIDE** $CdI_2.2NaI.6H_2O$

100 gms. Water sat. with the salt contain 158.8 gms. $CdI_2.2NaI$ at 15°
" " Alcohol " " " " " 116.2 " " " "
" " Ether " " " " " 9.9 " " " "

(Eder, 1876)

CADMIUM IODIDE CdI_2

SOLUBILITY OF CADMIUM IODIDE IN MIXTURES OF WATER AND ETHYL ETHER AT 20°

(Quempel, 1929.)

Within certain limits of temperature, the addition of CdI_2 renders water and ether miscible in all proportions.

Gms. Ether per 100 gms. solvent	Gms. CdI_2 per 100 gms. solvent	Percentage Composition of Ternary Mixture CdI_2	H_2O	$(C_2H_5)_2O$
0.0	85.53	46.10	53.30	0.0
16.09	93.61	48.35	43.34	8.31
29.70	97.98	49.49	35.51	15.00
38.67	99.96	49.99	30.67	19.34
65.96	107.94	51.91	16.37	31.72
79.08	104.40	51.09	10.23	38.69
84.90	89.93	47.35	7.95	44.70
90.20	72.00	41.86	5.70	52.44
96.00	27.54	21.60	3.14	75.26
100.0	0.07	0.07	0.0	99.95

SOLUBILITY OF CADMIUM IODIDE IN ETHYL ETHER CONTAINING WATER AT 12°.

(Tyrer, 1911.)

Gms. H_2O per 100 gms. ether+H_2O →	0.0	0.10	0.30	0.50	0.70	0.90	1.00	1.10	1.14 sat.
Gms. CdI_2 per 100 gms. solvent →	0.143	0.78	2.07	3.36	4.77	6.46	7.30	8.27	8.68

DISTRIBUTION OF CADMIUM IODIDE AT 30° BETWEEN:

(Dahr and Datter, 1913.)

Water and Amyl Alcohol. Gms. per 100 cc. H₂O Layer (c).	Alcohol Layer (c').	$\frac{c}{c'}$.	Water and Ethyl Ether. Gms. per 100 cc. H₂O Layer (c).	Ether Layer (c').	$\frac{c}{c'}$.
47.75	43	1.11	37.18	8.38	4.43
29.08	25.86	1.13	30.03	6.61	4.54
14.46	12.55	1.15	15.38	3.09	4.97
10.69	8.94	1.20	12.60	2.38	5.29
6.23	4.94	1.33	9.89	1.83	5.40
2.42	1.54	1.55	7.68	1.06	5.52
1.93	1.10	1.76	4.03	0.73	5.60
1.76	0.94	1.87	3.10	0.51	6.03

I

EQUILIBRIUM IN THE SYSTEM CADMIUM IODIDE, ETHER AND WATER.

(Quempel, 1929.)

The influence of CdI_2 upon the mutual solubility of water and ether was determined by adding, on the one hand,.successive amounts of ether to mixtures of known amounts of water and CdI_2, to appearance of clouding; and on the other hand, adding water to given mixtures of ether and CdI_2. The following results were obtained at 20°.

Percentage composition of the aqueous phrase CdI_2	H_2O	$(C_2H_5)_2O$	Percentage composition of the etheral phrase CdI_2	H_2O	$(C_2H_5)_2O$
0.0	93.50	6.50	0.0	1.20	98.80
10.50	82.66	6.90	11.32	5.68	83.00
25.50	67.20	7.20	22.20	10.50	67.50
34.45	53.05	12.50	28.83	10.15	66.02
39.78	38.00	22.22	34.81	14.14	50.78

The tie lines joining the conjugated layers were determined by analyzing for CdI_2 a series of immiscible layers representing points in the curve drawn from the above results. These tie lines showed that the critical mixture at 20° is composed of 39.45% CdI_2, 35.31% H_2O and 25.24% $(C_2H_5)_2O$, which corresponds to a critical solvent composed of 58.33% H_2O and 41.67% $(C_2H_5)_2O$. By adding increasing amounts of CdI_2 to such critical solvent it was found that the critical solution temperature rose with increasing concentrations of CdI_2. By extrapolation of these results to zero concentration of CdI_2 the lower critical solution temperature of a mixture of ether and water was found to be at -70°.

A series of determinations are also given showing the influence of temperature upon the solubility of ether in aqueous solutions of CdI_2 varying from 41.1% CdI_2 to saturation of the salt. Results are also given for the influence of CdI_2 upon the freezing-point of various mixtures of water and ether and of ether upon the f. pt. of mixtures of water and CdI_2; results are also given for the variation of the binary eutectic points of water-ether mixtures in contact with an excess of CdI_2.

Solubility of Cadmium Iodide in Methyl Alcohol, Ethyl Alcohol, Propyl Alcohol and in Isopropyl Alcohol at Different Temperatures.

(Muchin, 1913, see also Timofeiew, 1894.)

t°.	Grams CdI_2 per 100 Grams Sat. Solution in:			
	CH_3OH.	C_2H_5OH.	C_3H_7OH.	C_3H_7OH(iso).
0	67	33.5	16	36.9
5	...	41	22	36.9
10	68	54 (at 12.6° = tr. temp.)	28.5	37.2
20	69	53	41.5 (tr. temp.)	37.3
25	69.5	52.2	37.8	37.3
30	70	51.5	35.5	37.3
40	71	50.8	34.5	37.3
50	72.5	50	34.0	37.3

Solubility of Cadmium Iodide in Methyl Alcohol and in Ethyl Alcohol.

(Lloyd, Brown, Glynwyn, Bonnel and Jones, 1928.)

Results for Methyl Alcohol				Results ror Ethyl Alcohol			
t°	Gms. CdI_2 per 100 gms. CH_3OH	t°	Gms. CdI_2 per 100 gms. CH_3OH	t°	Gms. CdI_2 per 100 gms. C_2H_5OH	t°	Gms. CdI_2 per 100 gms. C_2H_5OH
10	206.8	40	206.0	20	110.5	50	102.7
20	206.7	50	208.1	30	108.1	60	103.3
30	206.7	60	208.6	40	103.8	70	103.4
		70	212.0			80	103.7

The solid phase is CdI_2 in all cases

100 gms. sat. solution of Cadmium Iodide in Acetone, $(CH_3)_2CO$, contain 30.0 gms. CdI_2 at 25°. (Zapata y Zapata, 1930.)

100 gms. Acetone dissolve 40.98 gms. CdI_2 at 25°. (Spinoglio and Reveuna, 1935.

These authors also give results for the solubility of Cadmium Iodide in acetone containing different amounts of naphthalene and of diphenyl. It was found that the amount of CI_2 dissolved is independent of the presence of these two hydro carbons.

100 gms. sat. solution of Cadmium Iodide in Ether, $(C_2H_5)_2O$, contain 0.065 gm. CdI_2 at 20°. (Guempel, 1929.)

Solubility of Cadmium Iodide in Organic Solvents.

Solvent.	t°.	Gms. CdI_2 per 100 Gms. Solution.	Gms. CdI_2 per 100 Gms. Solvent.	Observer.
Absolute Alcohol	15	50.5	102	(Eder.)
Ethyl Alcohol	20	42.6	74.27	(Timofeiew, 1891.)
Methyl Alcohol	20	59.0	143.7	(Timofeiew, 1891.)
Propyl Alcohol	20	28.9	40.67	(Timofeiew, 1891.)
Absolute Acetone	18	29	25*	(Naumann, 1904.)
Benzonitrile	18	...	1.63	(Naumann, 1914.)
Ethyl Acetate	18	...	1.84 †	(Naumann, 1910.)
Ethyl Ether	12°	...	0.143	(Tyrer, 1911.)
Anhy. Hydrazine	15–20	...	84 ‡	(Welsh and Broderson, 1915.)
Benzene	16.0		0.047	(Linebarger, 1895.)
"	35.0		0.094	"

* d_{18} = .994. † d_{18} = .9145. ‡ per 100 cc.

SOLUBILITY OF CADMIUM IODIDE IN ETHYL ETHER. (Linebarger, 1895.)

t°.	Mols CdI$_2$ per 100 Mols. CdI$_2$+(C$_2$H$_5$)$_2$O.	Gms. CdI$_2$ per 100 gms. (C$_2$H$_5$)$_2$O.
0	0.03	0.148
15.5	0.04	0.198
20.3	0.05	0.247

SOLUBILITY OF CADMIUM IODIDE IN METHYL FORMATE, ETHYL FORMATE, PROPYL FORMATE AND IN ETHYL ACETATE AT DIFFERENT TEMPERATURES. (Muchin, 1913.)

t°.	Gms. CdI$_2$ per 100 Gms. Sat. Solution in:			
	$HCOOCH_3$.	$HCOOC_2H_5$.	$HCOOC_3H_7$.	$CH_3COOC_2H_5$.
0	0.84	1.16	2.37	4.73(?)
13.0	0.75	1.05	2.07	1.67
26.0	0.66	0.77	1.53	2.02

SOLUBILITY OF CADMIUM IODIDE IN MIXTURES OF SOLVENTS AT DIFFERENT TEMPERATURES. (Muchin, 1913.)

Composition of Solvent in Mols.	Wt. per cent Alcohol in Solvent.	Gms. CdI$_2$ per 100 Gms. Sat. Solution at:		
		0°.	16.8°.	36.8°.
$1CH_3OH+2CHCl_3$	11.8	11.0	10.4	9.3
$1CH_3OH+1CHCl_3$	21.1	22.4	22.3	20.6
$1C_2H_5OH+2CHCl_3$	16.2	7.5	7.1	6.6
$1C_2H_5OH+1CHCl_3$	27.8	13.9	14.3	13.6
$2C_2H_5OH+1CHCl_3$	43.5	25.2	24.1	...
$xC_2H_5OH+yCHCl_3$	60.3	34.4	...	...
" "	91.5	45.4	...	...
$1C_2H_5OH+2C_6H_6$	22.8	17.6	16.3 (16.3°)	15.2 (31.2°)
$1C_2H_5OH+1C_6H_6$	37.1	26.1	26.0 (15.7°)	26.0 "
$2C_2H_5OH+1C_6H_6$	54.1	33.5	35.3 (15°)	...
$xC_2H_5OH+yC_6H_6$	9.8	6.5	...	...

SOLUBILITY OF CADMIUM IODIDE IN MIXTURES OF SOLVENTS.

(Muchin, 1913.)

Results for a mixed solvent composed of:

One Mol. Pyridine+One Mol. Chloroform.				One Mol. Pyridine+One Mol. Benzene.			
t°.	Gms. CdI$_2$ per 100 Gms. Sat. Sol.	t°.	Gms. CdI$_2$ per 100 Gms. Sat. Sol.	t°.	Gms. CdI$_2$ per 100 Gms. Sat. Sol.	t°.	Gms. CdI$_2$ per 100 Gms. Sat. Sol.
50.1	1.27	63	6.3	57.9	1.77	72.5	32.6
54	1.72	64	8.3	60	2.2	74.0	35.9
56	2.3	64.5	12.35	65	4.2	76	36.3
58	3.0	64	14.8	70	8.1	80	40.8
60	4.0	62	22.0	71	11.5	85	41.6
62	5.6	61.15	24.67	71.5	15.0	90.4	42.67

100 cc. of pyridine dissolve 0.43 gm. Cd I_2 at 18°. (Müller, R., 1924.

SOLUBILITY OF CADMIUM IODIDE IN ANILINE, PYRIDINE AND IN QUINOLINE AT DIFFERENT TEMPERATURES. (Muchin, 1913.)

t°.	Gms. CdI$_2$ per 100 Gms. Sat. Solution in:		
	$C_6H_5NH_2$.	C_5H_5N.	C_9H_7N.
40	1.7	...	...
50	2.3	0.1	...
60	3.1	0.5	2
70	4	1.7	3.5
80	5.1	4.8	5
90	6.4	13.4	6.7
100	8.4	30	8.3

100 gms. liquid Sulfur Dioxide, SO_2, dissolve 0.043 gm. CdI_2 at 0°. (Jander and Ruppold, 1937.)

Fusion-point data are given for the following mixtures:

CdI_2 + $AgNO_3$ (Bergmann, 1922-4, 1926.)
" + CuI (Herrmann, 1911.)
" + HgI_2 (Sandonnini, 1914; Losana, 1926; Pelabon and Lande, 1928.)
" + " + PbI_2 (Losana, 1926.)
" + KI (Brand, 1912.)
" + NaI, (" ")

CADMIUM AMMONIATES of the type $[Cd(NH_3)_6]X_2$.

NH

SOLUBILITY OF CADMIUM AMMONIATES AT 11° IN : (Ephraim and Mosimann, 1932.)

Aqueous ammonia of $d_{11} = 0.930$.

Salt.	Per liter of sat. solution Gms. Cd.	 G. mol. salt.
Iodide.......	1.57	0.014
Perchlorate..	2.57	0.023
Bromide.....	10.98	0.098
Nitrate......	35.36	0.316
Sulfate......	73.48	0.656
Chloride.....	108.32	0.967

Equal volumes of aq. ammonia of $d_{11} = 0.943$ and 96% alcohol.

Salt.	Per liter of sat. solution Gms. Cd.	 G. mol. salt.
Iodide........	0.71	0.0063
Perchlorate...	0.819	0.0073
Bromide......	2.94	0.026
Nitrate.......	15.75	0.140
Sulfate.......	1.04	0.009
Chloride......	23.83	0.213

In the case of the determinations in mixtures of ammonia and alcohol the solutions were prepared by adding an equal volume of 96 % alcohol to the sat. solutions of the salts in aq. ammonia of $d_{11} = 0.930$. The amount of salt which remanied in solution was determined

CADMIUM NITRATE $Cd(NO_3)_2 \cdot 4H_2O$

NO

SOLUBILITY OF CADMIUM NITRATE IN WATER.
(Sieverts, and Petzold, 1933.)

t°	Gms. $Cd(NO_3)_2$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Cd(NO_3)_2$ per 100 gms. sat. sol.	Solid Phase
-7.2	24.2	Ice	50	70.0	$Cd(NO_3)_2 \cdot 4H_2O$
-11.5	31.7	"	55	73.0	"
-20.0	41.4	"	58	74.4	"
-16.0 (Eutec)	36.9	" + $Cd(NO_3)_2 \cdot 9H_2O$	58	78.3	"
-14	38.2	$Cd(NO_3)_2 \cdot 9H_2O$	55	79.9	"
-10	41.6	"	48.7 tr.pt.	82.3	" + $Cd(NO_3)_2 2H_2O$
-5.2	45.9	"	51	82.7	$Cd(NO_3)_2$
+0.3	51.8	"	55	84.4	"
3.5 tr.pt.	56.1	" + $Cd(NO_3)_2 \cdot 4H_2O$	56.8	86.0	" + $Cd(NO_3)_2$
0.6	55.1	$Cd(NO_3)_2 \cdot 4H_2O$	61.0	86.1	$Cd(NO_3)_2$
15.0	58.7	"	79	87.0	"
25.0	61.3	"	100	87.2	"
35	64.3	"	130	88.2	"

The density of the sat. solution at 18° is 1.776 (Funk, 1900.)

The previous results of Funk, 1900, and the ice curve of Jones and Getman, 1904, differ somewhat from the above very accurate results.

SOLUBILITY OF CADMIUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 0°.

(Sieverts and Petzold, 1933a)

Gms. per 100 gms. sat. sol.		Solid	Gms. per 100 gms. sat. sol.		Solid	Gms. per 100 gms. sat. sol.		Solid
$Cd(NO_3)_2$	HNO_3	Phase	$Cd(NO_3)_2$	HNO_3	Phase	$Cd(NO_3)_2$	HNO_3	Phase
51.7	0.1	Cd9	13.2	40.5	Cd4	8.3	70.35	Cd. 2
50.3	1.85	"	8.0	49.15	"	6.9	72.5	"
48.9	3.75	"	7.25	51.3	"	6.1	74.8	"
48.7	4.3	"	6.1	54.5	"	5.75	75.4	"
47.35	6.53	" + Cd4	4.9	59.7	"	4.75	77.55	"
51.5	3.2*	Cd9	4.4	62.9	"	7.05	75.4*	Cd
48.9	5.3*	"	4.4	65.75	"	5.05	77.5*	"
46.1	7.4	Cd4	5.4	69.3	"	2.7	81.25	"
38.8	13.6	"	5.8	69.8	"	0.95	87.2	"
31.4	20.3	"	7.2	69.9	"	0.4	88.0	"
24.2	27.2	"	8.75	69.6	" + Cd2	0.01	96.5	"

* = metastable

Cd9 = $Cd(NO_3)_2 \cdot 9H_2O$; Cd4 = $Cd(NO_3)_2 \cdot 4H_2O$; Cd2 = $Cd(NO_3)_2 \cdot 2H_2O$; Cd = $Cd(NO_3)_2$

NO

SOLUBILITY OF CADMIUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 15°.

(Sieverts and Petzold, 1933a.)

Gms. per 100 gms. sat. sol.		Solid	Gms. per 100 gms. sat. sol.		Solid	Gms. per 100 gms. sat. sol.		Solid
$Cd(NO_3)_2$	HNO_3	Phase	$Cd(NO_3)_2$	HNO_3	Phase	$Cd(NO_3)_2$	HNO_3	Phase
46.9	10.1	Cd4	10.6	63.7	Cd4	11.75	68.5	Cd2
35.6	20.7	"	12.3	63.75	"	11.15	70.3	"
20.6	37.0	"	17.5	60.6	" + Cd2	9.35	72.7	"
11.9	50.8	"	16.8	61.4	Cd2	8.65	74.0	"
9.35	59.2	"	16.45	61.8	"	8.70	74.0	" + Cd
9.3	61.7	"	15.3	63.3	"	6.15	77.1	Cd

Cd4 = $Cd(NO_3)_2 \cdot 4H_2O$; Cd2 = $Cd(NO_3)_2 \cdot 2H_2O$; Cd = $Cd(NO_3)_2$.

SOLUBILITY OF CADMIUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 20°.

(Malquori, 1928.)

Gms. per 100 gms. sat. sol.		Solid	Gms. per 100 gms. sat. sol.		Solid	Gms. per 100 gms. sat. sol.		Solid
$Cd(NO_3)_2$	HNO_3	Phase	$Cd(NO_3)_2$	HNO_3	Phase	$Cd(NO_3)_2$	HNO_3	Phase
56.05	0.0	Cd4	10.29	60.31	Cd4	26.21	56.13	Cd2
50.05	7.45	"	10.50	62.50	"	27.82	60.01	" +Cd
38.21	18.52	"	12.18	63.72	"	18.53	70.13	Cd
28.47	29.02	"	21.57	59.49	"	12.81	79.07	"
16.57	47.00	"	25.84	52.95	" +Cd2	8.37	85.21	"
15.32	50.18	"	28.31	53.50	Cd2	3.00	96.11	"

SOLUBILITY OF CADMIUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 25°.

(Sieverts and Petzold, 1933a.)

Gms. per 100 gms. sat. sol.		Solid	Gms. per 100 gms. sat. sol.		Solid	Gms. per 100 gms. sat. sol.		Solid
$Cd(NO_3)_2$	HNO_3	Phase	$Cd(NO_3)_2$	HNO_3	Phase	$Cd(NO_3)_2$	HNO_3	Phase
61.2	0.15	Cd4	16.4	55.5	Cd4	17.5	63.2	Cd2
59.0	2.1	"	18.2	55.9	"	15.0	67.5	"
51.25	9.1	"	28.9	48.5	"	15.1	67.7	"+Cd
41.4	18.6	"	32.45	45.8	"	32.9	49.6*	Cd
25.15	36.8	"	33.9	44.7	"	16.4	65.6*	Cd
21.8	41.45	"	33.8	44.65	"+Cd2	9.3	72.9	"
18.2	47.0	"	30.1	48.6	Cd2	4.05	80.15	"
18.3	47.3	"	29.6	49.2	"	0.95	80.2	"
16.1	52.6	"	24.4	55.0	"	0.08	92.0	"

* = metastable

Cd4 = $Cd(NO_3)_2.4H_2O$; Cd2 = $Cd(NO_3)_2.2H_2O$; Cd = $Cd(NO_3)_2$

Sieverts and Petzold also give results for the isotherms, 35°, 45° and 50°.

SOLUBILITY OF CADMIUM NITRATE IN LIQUID AMMONIA.

(Donakaja and Portnov, 1939.)

NO

t°	Gms. $Cd(NO_3)_2$ per 100 gms. NH_3	Solid Phase	t°	Gms. $Cd(NO_3)_2$ per 100 gms. NH_3	Solid Phase
-81	6.5	NH_3	-33	5.93	$Cd(NO_3)_2.4NH_3$
-79.5	11.5	"	-29	4.58	"
-77.5	29.5	" + $Cd(NO_3)_2.4(?)NH_3$	-25	3.49	"
-75	29.02	" "	-21	2.68	"
-68	24.42	$Cd(NO_3)_2.4NH_3$	-9	1.74	"
-56	16.78	"	+4	1.01	"
-47	12.49	"	37	0.28	"

CADMIUM OXIDE CdO.

The solubility of cadmium oxide (or hydroxide) in water at 18° was found to be 0.038 millimols (5.0 milligrams) per liter as calculated from electrolytic conductivity, taking into consideration the carbonate content of the H_2O and assuming complete dissociation. The value obtained from the used amount of acid required for saturation, determined conducto-titrametrically, was 0.036 millimols (4.80 milligrams) per liter. OH

(Remy, 1925.)

The solubility of cadmium hydroxide in water at 25° was determined by conductivity measurements, using one sample of CdO and three samples of $Cd(OH)_2$. The results in mols. Cd per liter varied from $1.7x10^{-5}$ to $1.11x10^{-5}$. Calculating from $1.15x10^{-5}$ mols. per liter there is 1.3 mg. Cd per liter. The average of 8 electrolytic determinations (varying from 0.4 to 2.0 mgs. per liter) was 1.0 mg. Cd per liter. These variations were ascribed to the influence of CO_2. (Piater, 1928.)

By means of potentiometric measurements Ishikawa and Shiteata, 1932, found $1.4x10^{-5}$ mol. Cd per liter of solution saturated with $Cd(OH)_2$ at 25°.

CADMIUM HYDROXIDE $Cd(OH)_2$.

SOLUBILITY IN WATER.

1 liter of aqueous solution contains 0.0026 gm. $Cd(OH)_2$ at 25°. (Bodländer, 1898.)

SOLUBILITY IN AQUEOUS AMMONIUM HYDROXIDE SOLUTIONS.

Results at 25°. (Bonsdorff, 1904.)

Normality of NH_3.	Gms. $Cd(OH)_2$ per liter.
0.5	0.274
1.0	0.707
1.8	1.516
4.6	5.609

Results at 16-21°. (Euler, 1903.)

t°.	Normality of NH_3.	Gms. $Cd(OH)_2$ per liter.
16-17	0.47	0.44
"	0.87	1.17
21	0.26	0.09
"	0.51	0.32

SOLUBILITY OF CADMIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE AT 25°.

(Plater, 19P8.)

OH

The average of a long series of determinations made with varying amounts of excess solid, periods of shaking etc. gave the following values:

Normality of Aq. NaOH	Mols. Cd per liter	Solid Phase
0.0(= H_2O)	1.2×10^{-5}	$Cd(OH)_2$
0.01	0.13×10^{-5}	"
0.10	0.13×10^{-5}	"
1.0	0.7×10^{-5}	"
5.0	9.0×10^{-5}	"

CADMIUM Tetra Ammonium Per RHENATE $[Cd(NH_3)_4](ReO_4)_2$

ReO

One liter aq. Ammonia of d = 0.930 dissolve 0.37 gm $[Cd(NH_3)_4](ReO_4)_2$ at 11°. (Wilke-Dorfurt and Gunzert, 1933.)

CADMIUM SULFIDE CdS.

Critical reviews of the published solubilities of the metal sulfides in water are given by Kolthoff, 1931, and by Ravitz, 1936. Kolthoff calls attention to the incorrectness of Weigels, 1906, results. He gives a revised list of solubilities and solubility products but made no attempt to correct for activities. Ravitz made a careful study of the results of previous investigators and recalculated them with the aid of recent activity data. His preferred value for cadmium sulfide is:

One liter sat solution in water contains 1.46×10^{-10} gm. mols. CdS at 25°. The solubility product is 1.14×10^{-28}.

CADMIUM SULPHATE $CdSO_4$.

SOLUBILITY IN WATER.

(Mylius and Funk — W. Abh. p. t. Reichanstalt 3, 444, '00; see also Kohnstamm and Cohn — Wied Ann. 65, 344, '98; Steinwehr — Ann. der Phys. (Drude) [4] 9, 1050, '02; Etard — Ann. chim. phys [7] 2 536, '94.)

t°.	Gms. $CdSO_4$ per 100 Gms.		Solid Phase.	t°.	Gms. $CdSO_4$ per 100 Gms.		Solid Phase.
	Solution.	Water.			Solution.	Water.	
−17	44.5	80.2	$CdSO_4.7H_2O$	40	43.99	78.54	$CdSO_4.\frac{8}{3}H_2O$.
−10	46.1	85.5	"	60	44.99	83.68	"
− 5	48.5	94.2	"	73.5.	46.6	87.28	"
−18	43.35	76.52	$CdSO_4.\frac{8}{3}H_2O$	74.5	46.7	87.62	$CdSO_4.H_2O$
−10	43.27	76.28	"	77	42.2	73.02	"
0	43.01	76.48	"	85	39.6	65.57	"
+10	43.18	76.00	"	90	38.7	63.13	"
20	43.37	76.60	"	100	37.8	60.77	"

For results at high pressures, see Cohen (1909).

CADMIUM SULFATE $CdSO_4.\frac{8}{3}H_2O$.

SOLUBILITY OF CADMIUM SULFATE IN WATER.

(Cohen and Wolters, 1917, 1920; Steinwehr, 1920.)

SO

t°.	Mols. H_2O required to dissolve 1 mol $CdSO_4$.	Gms. $CdSO_4$ per 100 gms. H_2O.	Solid Phase.	t°.	Mols. H_2O required to dissolve 1 mol $CdSO_4$.	Gms. $CdSO_4$ per 100 gms. H_2O.	Solid Phase.
−12...	15.326	75.51	$CdSO_4.{}^8/_3H_2O$	11.5...	15.243	75.93	$CdSO_4.{}^8/_3H_2O$
− 9...	15.338	75.46	»	13.....	15.223	76.02	»
− 6...	15.331	75.50	»	15.....	15.207	76.08	»
− 3...	15.315	75.46	»	16.....	15.195	76.17	»
0...	15.327	75.51	»	16.96..	15.179	76.25	»
+ 5...	15.301	75.63	»	18.....	15.167	76.30	»
7....	15.295	75.68	»	19.....	15.153	76.37	»
9...	15.261	75.84	»	25.....	15.070	76 79	»

The density of the sat. solution at 15° = 1.6159; at 20° = 1.6165; at 25° = 1.6186. (Flöttmann, 1928.)

More recent determinations by Benrath and Thionnessen, 1932, indicate the existence of two hitherto unrecognized monohydrates of cadmium sulfate. The authors also call attention to other peculiarities in the crystal forms of this compound.

t°	Gms. $CdSO_4$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $CdSO_4$ per 100 gms. sat. sol.	Solid Phase
0	43.39	$CdSO_4\frac{8}{3}H_2O$	64	42.1	$CdSO_4.H_2O\ \alpha$
11.3	43.36	"	71	41.27	"
25	43.73	"	74.5	40.95	"+$CdSO_4.H_2O\beta$
34	43.98	"	75	40.97	$CdSO_4.H_2O\beta$
36.5	44.09	"	79	40.34	"
34.7	44.93*	$CdSO_4.H_2O\ \alpha$	86.5	39.08	"
40.5	44.48	"	97.	37.23	"
41.5	44.32	"+$CdSO_4\frac{8}{3}H_2O$	99	36.85	"
50	43.53	$CdSO_4.H_2O\ \alpha$			

SOLUBILITY OF CADMIUM SULFATE AT TEMPERATURES ABOVE 100°.

(Benrath, Gjedebo, Schiffers and Wunderlich, 1937.)

t°	$CdSO_4$ Gms. per 100 gms. sat. sol.	Solid Phase	t°	$CdSO_4$ Gms. per 100 gms. sat. sol.	Solid Phase
112 tr. pt.	—	$CdSO_4.H_2O + CdSO_4$	161	14.8	$CdSO_4$
119	32.3	$CdSO_4$	166	12.3	"
131	26.9	"	172	9.8	"
159	15.6	"	187	4.9	"

THE SYSTEM CADMIUM SULFATE, COBALT SULFATE AND WATER.

(Bassett and Sanderson, 1934.)

The purpose of this work was to obtain light upon the hydrates of Cadmium Sulfate. It was found that at 80° $CdSO_4\frac{8}{3}H_2O$ forms solid solutions with the corresponding cobalt compound. It was also found that the α and β forms of cadmium sulfate monohydrate give rise to two independent sets of solid solutions containing cobalt sulfate monohydrate--All the solid phases are solid solutions, although the amount of cobalt sulfate in the $CdSO_4\frac{8}{3}H_2O$ phase at 25° is very small.

SO

Gms. per 100 gms. sat. sol. $CoSO_4$	Gms. per 100 gms. sat. sol. $CdSO_4$	Solid Phase	Gms. per 100 gms. sat. sol. $CoSO_4$	Gms. per 100 gms. sat. sol. $CdSO_4$	Solid Phase	Gms. per 100 gms. sat. sol. $CoSO_4$	Gms. per 100 gms. sat. sol. $CdSO_4$	Solid Phase
27.05	0.0	A	13.42	28.88	B	8.00	35.85	D
22.38	9.97	B	12.35	31.02	"	5.05	38.84	"
18.89	17.78	"	11.55	32.64	C	3.43	40.46	"
15.62	23.90	"	9.44	34.52	D	1.78	41.84	"
						0.0	43.83	E

A = $CoSO_4.7H_2O$; B = Solid Solution of $CoSO_4.7H_2O$ and $CdSO_4.7H_2O$; C = Solid Solution of B and $CdSO_4\frac{8}{3}H_2O$ (Solid Solution); D = $CdSO_4\frac{8}{3}H_2O$ (Solid Solutions) E = $CdSO_4\frac{8}{3}H_2O$

Results at 80°

Gms. per 100 gms. sat. sol. $CoSO_4$	Gms. per 100 gms. sat. sol. $CdSO_4$	Solid Phase	Gms. per 100 gms. sat. sol. $CoSO_4$	Gms. per 100 gms. sat. sol. $CdSO_4$	Solid Phase	Gms. per 100 gms. sat. sol. $CoSO_4$	Gms. per 100 gms. sat. sol. $CdSO_4$	Solid Phase
39.94	—	F	26.90	19.31	II	8.31	34.95*	III
36.60	5.94	I	28.25	19.30*	III	4.66	39.33*	"
34.30	9.91	"	25.59	20.83	"	3.63	40.40*	"
31.67	15.35*	"	24.63	21.24	"	18.32	28.25*	IV
32.01	14.08	" + II	23.32	21.85	"	16.74	29.15*	"
29.46	18.96*	" + III	22.06	22.83	"	12.53	31.45*	"
29.66	16.63	II	18.12	26.08	"	7.20	34.98	"
28.77	17.30	"	15.56	27.94	"	3.00	38.11	"
28.32	17.83	"	14.13	29.37	"	0.0	40.31	G
						0.0	45.80	H

* = metastable

F = $CoSO_4.4H_2O$; G = β $CdSO_4H_2O$; H = α$CdSO_4.H_2O$

I = Solid solution of $CdSO_4.4H_2O$ and $CoSO_4.4H_2O$; II = solid solution of $CdSO_4\frac{8}{3}H_2O$ and $CoSO_4\frac{8}{3}H_2O$; III = solid solution of $CdSO_4.H_2O$ and $CoSO_4H_2O$; IV = solid solution of β $CdSO_4.H_2O$ and β $CoSO_4.H_2O$

The above solid solutions and also the solid solutions of $CdSO_4.7H_2O$ and $CoSO_4.7H_2O$ are red.

SOLUBILITY OF MIXED CRYSTALS OF CADMIUM SULPHATE AND FERROUS SULPHATE IN WATER AT 25°.

(Stortenbecker — Z. physik. Chem. 34, 109, '00.)

Composition of Solution.					Mol. per cent Cd in Crystals of Solid Phase.
Gms. per 100 Gms. H_2O.		Mols. per 100 Mols. H_2O.		Mol. % Cd. in Sol.	
$CdSO_4$.	$FeSO_4$.	Cd.	Fe.		
Crystals with 2⅔ Mols. H_2O.					
76.02	0.0	6.57	0.0	100	100
57.61	10.63	4.98	1.26	79.8	99.0
Crystals with 7 Mols. H_2O.					
57.61	10.63	4.98	1.26	79.8	36.6
...	...	...	...	78.5	34.6
...	...	...	...	44.6	11.1
...	...	...	...	24.4	4.8
0.0	26.69	0.0	3.165	0.0	0.0

SOLUBILITY OF CADMIUM SULPHATE IN AQUEOUS SOLUTIONS OF SULPHURIC ACID AT 0°.

(Engel — Compt. rend. 104, 507, '87.)

Equivalents per 10 Gms H_2O.		Density of Solutions.	Grams per 100 Grams H_2O.	
H_2SO_4.	$CdSO_4$.		H_2SO_4.	$CdSO_4$.
0.	71.6	1.609	0.00	74.61
3.87	70.9	1.591	1.90	73.87
12.6	62.4	1.545	6.18	65.03
28.1	50.6	1.476	13.78	52.73
43.3	40.8	1.435	21.23	42.52
47.6	37.0	1.421	23.34	38.56
53.8	32.7	1.407	26.38	34.07
71.5	23.0	1.379	35.06	23.96

SO

Additional data for this system at 0°, 16°, 21° and 35.5° are given by Arditti, 1933, but the results are presented only in the form of diagrams.

SOLUBILITY OF CADMIUM SULFATE IN AQUEOUS SOLUTIONS OF ACETIC ACID AT 25°.

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
CH_3COOH	$CdSO_4$		CH_3COOH	$CdSO_4$	
9.78	31.72	$CdSO_4 \frac{8}{3} H_2O$	71.34	0.11	$CdSO_4 \frac{8}{3} H_2O$
20.85	19.87	"	76.35	0.05	"
32.39	10.05	"	85.49	0.02	$CdSO_4 . H_2O$
46.23	2.77	"	95.79	0.015	"

Several determinations at 30° gave results practically identical with the above.

CADMIUM POTASSIUM SULFATE $CdK_2(SO_4)_2$.

SOLUBILITY IN WATER.

(Wyrouboff, 1901.)

t°.	G. $CdK_2(SO_4)_2$ per 100 Gms. H_2O.	Solid Phase.	t°.	G. $CdK_2(SO_4)_2$ per 100 Gms. H_2O.	Solid Phase.
16	42.89	$CdK_2(SO_4)_2.2H_2O$	26	42.50	$CdK_2(SO_4)_2.1\frac{1}{2}H_2O$
31	46.82	"	31	42.80	"
40	47.40	"	40	43.45	"
			64	44.90	"

EQUILIBRIUM IN THE SYSTEM CADMIUM SULFATE, POTASSIUM SULFATE AND WATER AT 25°.

(Malhotra and Suri, 1930.)

Gms. per 100 gms. sat. sol. $CdSO_4$	Gms. per 100 gms. sat. sol. K_2SO_4	Solid Phase	Gms. per 100 gms. sat. sol. $CdSO_4$	Gms. per 100 gms. sat. sol. K_2SO_4	Solid Phase
43.53	0.0	$CdSO_4\frac{8}{3}H_2O$	24.91	11.18	$CdSO_4.K_2SO_4$
43.71	0.55	"	24.19	11.91	" + K_2SO_4
43.21	1.85	"	18.95	11.90	K_2SO_4
43.05	3.15	" + $CdSO_4.K_2SO_4$	15.73	11.62	"
39.22	4.33	$CdSO_4.K_2SO_4$	12.55	11.40	"
35.83	5.46	"	10.62	11.39	"
33.81	6.14	"	6.60	11.50	"
31.24	7.20	"	4.58	11.13	"
29.00	8.48	"	2.66	10.77	"
27.02	10.05	"	0.0	10.77	"

EQUILIBRIUM IN THE SYSTEM CADMIUM SULFATE, POTASSIUM SULFATE AND WATER AT VARIOUS TEMPRRATURES.

(Benrath and Thonnessen, 1932.)

SO

Gms. per 100 gms. sat. sol. $CdSO_4$	Gms. per 100 gms. sat. sol. K_2SO_4	Solid Phase
Results at 0°		
42.78	2.27	Cd$\frac{8}{3}$+D
41.04	3.17	D
39.23	4.22	"
39.08	4.52	" +B
30.15	6.42	B
27.38	7.20	"
20.01	9.04	" +K
15.48	8.60	K
Results at 13.3°		
41.86	2.48	Cd$\frac{8}{3}$+D
41.52	2.68	D
36.93	5.61	" +B+C
35.58	6.05	B
31.80	7.07	"
21.18	10.64	" +K
15.69	10.39	K
6.69	9.89	"
Results at 25°		
43.4	2.08	Cd$\frac{8}{3}$+D
39.38	3.58	D
35.22	6.38	" +C
30.62	7.97	C
26.11	9.52	"
22.03	11.12	"
20.52	11.90	" +K
16.35	11.90	K

Gms. per 100 gms. sat. sol. $CdSO_4$	Gms. per 100 gms. sat. sol. K_2SO_4	Solid Phase
Results at 50°		
43.58	20.7	Cd1α+E
41.10	2.83	E
40.43	3.14	" +D
35.33	5.78	D
31.70	8.52	" +C
29.20	9.22	C
23.70	11.19	"
17.35	13.77	"
15.14	14.88	" +K
3.20	14.33	K
Results at 60°		
42.65	1.90	Cd1α +E
37.93	4.12	E
33.80	6.42	"
31.51	8.07	" +D+F
30.38	9.07	F
29.50	9.39	" +C
Result at 66°		
30.20	9.2	E + F
Results at 75°		
40.88	2.24	Cd1β + E
35.13	4.05	E
25.68	10.45	"
26.15	10.3	" +F
23.1	11.65	F
21.79	12.39	" +C

Gms. per 100 gms. sat. sol. $CdSO_4$	Gms. per 100 gms. sat. sol. K_2SO_4	Solid Phase
Results at 75° (Con.)		
17.32	14.37	C
14.17	15.93	"
11.69	17.54	" +K
6.70	17.06	K
Results at 90°		
39.42	2.38	Cd1β + E
32.04	4.44	E
25.71	7.68	"
20.61	12.83	" +F
17.44	14.78	F
15.91	15.79	" +C
13.37	16.43	C
10.45	19.45	" +K
6.0	19.42	K
Results at 99°		
37.58	2.54	Cd1β + E
32.31	3.69	E
28.73	4.95	"
22.42	7.77	"
20.13	10.58	"
17.38	13.74	" +F
16.36	14.36	F
13.17	17.53	" +C
10.78	19.29	C
9.5	20.23	" +K
5.29	19.93	K

Cd$\frac{8}{3}$ = $CdSO_4\frac{8}{3}H_2O$; Cd1 = $CdSO_4.H_2O$; B = $CdSO_4.K_2SO_4.4H_2O$;
C = $CdSO_4.K_2SO_4 1\frac{1}{2}H_2O$; D = $3\ CdSO_4.K_2SO_4.5\ H_2O$; E = $3CdSO_4.K_2SO_4.2H_2O$
F = $3CdSO_4.2K_2SO_4.H_2O$; K = K_2SO_4

EQUILIBRIUM IN THE SYSTEM CADMIUM SULFATE, LITHIUM SULFATE AND WATER AT 30°.

(Parks, Patterson and Vosburgh, 1937.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$CdSO_4$	Li_2SO_4		$CdSO_4$	Li_2SO_4	
42.5	0.9	$CdSO_4.\frac{8}{3}H_2O$	26.0	13.9	$Li_2SO_4.H_2O$
40.0	2.9	"	15.7	17.8	"
36.7	6.6	"	9.7	20.3	"
29.6	12.5	" + $Li_2SO_4.H_2O$	2.9	23.2	"

EQUILIBRIUM IN THE SYSTEM CADMIUM SULFATE, MANGANESE SULFATE AND WATER AT SEVERAL TEMPERATURES

(Benrath and Thiemann, 1936.)

The determinations were made for the purpose of gaining information in regard to the nature of the other form into which cadmium sulfate monohydrate changes at 75°. If this is a monomeric Kieserite there should be a gap in the mixed crystals formed with $MnSO_4$ below 75° and none above that temperature. From the several series of determinations the following values for the two salt points and border concentrations of mixed crystal series were obtained.

t°	Two salt pairs		Border concs. of Cd mixed cryst. series		Border concs. of Mn mixed cryst. series	
	I	II	I	II	I	II
53	53.0*	12.2	40.0	1.0	64.0	1.0
68	53.0	13.2	41.0	1.0	64.5	1.0
75	54.5	13.6	41.5	1.0	65.0	1.0
99	65.0	15.1	53.0	1.0	77.0	1.0

SO

EQUILIBRIUM IN THE SYSTEM CADMIUM SULFATE AMMONIUM SULFATE AND WATER AT 25°.

(Malhotra and Suri, 1930.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$CdSO_4$	$(NH_4)_2SO_4$		$CdSO_4$	$(NH_4)_2SO_4$	
43.5	0.0	$CdSO_4.\frac{8}{3}H_2O$	16.75	24.24	$CdSO_4.(NH_4)_2SO_4.6H_2O$
42.63	3.44	"	15.38	26.29	"
42.30	0.72	"	11.04	33.03	"
41.84	7.32	" + $CdSO_4.(NH_4)_2SO_4.6H_2O$	7.93	38.50	"
37.98	8.82	$CdSO_4.(NH_4)_2SO_4.6H_2O$	7.55	39.68	" + $(NH_4)_2SO_4$
36.04	9.28	"	6.95	39.90	$(NH_4)_2SO_4$
32.15	11.80	" "	4.99	40.75	"
28.78	13.90	" "	2.42	42.01	"
25.25	16.72	"	0.0	43.40	"

100 cc H_2O sat. with $CdSO_4.(NH_4)_2SO_4.6H_2O$ at 25° contain 72.3 gms. $CdSO_4.(NH_4)_2SO_4$. (Locke, 1901.)

CADMIUM SULFATE

EQUILIBRIUM IN THE SYSTEM CADMIUM SULFATE, AMMONIUM SULFATE AND WATER AT SEVERAL TEMPERATURES.

(Benrath and Thiemann, 1932.)

Results at 0°

Gms. per 100 gms. sat. sol.		Solid Phase
$CdSO_4$	$(NH_4)_2SO_4$	
2.56	39.60	N + Sch
3.73	34.45	Sch
0.63	26.75	"
10.97	18.86	"
19.84	11.77	"
25.28	9.18	"
32.59	6.34	"
38.91	4.83	"
40.68	4.47	" + $Cd_{\frac{8}{3}}$

Results at 44.9°

Gms. per 100 gms. sat. sol.		Solid Phase
$CdSO_4$	$(NH_4)_2SO_4$	
32.50	19.70	D + Sch
41.83	8.12	" + Cd_1
42.13	8.10	" "

Results at 45.5°

Gms. per 100 gms. sat. sol.		Solid Phase
$CdSO_4$	$(NH_4)_2SO_4$	
16.82	37.21	N + Sch
31.87	20.34	D
33.84	17.80	"

Results at 50°

Gms. per 100 gms. sat. sol.		Solid Phase
$CdSO_4$	$(NH_4)_2SO_4$	
4.69	42.79	N
10.87	39.98	"
15.38	37.97	"
17.09	37.20	" + C
19.10	35.01	C
21.27	32.44	"
23.05	30.52	C
25.98	27.21	" + L
28.46	23.51	L
31.00	21.87	D
32.69	19.20	" + L
32.20	19.30	"
32.84	19.19	"
36.24	14.41	"
39.06	11.25	"
42.06	8.10	" + Cd_1
42.18	5.17	Cd_1
43.64	0.0	"

Results at 55.5°

Gms. per 100 gms. sat. sol.		Solid Phase
$CdSO_4$	$(NH_4)_2SO_4$	
35.61	14.03	L + D
41.13	9.03	Cd_1+"

Results at 61.9°

Gms. per 100 gms. sat. sol.		Solid Phase
$CdSO_4$	$(NH_4)_2SO_4$	
15.89	39.31	N + L
18.97	33.85	L
20.19	32.14	"
40.09	10.13	" + Cd_1

Results at 62.4°

Gms. per 100 gms. sat. sol.		Solid Phase
$CdSO_4$	$(NH_4)_2SO_4$	
15.82	39.42	N + L
36.25	13.20	L
39.05	10.88	"
40.11	10.03	" + Cd_1

Results at 77.1°

Gms. per 100 gms. sat. sol.		Solid Phase
$CdSO_4$	$(NH_4)_2SO_4$	
0.0	47.43	N
5.42	45.63	"
11.39	42.81	N
12.88	42.12	" + L
12.37	42.17	L
13.50	40.78	"
14.68	38.86	"
17.37	33.64	"
19.20	30.89	"
22.41	26.40	"
25.44	22.31	"
29.45	17.83	"
34.20	13.72	"
39.14	9.95	" + Cd_1
39.31	8.43	Cd_1
40.13	3.38	"

Results at 97°

Gms. per 100 gms. sat. sol.		Solid Phase
$CdSO_4$	$(NH_4)_2SO_4$	
0.0	50.11	N
4.67	47.95	"
9.80	45.60	" + L
10.83	42.59	L
14.90	33.32	"
17.76	28.22	"
23.34	20.49	"
30.93	13.19	"
37.31	8.13	Cd_1
41.52	6.47	L
35.79	4.35	Cd_1

N = $(NH_4)_2SO_4$; $Cd_{\frac{8}{3}}$ = $CdSO_4.\frac{8}{3}H_2O$; Cd_1 = $CdSO_4.H_2O$; Sch = $CdSO_4.(NH_4)_2SO_4.6H_2O$; C = $CdSO_4.(NH_4)_2SO_4.2H_2O$; D = $3CdSO_4.(NH_4)_2SO_4.5H_2O$; L = $2CdSO_4.(NH_4)_2SO_4$.

The densities of the saturated solutions are also given.

CADMIUM SODIUM SULFATE $CdNa_2(SO_4)_2.2H_2O$.

SOLUBILITY IN WATER, ALSO WITH THE ADDITION OF CADMIUM SULPHATE AND OF SODIUM SULPHATE.

(Koppel, Gumpery — Z. physik. Chem. 52, 413, '05.)

t°.	Gms. per 100 Gms. Solution.		Gms. per 100 Gms. H_2O.		Mols. per 100 Mols. H_2O.		Solid Phase.
	$CdSO_4$.	Na_2SO_4.	$CdSO_4$.	Na_2SO_4.	$CdSO_4$.	Na_2SO_4.	
24	22.25	15.07	35.49	24.04	3.07	3.05	$CdNa_2(SO_4)_2.2H_2O$
30	22.55	15.29	36.28	24.60	3.14	3.12	
40	22.89	15.65	37.24	25.45	3.22	3.28	
0	40.32	4.85	73.54	8.85	6.36	1.12	$CdNa_2(SO_4)_2.2H_2O + CdSO_4.\frac{8}{3}H_2O$
10	39.91	5.24	72.77	9.55	6.30	1.21	
20	40.26	5.16	73.81	9.45	6.39	1.20	
40	39.89	7.18	75.38	13.56	6.52	1.72	
−14.8	40.18	4.60	72.68	8.32	6.29	1.05	$CdNa_2(SO_4)_2.2H_2O + Na_2SO_4.10H_2O$
0	37.30	6.53	66.32	11.62	5.74	1.47	
10	32.53	8.69	55.34	14.78	4.79	1.84	
20	22.69	14.71	36.25	23.52	3.14	2.98	
25	16.33	19.82	25.60	31.06	2.21	3.94	
30	9.21	27.80	14.62	44.14	1.26	4.59	$CdNa_2(SO_4)_2.2H_2O + Na_2SO_4$
35	8.26	29.35	13.26	47.06	1.15	5.96	
40	9.98	28.27	16.24	46.27	1.41	5.86	

SO

EQUILIBRIUM IN THE SYSTEM CADMIUM SULFATE, SODIUM SULFATE AND WATER AT SEVERAL TEMPERATURES.

(Benrath and Thiermann, 193?.)

Gms. per 100 gms. sat. sol.		Solid Phase
$CdSO_4$	Na_2SO_4	
Resnlts at 50°		
4.25	29.94	Na
7.82	28.67	"
9.10	28.07	"+N
10.46	26.92	N
12.96	25.11	"+L
14.54	23.60	L
18.46	20.26	"
28.72	13.15	"
32.74	10.83	"
39.36	7.63	"+Cd1
41.39	3.27	Cd1
44.58	0.0	"+Cd$\frac{8}{3}$
Results at 59°		
8.52	28.07	Na+N
12.35	24.77	N
17.21	21.78	"+L
20.06	19.10	L
32.32	11.50	"

Gms. per 100 gms. sat. sol.		Solid Phase
$CdSO_4$	Na_2SO_4	
Results at 65°		
4.33	29.26	Na
8.06	28.09	"+N
11.35	25.34	N
15.02	22.84	"+G
20.69	18.84	G
26.36	14.96	"
36.78	9.63	"+Cd1
38.04	7.00	Cd1
39.94	3.28	"
42.10	0.0	"
Results at 70°		
6.94	28.33	Na+V
8.42	27.26	N+V
12.04	24.53	N
15.74	22.13	N+G
15.73	21.80	G

Gms. per 100 gms. sat. sol.		Solid Phase
$CdSO_4$	Na_2SO_4	
Results at 75°		
5.55	28.70	Na+V
6.55	27.75	V
9.48	26.33	V+N
11.94	24.62	N
Results at 80°		
1.69	29.76	Na
4.23	29.11	"+V
6.48	27.23	V
9.53	24.87	"
12.12	23.58	"+G
15.87	20.39	G
18.72	18.15	"
25.20	14.23	"
35.96	9.39	"+Cd1
38.75	1.88	Cd1
Results at 90°		
3.63	28.96	Na+V
11.24	22.99	V+G

Na = Na_2SO_4; Cd$\frac{8}{3}$ = $CdSO_4.\frac{8}{3}H_2O$; Cd1 = $CdSO_4.H_2O$; G = $CdSO_4.Na_2SO_4$;
L = $CdSO_4.Na_2SO_4.2H_2O$; N = $CdSO_4.2Na_2SO_4$; V = $CdSO_4.3Na_2SO_4$.

The densities of the sat. solutions are also given.

EQUILIBRIUM IN THE SYSTEM CADMIUM SULFATE, SODIUM SULFATE AND WATER AT 97°.

(Benrath and Benrath, 1929.)

Gms. per 100 gms. sat. sol. $CdSO_4$	Gms. per 100 gms. sat. sol. Na_2SO_4	Solid Phase	Gms. per 100 gms. sat. sol. $CdSO_4$	Gms. per 100 gms. sat. sol. Na_2SO_4	Solid Phase	Gms. per 100 gms. sat. sol. $CdSO_4$	Gms. per 100 gms. sat. sol. Na_2SO_4	Solid Phase
0.0	30.50	Na	10.91	22.60	V + G	27.33	11.84	G
2.24	28.59	"	11.20	22.26	" "	34.97	9.44	G + Cd1
2.92	28.98	" + V	12.98	20.02	G	35.50	7.42	Cd1
3.87	27.82	V	13.90	18.89	"	36.32	5.32	"
6.04	25.29	"	18.90	15.78	"	36.85	2.40	"
8.24	24.14	"	23.90	13.02	"	37.23	0.0	"

Na = Na_2SO_4; V = $CdSO_4.3\ Na_2SO_4$; G = $CdSO_4.Na_2SO_4$; Cd1 = $CdSO_4.H_2O$

EQUILIBRIUM IN THE SYSTEM CADMIUM SULFATE RUBIDIUM SULFATE AND WATER.

(Benrath and Thonnessen, 1932.)

SO

Gms. per 100 gms. sat. sol. $CdSO_4$	Gms. per 100 gms. sat. sol. Rb_2SO_4	Solid Phase	Gms. per 100 gms. sat. sol. $CdSO_4$	Gms. per 100 gms. sat. sol. Rb_2SO_4	Solid Phase	Gms. per 100 gms. sat. sol. $CdSO_4$	Gms. per 100 gms. sat. sol. Rb_2SO_4	Solid Phase
Results at 0°			Results at 50°			Results at 75°		
41.92	3.90	Cd$\frac{8}{3}$ + D	43.48	2.89	Cd1 + D	40.4	4.38	Cd1β+D
39.39	4.8	D	39.05	4.9	D	39.75	4.7	D
30.88	6.25	D + Sch	36.32	5.86	"	31.06	9.49	"
27.51	8.09	Sch	29.9	11.83	"	27.81	11.34	" + L
18.34	10.0	"	23.31	18.09	"	22.17	15.35	L
10.86	12.78	"	22.68	20.17	"	13.93	24.4	"
6.22	16.97	"	19.65	25.23	" + C	13.93	24.4	"
4.91	19.2	" + Rb	16.51	27.01	C	10.0	30.61	"
			14.8	29.1	"	8.35	38.3	"
Results at 25°			13.12	31.1	"	7.61	40.89	" + Rb
			8.82	35.93	"			
42.27	3.51	Cd$\frac{8}{3}$ + D	7.92	37.54	" + Rb	Results at 97.5°		
42.14	3.6	D						
38.75	5.1	"	Results at 62°			37.8	6.25	Cd1β+L
32.7	9.27	"				38.15	5.53	L
28.41	14.29	"	22.32	19.0	D	30.28	8.96	"
26.81	16.9	" + Sch	19.9	24.1	" + L	14.74	14.89	"
14.89	24.56	Sch	17.47	24.85	L	9.38	26.5	"
9.18	30.66	"	15.3	30.03	" + C	5.43	38.82	"
6.7	32.75	" + Rh	10.19	35.79	C	2.27	46.25	"
4.39	34.39	Rb	8.94	38.26	" + Rb			

Cd$\frac{8}{3}$ = $CdSO_4.\frac{8}{3}H_2O$; D = $3\ CdSO_4.Rb_2SO_4.5H_2O$; Sch = $CdSO_4.Rb_2SO_4.6H_2O$;
C = $CdSO_4.Rb_2SO_4.2H_2O$; L = $2CdSO_4.Rb_2SO_4$; Cd1 = $CdSO_4.H_2O$.

EQUILIBRIUM IN THE SYSTEM CADMIUM SULFATE, THALLIUM SULFATE AND WATER.

(Benrath and Thonnessen, 1932.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$CdSO_4$	Tl_2SO_4		$CdSO_4$	Tl_2SO_4		$CdSO_4$	Tl_2SO_4	
Results at 0°			Results at 50°			Results at 75° (Con.)		
41.90	3.4	$Cd\frac{8}{3}$ + D	43.32	4.81	Cd1 + D	26.63	17.42	L
39.48	5.21	D	37.95	6.97	D	23.06	19.54	"
39.07	6.5	" + Tl	38.12	7.38	"	22.05	20.95	" + Tl
32.04	8.13	Tl	36.0	8.1	"	12.34	19.06	Tl
			32.07	12.03	"			
Results at 25°			28.93	16.77	" + Tl	Results at 97°		
			12.18	12.88	Tl			
42.75	1.8	$Cd\frac{8}{3}$				36.85	5.2	Cd1β
42.0	3.6	" + D	Results at 75°			36.25	7.33	" + L
39.43	4.95	D	37.25	7.9	Cd1β + D	34.51	8.07	L
35.03	8.55	"	36.65	8.83	D	27.65	10.88	"
31.12	12.95	" + Tl	32.78	12.7	" + L	21.24	14.64	"
5.81	7.21	Tl	29.28	16.22	L	11.84	23.97	" + Tl

$Cd\frac{8}{3} = CdSO_4.\frac{8}{3}H_2O$; $D = 3CdSO_4.Tl_2SO_4.5H_2O$; $L = 2CdSO_4.Tl_2SO_4$; $Tl = Tl_2SO_4$
$Cd1 = CdSO_4.H_2O$.

SO

SOLUBILITY OF CADMIUM SULFATE IN ABSOLUTE METHYL AND ETHYL ALCOHOLS.

(Gibson, Driscoll, and Jones, 1929.)

Results for Methyl Alcohol			Results for Ethyl Alcohol		
t°	Gms. $CdSO_4$ per 100 gms. CH_3OH	Solid Phase	t°	Gms. $CdSO_4$ per 100 gms. C_2H_5OH	Solid Phase
15	0.038	$CdSO_4$	35	0.027	$CdSO_4$
25	0.031	"	45	0.025	"
35	0.026	"	55	0.019	"
45	0.022	"			
55	0.019	"			

The solubility of Cadmium Sulfate in aqueous solutions of tertiary Butyl Alcohol was determined by the synthetic method and the composition of the homogeneous mixture (plait point) at 25°, found to be 8.1% $CdSO_4$, 21.3% tert. $(CH_3)_3COH$ and 70.6% H_2O. Equations for the composition of the binodal curve are also given. (Ginnings, Herring and Bailey, 1933.) Similar data, showing the constants of the equations for the composition of the binodal curve for Cadmium Sulfate in aqueous solutions of allyl alcohol at 25° are given by Ginnings and Dees, 1935.)

100 gms. 95% formic acid dissolve 0.06 gm. $CdSO_4$ at 18.5°. (Aschan, 1913.)

Fusion-point data are given for mixtures of $CdSO_4$ + Li_2SO_4, $CdSO_4$ + K_2SO_4 and $CdSO_4$ + Na_2SO_4 by Calcagni and Marotta, 1913.)

CADMIUM SILICATE $CdSiO_3$.

Fusion-point data are given for $CdSiO_3$ + $ZnSiO_3$. (van Klooster, 1910–11.)

CERIUM BROMIDE $CeBr_3$

SOLUBILITY OF CERIUM BROMIDE IN PYRIDINE.

(Müller, 1932a.)

t°	Gms. $CeBr_3$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $CeBr_3$ per 100 gms. sat. sol.	Solid Phase
−5	0.437	$CeBr_3 \cdot 3C_5H_5N$	18	3.53	$CeBr_3 \cdot 2C_5H_5N$ + $CeBr_3 \cdot C_5H_5N$
−2	0.713	"			
0	0.907	"	22	2.614	$CeBr_3 \cdot C_5H_5N$
+3	1.33	" + $2CeBr_3 \cdot 3C_5H_5N$	25	2.12	"
4	1.034	$2CeBr_3 \cdot 3C_5H_5N$	28	1.408	"
5	0.768	" + $CeBr_3 \cdot 2C_5H_5N$	30	0.821	" + $3CeBr_3 \cdot 2C_5H_5N$
8	1.215	$CeBr_3 \cdot 2C_5H_5N$	40	0.791	$3CeBr_3 \cdot 2C_5H_5N$
10	1.63	"	50	0.719	"
12	2.14	"	60	0.721	"
15	2.91	"	70	0.691	"
			80	0.653	"

CERIUM ACETATE, BUTYRATE, FORMATE, etc.

SOLUBILITY IN WATER.

(Wolff — Z. anorg. Chem. 45, 102, '05.)

Salt.	Formula.	Grams Anhydrous Salt per 100 Gms. Solution at: 11°	15°.	70°.
Acetate	$Ce(C_2H_3O_2)_3 \cdot 1\frac{1}{2}H_2O$	...	19.61	12.97
Butyrate	$Ce(C_4H_7O_2)_3$, and $3H_2O$	3.544	3.406	1.84
Iso Butyrate	$Ce(C_4H_7O_2)_3 \cdot 3H_2O$	...	6.603 (20.4°)	3.39
Formate	$Ce(CHO_2)_3$	...	0.398 (13°)	0.374 (75.3°)
Propionate	$Ce(C_3H_5O_2)_3 \cdot H_2O$, and $3H_2O$	...	18.99	15.93

100 gms. pure methyl alcohol saturated with anhydrous cerium acetate contain 3.33 gm $Ce(CH_3COO)_3$ at 15° and 3.71 gms. at 66.6°. (b. pt.) (Henstock, 1934.)

CERIUM GLYCOLATE $Ce(C_2H_3O_3)_3$.

One liter H_2O dissolves 3.563 gms. of the salt at 20°. (Jantsch and Grunkraut, 1912–13)

CERIUM MALONATE $Ce_2(C_3H_2O_4)_3 + 6H_2O$.

Solvent.	t°.	Gms. $Ce_2(C_3H_2O_4)_3$ per 100 Grams. Solvent.
Aq. Ammonium Malonate, containing 10 gms. per 100 cc.	20	0.2
Aq. Malonic Acid, containing 20 gms. per 100 cc.	20	0.6

(Holmberg, 1907.)

CERIUM TARTRATE $Ce_2(C_4H_4O_6)_3 \cdot 4\frac{1}{2}H_2O$, also $6H_2O$.

SOLUBILITY IN WATER (Rimbach and Shubert, 1909, by electrolytic method) AND IN AQ. SOLUTIONS. (Holmberg, 1907.)

Solvent.	t°.	Gms. Anhydrous Salt per 100 Gms. Sat. Sol	Solid Phase.
Water	25	0.005	$Ce_2(C_4H_4O_6)_3 \cdot 4\frac{1}{2}H_2O$
Aq. Am. Tartrate, 10 Gms. per 100 cc.	20	0.7	$Ce_2(C_4H_4O_6)_3 \cdot 6H_2O$
Aq. Am. Tartrate, 20 Gms. per 100 cc.	20	2	"
Aq. Tartaric Acid, 20 Gms. per 100 cc.	20	0.4	"
Aq. Tartaric Acid, 40 Gms. per 100 cc.	20	0.2	"

CERIUM CITRATE $2(CeC_6H_5O_7) \cdot 7H_2O$.

100 gms. of aq. citric acid solution containing 10 gms. citric acid per 100 cc., dissolve 0.3 gm. $Ce(C_6H_5O_7)$ at 20°. (Holmberg, 1907.)

CERIUM SULFONATES.

SOLUBILITY IN WATER. (Holmberg, 1907; Katz and James, 1913.)

Name.	Formula.	t°.	Gms. Anhydrous Salt per 100 Gms. H_2O.
Cerium *m* Nitrobenzene Sulfonate	$Ce[C_6H_4(NO_2)SO_3]_3.6H_2O$	15	25.5
Cerium Bromonitrobenzene Sulfonate	$Ce[C_6H_3Br(NO_2)SO_3 1.4.2]_3.8H_2O$	25	5.89

CH

CEROUS ELAIDATE, PALMITATE and STEARATE.

SOLUBILITIES IN ETHER AND IN TURPENTINE. (Morrell, 1918.)

Compound.	Formula.	Solvent.	t°.	Gms. cmpd. per 100 gms. sat. sol.
Cerous Elaidate......	$Ce(C_{18}H_{33}O_2)_3$	Ether	cold	1.07
» Palmitate....	$Ce(C_{16}H_{31}O_2)_3$	Ether	»	0.8
» »	»	Turpentine	»	0.18
» Stearate......	$Ce(C_{18}H_{35}O_2)_3$	Ether	»	0.6

CN

CERIUM COBALTICYANIDE $Ce_2(CoC_6N_6)_2.9H_2O$.

100 gms. aq. 10% HCl (d_{15} = 1.05) dissolve 1.075 gms. of the salt at 25°. (James and Willand, 1916.)

CERIUM Campho CARBONATE $Ce(C_{11}H_{15}O_3)_3$

CO

SOLUBILITY IN SEVERAL SOLVENTS.

(Picon, 1931.)

Solvent	t°	Gms. $Ce(C_{11}H_{15}O_3)_3$ per 100 cc. sat. sol.	Solvent	t°	Gms. $Ce(C_{11}H_{15}O_3)_3$ per 100 cc. sat. sol.
Water	20	0.68	Benzene	17	More than 70.0
Methyl alcohol	17	34.72	Chloroform	17	" " 70.0
Ethyl alcohol	17	37.44	Carbon tetra chloride	17	" " 50.0
Ethyl ether	17	5.28	Carbon Di Sulfide	17	" " 70.0
Acetone	17	6.51	Petroleum ether	17	0.0
Ethyl acetate	17	6.47	Oils	17	trace

CERIUM OXALATE $Ce_2(C_2O_4)_3.9H_2O$.

One liter H_2O dissolves 0.00041 gm. $Ce_2(C_2O_4)_3$ at 25°, determined by the electrolytic method. (Rimbach and Schubert, 1909.)

SOLUBILITY OF CERIUM OXALATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AND OF OXALIC ACID AT 25°.

(Hauser and Wirth, 1908; Wirth, 1912.)

Conc. of Aqueous Acid.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Conc. of Aq. Acid.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
	CeO_2=	$Ce_2(C_2O_4)_3$.			CeO_2=	$Ce_2(C_2O_4)_3$.	
0.1*n* H_2SO_4	0.0136	0.0215	$Ce(C_2O_4)_3.9H_2O$	0.1*n*$(COOH)_2$	0.0020	0.0032	$Ce_2(C_2O_4)_3.9H_2O$
0.5 "	0.0524	0.0828	"	0.5 "	0.0083	0.0131	"
1.0 "	0.114	0.1802	"	1.0 "	0.0040	0.0063	"
1.445 "	0.1764	0.2788	"	3.2 " (sat.)	0.0019	0.0030	"
2.39 "	0.3083	0.4871	"	0.05 " +.05*n* H_2SO_4	0.0030	0.0047	"
2.9 "	0.4724	0.7467	"	0.05 " +.5 "	0.0025	0.0039	"
3.9 "	0.6300	0.9957	"	0.25 " +.25 "	0.0046	0.0073	"
4.32 "	0.7502	1.1860	"	0.50 " +.05 "	0.0105	0.0166	"
5.3 "	0.9019	1.4250	"	0.50 " +.50 "	0.0010	0.0016	"

SOLUBILITY OF CERIUM OXALATE IN AQUEOUS SOLUTIONS OF ACIDS AT 25°.

(Sarver and Brinton, 1927.)

Composition of Aq. Solvent in Normality	Gms. $Ce_2(C_2O_4)_3$ per 100 gms. sat. sol.	Composition of Aq. Solvent in Normality	Gms. $Ce_2(C_2O_4)_3$ per 100 gms. sat. sol.
H_2O alone	0.000109	6.00 HCl+satd. $(COOH)_2$	0.1862
0.1008 HCl	0.0131	6.20 " + " "	0.1604
0.2576 "	0.0376	0.2462 HNO_3	0.0355
0.5004 "	0.0834	1.992 "	0.6808
1.018 "	0.2174	4.054 "	2.264
1.484 "	0.3552	2.00 " + 0.1 $(COOH)_2$	0.3100
2.000 "	0.5518	3.03 " " "	0.9328
2.865 "	0.9354	4.00 " " "	1.738
0.978 " + 0.1 $(COOH)_2$	0.0272	2.00 " 0.5 "	0.0526
2.000 " " "	0.2120	3.03 " " "	0.2004
2.865 " " "	0.5486	4.00 " " "	0.7934
3.965 " " "	1.152	4.00 " + satd. "	0.4014
0.978 " + 0.5 "	0.0049	6.00 " " "	1.328
2.000 " " "	0.0338	0.086 H_2SO_4	0.0142
2.865 " " "	0.1142	0.419 "	0.0683
3.965 " " "	0.3808	0.958 "	0.1738
1.484 " + satd. "	0.0068	1.846 "	0.3820
4.00 " + " "	0.0313	2.612 "	0.5904

Cl

CEROUS CHLORIDE $CeCl_3$.

100 cc. anhydrous hydrazine dissolve 3 gms. $CeCl_3$, with evolution of gas, at room temp. (Welsh and Broderson, 1915.)

100 gms. pyridine dissolve 1.58 gms. $CeCl_3$ at 0°. (Müller, R., 1924.)

CERIUM Hexa Antipyrine Per CHLORATE $[Ce(COC_{10}H_{12}N_2)_6](ClO_4)_3$

100 gm. sat. solution in water contain 1.07 gm. of the salt at 20°. (Wilke Dorfurt and Schliephake, 1925.)

F

CERIUM FLUORIDE CeF_3.

Freezing-point lowering data are given for mixtures of CeF_3 + KF by Puschin and Baskow, 1913.

CERIUM IODATE $Ce(IO_3)_3$.

One liter sat. aqueous solution contains 1.456 gms. $Ce(IO_3)_3$, determined by a chemical method, and 1.636 gms. determined electrolytically. (Rimbach and Schubert, 1909.) IO

SOLUBILITY OF CERIUM IODATE IN AQUEOUS SOLUTIONS OF SALTS AT 25°.

(Chloupek, Danes and Danesova, 1932.)

In Aqueous Solutions of:

Potassium Nitrate		Potassium Sulfate	
Molality of aq. KNO_3	Gms. $Ce(IO_3)_3$ per 1000 gms. H_2O	Molality of K_2SO_4	Gms. $Ce(IO_3)_3$ per 1000 gms. H_2O
0.005	1.846	0.0 ($=H_2O$)	1.732
0.01	1.932	0.002	2.013
0.02	2.097	0.005	2.370
0.05	2.418	0.01	2.819
0.10	2.736	0.02	3.510
0.20	3.120	0.05	4.529
0.50	3.976	0.10	5.660

Magnesium Sulfate		Magnesium Chloride	
Molality of $MgSO_4$	Gms. $Ce(IO_3)_2$ per 1000 gms. H_2O	Molality of $MgCl_2$	Gms. $Ce(IO_3)_2$ per 1000 gms. H_2O
0.002	2.056	0.002	1.870
0.005	2.442	0.005	1.993
0.01	2.917	0.01	2.169
0.02	3.508	0.02	2.427
0.05	4.695	0.05	2.983
0.10	6.025	0.10	3.533

CERIUM NITRATE $Ce(NO_3)_3.6H_2O$

NO

SOLUBILITY IN WATER.

(Quill and Robey, 1937.)

t°	d. of sat. sol.	Gms. $Ce(NO_3)_3$ per 100 gms. sat. sol.	Solid Phase
25	1.880	63.71	$Ce(NO_3)_3.6H_2O$
50	2.040	73.88	"

10 cc. of ethyl ether saturated at about 20° with hydrated cerium nitrate contained 0.001 gm. CeO_2. 10 cc. of ethyl ether saturated at about 20° with anhydrous cerium nitrate contained 0.0139 gm. CeO_2. (Wells, 1930.)

CERIUM Magnesium NITRATE $2Ce(NO_3)_3.3Mg(NO_3)_2.24H_2O$

SOLUBILITY OF THE HYDRATED SALT IN WATER.

(Friend and Wheat, 1935.)

t°	11°	18°	24.8°	31.8°	42.2°	57.0°	111.5°
Gms. $2Ce(NO_3)_3.3Mg(NO_3)_2.24H_2O$ per 100 gms. sat. sol.	61.98	62.89	65.63	66.20	69.26	72.78	100.

CERIUM Magnesium, etc., NITRATES.

SOLUBILITY IN CONC. AQ. HNO_3 ($d_{16} = 1.325 = 51.59$ Gms. HNO_3 per 100 cc.) AT 16°.

(Jantsch, 1912.)

Cerium magnesium nitrate,	1 liter	sat.	solution	contains	58.5	gms.	$[Ce(NO_3)_6]Mg_3$	$.24H_2O$.
" nickel	"	"	"	"	75.3	"	" Ni_3	"
" cobalt	"	"	"	"	103.3	"	" Co_3	"
" zinc	"	"	"	"	111.7	"	" Zn_3	"
" manganese	"	"	"	"	178.8	"	" Mn_3	"

CERIUM AMMONIUM NITRATE (Ceri) $Ce(NO_3)_4.2NH_4NO_3$.

SOLUBILITY IN WATER.

(Wolff.)

t°.	Gms. per 100 Gms. Solution.		Atomic Relation.	Gms. $Ce(NO_3)_4.2NH_4NO_3$ per 100 Gms.	
	NH_4.	Ce.	NH_4 : Ce.	Solution.	Water.
25	4.065	15.16	2.08 : 1	58.49	140.9
35.2	4.273	16.10	2.06 : 1	61.79	161.7
45.3	4.489	16.69	2.08 : 1	64.51	174.9
64.5	4.625	17.40 Ce 15.03 Ce IV	2.06 : 1 Ce 2.39 : 1 Ce IV	66.84	201.6
85.6	4.778	18.16 Ce 15.79 Ce IV	2.04 : 1 Ce 2.34 : 1 Ce IV	69.40	226.8
112	6.117	22.82 Ce 16.22 Ce IV	2.08 : 1 Ce 2.95 : 1 Ce IV	88.03	735.4

NO

CERIUM AMMONIUM NITRATE (Cero) $Ce(NO_3)_3.2NH_4NO_3.4H_2O$.

SOLUBILITY IN WATER.

(Wolff.)

t°.	Gms. per 100 Gms. Solution.		Atomic Relation.	Gms. $Ce(NO_3)_3.2NH_4NO_3$ per 100 Gms.	
	NH_4.	Ce.	NH_4 : Ce.	Solution.	Water.
8.75	4.787	18.56	1.999 : 1	70.2	235.5
25.0	5.09	19.80	1.995 : 1	74.8	296.8
45.0	5.53	21.06	2.037 : 1	80.4	410.2
60.0	6.01	22.77	2.054 : 1	87.2	681.2
65.06	6.11	23.42	2.022 : 1	89.1	817.4

O

CERIUM OXIDE CeO_2

Data for the distribution of cerium oxide between aqueous solutions of nitric acid and ethyl ether are given by Imre, 1927.

Fusion-point data for mixtures of CeO_2 + MgO and CeO_2 + ZrO_2 are given by V. Wartenburg and Prophet, 1932, and v. Wartenburg and Gurr, 1931.

PO

CERIUM Dimethyl PHOSPHATE $Ce_2[(CH_3)_2PO_4]_6.H_2O$.

100 gms. H_2O dissolve 79.6 gms. $Ce_2[(CH_3)_2PO_4]_6$ at 25° and about 65 gms. at 95°.

(Morgan and James, 1914.)

For more recent determinations see also the system cerium sulfate, potassium sulfate sulfate and water.

CERIUM SULFATE $Ce_2(SO_4)_3$.

SOLUBILITY OF THE SEVERAL HYDRATES IN WATER.

(Koppel, 1904; the previous determinations by Muthman and Rolig, 1898, and by Wyrouboff, 1901, are shown by Koppel to be inaccurate.)

t°.	Gms. $Ce_2(SO_4)_3$ per 100 Gms. Solution.	Mols. $Ce_2(SO_4)_3$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Ce_2(SO_4)_3$ per 100 Gms. Solution.	Mols. $Ce_2(SO_4)_3$ per 100 Mols. H_2O.	Solid Phase.
0	14.20	0.525	$Ce_2(SO_4)_3.12H_2O$	20.5	8.69	0.302	$Ce_2(SO_4)_3.8H_2O$
18.8	14.91	0.555	"	40	5.613	0.188	"
19.2	15.04	0.561	"	60	3.88	0.129	"
0	17.35	0.665	$Ce_2(SO_4)_3.9H_2O$	45	8.116	0.280	$Ce_2(SO_4)_3.5H_2O$
15	10.61	0.376	"	60	3.145	0.103	"
21	8.863	0.308	"	80	1.19	0.0382	"
31.6	6.686	0.227	"	100.5	0.46	0.0149	"
45.6	4.910	0.164	"	35	7.8	0.27	$Ce_2(SO_4)_3.4H_2O$
50	4.465	0.148	"	40	5.71	0.19	"
60	3.73	0.123	"	50	3.31	0.11	"
65	3.47	0.114	"	65	1.85	0.06	"
0	15.95	0.605	$Ce_2(SO_4)_3.8H_2O$	82	0.98	0.032	"
15	9.95	0.350	"	100.5	0.42	0.014	"

CERIUM SULFATE $Ce_2(SO_4)_3.8H_2O$ and $.9H_2O$.

SO

SOLUBILITY OF EACH HYDRATE SEPARATELY IN WATER.

(Voogd, 1933.)

More recent very accurate determinations confirming the results of Koppel for the 8 and 9 hydrates are as follows.

t°	Gms. $Ce_2(SO_4)_3$ per 100 gms. H_2O	Solid Phase	t°	Gms. $Ce_2(SO_4)_3$ per 100 gms. H_2O	Solid Phase
0	18.83	$Ce_2(SO_4)_3.8H_2O$	0	21.37	$Ce_2(SO_4)_3.9H_2O$
20	9.431	"	20	9.845	"
25	8.211	"	25	8.303	"
30.4	7.102	"	30	7.241	"
35	6.385	"	35	6.349	"
40	5.700	"	40	5.632	"
45	5.153	"	45	5.036	"

EQUILIBRIUM IN THE SYSTEM CERIUM SULFATE, CAESIUM SULFATE AND WATER AT 25°.

(Zambonini and Restaino, 1929.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
Cs_2SO_4	$Ce_2(SO_4)_3$		Cs_2SO_4	$Ce_2(SO_4)_3$	
46.85	—	1.1.8 + Cs_2SO_4	4.33	3.67	1.1.8
41.74	—	1.1.8	2.29	4.20	"
33.90	—	"	1.46	5.38	"
22.45	—	"	0.45	8.06	" - $Ce_2(SO_4)_3.8H_2O$
6.02	—	"			

1.1.8 = $Ce_2(SO_4)_3.Cs_2SO_4.8H_2O$

SOLUBILITY OF CERIUM SULFATE IN AQ. SOLUTIONS OF SULFURIC ACID AT 25°.

(Wirth, 1912.)

Normality of Aq. H_2SO_4.	Gms. per 100 Gms. Sat. Sol. CeO_2	= $Ce_2(SO_4)_3$.	Solid Phase.	Normality of Aq. H_2SO_4.	Gms. per 100 Gms. Sat. Sol. CeO_2	= $Ce_2(SO_4)_3$.	Solid Phase.
0.0	4.604	7.60	$Ce_2(SO_4)_3.8H_2O$	4.32	2	3.301	$Ce_2(SO_4)_3.8H_2O$
0.1	4.615	7.618	"	6.685	0.9115	1.505	"
1.1	3.64	6	"	9.68	0.4439	0.733	"
2.16	3.04	5.018	"	15.15	0.145	0.239	"

SOLUBILITY OF CERIUM SULFATE IN AQUEOUS SOLUTIONS OF ALKALI SULFATES.

(Barre, 1910.)

SO

In aq. sols. of K_2SO_4 at 16°. Gms. per 100 Gms. H_2O. K_2SO_4.	$Ce_2(SO_4)_3$.	In aq. sols. of Na_2SO_4 at 19°. Gms. per 100 Gms. H_2O. Na_2SO_4.	$Ce_2(SO_4)_3$.	In aq. sols. of $(NH_4)_2SO_4$ at 16°. Gms. per 100 Gms. H_2O. $(NH_4)_2SO_4$.	$Ce_2(SO_4)_3$.
0	10.747	0	9.648	0	10.747
0.178	0.956	0.328	0.637	3.464	1.026
0.510	0.432	0.684	0.259	9.323	0.782
0.726	0.250	1.091	0.0937	19.240	0.748
1.290	0.042	1.392	0.0570	29.552	0.701
0	6.949 (at 33°)	1.699	0.0303	45.616	0.497
		2.640	0.0120	55.083	0.194
		3.589	0.0065	63.920	0.090
		5.660	0.0040	72.838	0.035
		7.710	0.0037		

The following double salts were found. $Ce_2(SO_4)_3.K_2SO_4.2H_2O$, $2Ce_2(SO_4)_3.3K_2SO_4.8H_2O$, $Ce_2(SO_4)_3.5K_2SO_4$, $Ce_2(SO_4)_3.Na_2SO_4.2H_2O$, $Ce_2(SO_4)_3(NH_4)_2SO_4.8H_2O$ and $Ce_2(SO_4)_3.5(NH_4)_2SO_4$.

CERIUM Potassium **SULFATES.**

EQUILIBRIUM IN THE SYSTEM CERIUM SULFATE, POTASSIUM SULFATE AND WATER AT 25°.

(Zambonini and Restaino, 1926 *a*.)

Gms. per 100 gms. sat sol. K_2SO_4.	$Ce_2(SO_4)_3$.	Solid Phase.	Gms. per 100 gms. sat. sol. K_2SO_4.	$Ce_2(SO_4)_3$.	Solid Phase.
0.02	7.95	1.1.2	1.43	0.05	1.4½
0.04	6.66	»	1.77	0.00	»
0.07	4.88	»	2.87	0.00	»
0.12	3.48	»	4.65	0.00	»
0.16	1.74	»+2.3.8	5.56	0.00	1.5
0.79	0.30	2.3.8	6.22	0.00	»
1.26	0.12	»+1.4½	7.72	0.00	»
1.13	0.15	» »	9.22	0.00	»
1.17	0.13	» »	9.66–9.80	0.00	» + K_2SO_4

1.1.2 = $Ce_2(SO_4)_3.K_2SO_4.2H_2O$: 2.3.8 = $2Ce_2(SO_4)_3.3K_2SO_4.8H_2O$: 1.4½ = $Ce_2(SO_4)_3.4\frac{1}{2}K_2SO_4$: 1.5 = $Ce_2(SO_4)_3.5K_2SO_4$.

EQUILIBRIUM IN THE SYSTEM CERIUM SULFATE, POTASSIUM SULFATE AND WATER AT SEVERAL TEMPERATURES.

(Schröder and Schackmann, 1934.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$Ce_2(SO_4)_3$	K_2SO_4		$Ce_2(SO_4)_3$	K_2SO_4		$Ce_2(SO_4)_3$	K_2SO_4	
Results at 0°			Results at 25° (Con.)			Results at 50° (Con.)		
13.93	0.0	Ce12	0.461	0.307	1.1.2	0.055	1.651	1.4(-5)
14.06	0.0	Ce8	0.356	0.471	"	0.034	2.029	"
13.94	0.012	1.1.2	0.321	0.657	"+2.3.8	0.016	2.289	"
9.79	0.073	"	0.285	0.686	2.8.3	—	7.39	"
6.11	0.107	"	0.218	0.934	"	—	11.33	"
5.58	0.107	"+2.3.8	0.189	0.983	"	—	13.64	" + K
4.12	0.142	2.3.8	0.157	1.056	"+1.4	—	14.14	K
2.04	0.217	"	0.117	1.148	1.4(-5)			
1.10	0.279	"	0.043	1.395	"	Results at 75°		
0.631	0.407	"	0.002	2.641	"			
0.190	0.692	"+1.4	—	9.06	"	1.076	0.0	Ce4
0.158	0.724	1.4(-5)	—	10.71	"+K	1.150	0.019	"
0.091	0.812	"	—	10.75	K	1.356	0.061	"+1.1.2
0.018	1.353	"				1.148	0.068	1.1.2
—	6.212	"	Results at 50°			0.697	0.101	"
—	6.870	"+K				0.384	0.144	"
—	6.850	K	4.622	0.0	Ce8	0.134	0.324	"
			3.327	0.0	Ce4	0.065	0.545	"
Results at 25°			4.278	0.011	"+1.1.2	0.040	1.549	"
			3.735	0.021	1.1.2	0.019	2.197	"
7.77	0.0	Ce8	1.904	0.062	"	0.023	2.278	"+1.4
8.01	—	"+1.1.2	0.776	0.132	"	—	3.11	1.4(-5)
7.27	0.032	1.1.2	0.460	0.190	"	—	5.20	"
4.63	0.062	"	0.279	0.320	"	—	8.63	"
2.60	0.083	"	0.160	0.532	"	—	11.72	"
1.09	0.142	"	0.083	0.819	"	—	14.89	"
0.642	0.202	"	0.078	1.482	"+1.4	—	17.15	K

SO

Ce12 = $Ce_2(SO_4)_3.12H_2O$; Ce8 = $Ce_2(SO_4)_3.8H_2O$; Ce4 = $Ce_2(SO_4)_3.4H_2O$
1.1.2 = $Ce_2(SO_4)_3.K_2SO_4.2H_2O$; 2.3.8 = $2Ce_2(SO_4)_3.3K_2SO_4.8H_2O$;
1.4 (-5) = $Ce_2(SO_4)_3.4K_2SO_4$ (or $5K_2SO_4$); K = K_2SO_4.

The authors also give the densities of the saturated solutions.

CERIUM Ammonium **SULFATES.**

EQUILIBRIUM IN THE SYSTEM CERIUM SULFATE, AMMONIUM SULFATE AND WATER AT 5°. (Zambonini and Restaino, 1926.)

The saturated solutions and the solid phases were analyzed.

Gms. per 100 gms. sat. sol.			Gms per 100 gms. sat. sol.		
$(NH_4)_2SO_4$.	$Ce_2(SO_4)_3$.	Solid Phase.	$(NH_4)_2SO_4$.	$Cl_2(SO)_3$.	Solid Phase.
0.71	8.66	$Ce_2(SO_4)_3.8H_2O$+1.1.8	28.47	0.73	1.5
0.97	5.63	» »	29.19	0.61	»
1.02	3.64	» »	31.59	0.36	»
6.28	0.89	1.1.8	35.73	–	»
12.91	0.79	»	40.06	–	»
18.38	0.81	»	41.00		»
25.35	0.83	»	42.17		»
28.62	0.87	» +1.5	43.69		»+$(NH_4)SO_4$

1.1.8 = $Ce_2(SO_4)_3.(NH_4)_2SO_4.8H_2O$; 1.5 = $Ce_2(SO_4)_3.5(NH_4)_2SO_4$.

CERIUM AMMONIUM SULPHATE $Ce_2(SO_4)_3.(NH_4)_2SO_4.8H_2O$.

SOLUBILITY IN WATER.

(Wolff.)

t°.	Gms. $Ce_2(SO_4)_3.(NH_4)_2SO_4$ per 100 Gms. Solution.	Gms. $Ce_2(SO_4)_3.(NH_4)_2SO_4$ per 100 Gms. Water.	Solid Phase.	t°.	Gms. $Ce_2(SO_4)_3.(NH_4)_2SO_4$ per 100 Gms. Solution.	Gms. $Ce_2(SO_4)_3.(NH_4)_2SO_4$ per 100 Gms. Water.	Solid Phase.
22.3	5.06	5.33	$.8H_2O$	45.0	2.91	2.99	Anhydride
35.1	4.93	5.18	"	55.25	2.16	2.21	"
45.2	4.76	4.99	"	75.4	1.46	1.48	"
				85.2	1.17	1.18	"

SOLUBILITY OF CERIUM SULFATE IN AQUEOUS SOLUTIONS OF AMMONIUM SULFATE AND VICE VERSA AT 25°.

(Schröder, Kehren, Frings and van Poelvoorde, 1938.)

d of sat. sol.	Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$	Gms. per 100 gms. sat. sol. $Ce_2(SO_4)_3$	Solid Phase	d of sat. sol.	Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$	Gms. per 100 gms. sat. sol. $Ce_2(SO_4)_3$	Solid Phase
1.0775	0.0	7.78	Ce8	1.1573	25.98	0.779	1.1.8
1.0791	0.056	7.81	"	1.1664	28.49	0.454	" + 1.4(5)
1.0813	0.279	7.94	"	1.0829	0.327	7.931	Ce8+1.1.2
1.0870	0.601	8.23	" + 1.1.8	1.0687	0.357	6.876	1.1.2
1.0818	0.615	7.88	1.1.8	1.0402	0.461	3.942	"
1.0746	0.644	7.32	"	1.0242	0.572	2.451	"
1.0664	0.695	6.33	"	1.0174	0.792	1.754	"
1.0576	0.751	5.44	"	1.0138	1.093	1.402	"
—	0.340	4.61	"	1.0169	2.121	0.708	"
1.0416	0.923	3.97	"	1.0449	7.637	0.322	"
1.0377	1.010	3.46	"	1.1272	21.89	0.281	"
1.0337	1.105	2.99	"	1.1664	28.72	0.239	"
1.0291	1.320	2.54	"	1.1765	30.61	0.187	" + 1.4(5)
1.0263	1.769	1.73	"	1.1780	30.13	0.413	1.4(5)
1.0258	2.320	1.25	"	1.1835	31.60	0.325	"
1.303	3.775	0.853	"	1.1860	31.92	0.305	"
1.0455	7.031	0.845	"	1.1964	32.94	0.248	"
1.0554	8.588	0.798	"	1.2220	38.70	0.062	"
1.0715	11.27	0.780	"	1.2434	43.17	—	" + $(NH_4)_2SO_4$
1.1043	16.92	0.785	"	1.2419	43.42	0.0	$(NH_4)_2SO_4$

C8 = $Ce_2(SO_4)_3.8H_2O$; 1.1.8 = $Ce_2(SO_4)_3.(NH_4)_2SO_4.8H_2O$; 1.1.2 = $Ce_2(SO_4)_3.(NH_4)_2SO_4.2H_2O$; 1.4(5) = $Ce_2(SO_4)_3.4(or\ 5)(NH_4)_2SO_4$.

The authors also give similar results for the isotherms at 0°, 28°, 33°, 38°, 50°, 75°, 85° and 99.5°. By means of these extensive determinations the solubility relations of the various hydrates and double salts in this system have been completely established.

EQUILIBRIUM IN THE SYSTEM CERIUM SULFATE, SODIUM SULFATE AND WATER AT 25°.

(Zambonino and Restaino, 1927.)

Gms. per 100 gms. sat. sol. Na_2SO_4	Gms. per 100 gms. sat. sol. $Ce_2(SO_4)_3$	Solid Phase	Gms. per 100 gms. sat. sol. Na_2SO_4	Gms. per 100 gms. sat. sol. $Ce_2(SO_4)_3$	Solid Phase
15.34	—	4.5.8+Na_2SO_4	7.51	—	4.5.8
13.75	—	4.5.8	5.50	—	1.1.2
12.41	—	"	1.92	—	"
10.95	—	"	0.14	9.35	"
9.99	—	"	0.14	3.59	1.1.2+$Ce_2(SO_4)_3.8H_2O$
			1.13	4.04	"

1.1.2 = $Ce_2(SO_4)_3.Na_2SO_4.2H_2O$; 4.5.8 = $4Ce_2(SO_4)_3.5K_2SO_4.8H_2O$.

CERIUM Thallium SULFATES.

EQUILIBRIUM IN THE SYSTEM CERIUM SULFATE, THALLIUM SULFATE AND WATER AT 25°.

(Zambonini and Restaino, 1926 *a*.)

Gms. per 100 gms. sat. sol. Tl_2SO_4.	Gms. per 100 gms. sat. sol. $Ce_2(SO_4)_3$.	Solid Phase.	Gms. per 100 gms. sat. sol. Tl_2SO_4.	Gms. per 100 gms. sat. sol. $Ce_2(SO_4)_3$.	Solid Phase.
1.01	1.02	1.1.4	2.52	0.14	1.3.1
1.14	0.65	»	2.44	0.16	» + 1.4$^1/_2$
1.23	0.54	»	2.55	0.12	» »
1.80	0.32	»	3.46	0.05	1.4$^1/_2$
1.90	0.33	»	5.33	0.00	»
2.35	0.24	» + 1.3.1	5.21	0.00	
2.29	0.18	» »	5.45	0.00	
2.44	0.17	» »			

1.1.4 = $Ce_2(SO_4)_3.Tl_2SO_4.4H_2O$; 1.3.1 = $Ce_2(SO_4)_3.3Tl_2SO_4.H_2O$; 1.4$^1/_2$ = $Ce_2(SO_4)_3.4^1/_2Tl_2SO_4$.

CERIUM SELENATE $Ce_2(SeO_4)_3.11H_2O$.

SOLUBILITY IN WATER. (Cingolani, 1908.)

t°.	Gms. $Ce_2(SeO_4)_3$ per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. $Ce_2(SeO_4)_3$ per 100 Gms. H_2O.	Solid Phase.
0	39.55	$Ce_2(SeO_4)_3.12H_2O$	60	13.68	$Ce_2(SeO_4)_3.8H_2O$
11.6	37.0	"	60.8	13.12	"
12.6	36.9	$Ce_2(SeO_4)_3.11H_2O$	78.2	5.53	"
26	33.84	"	80.5	4.56	$Ce_2(SeO_4)_3.7H_2O$
28.8	33.22	"	91	2.02	"
34.2	33.15	$Ce_2(SeO_4)_3.10H_2O$	95.4	1.536	$Ce_2(SeO_4)_3.4H_2O$
45	32.16	"	98	1.785	"
45.9	31.89	"	100	2.513	"

CERIUM TUNGSTATES $Ce_2(WO_4)_3$. Hydrate.

EQUILIBRIUM IN THE SYSTEM CERIUM TUNGSTATE, SODIUM TUNGSTATE AND WATER AT 25°.

(Carobbi, 1928.)

WO

Gms. per 100 gms. sat. sol. Na_2WO_4	Gms. per 100 gms. sat. sol. $Ce_2(WO_4)_3$	Solid Phase	Gms. per 100 gms. sat. sol. Na_2WO_4	Gms. per 100 gms. sat. sol. $Ce_2(WO_4)_3$	Solid Phase
2.65	0.62	Ce aq + 1.1.11	23.32	0.40	1.3.16
4.00	0.60	1.1.11	25.35	0.32	"
6.13	0.52	"	27.64	0.24	" + 1.5.23
10.71	0.56	"	30.24	0.15	1.5.23
13.28	0.48	"	35.07	trace	"
14.24	0.60	"	37.42	—	"
15.03	0.57	" + 1.3.16	39.90	—	"
17.98	0.42	1.3.16	42.14	—	"
20.03	0.39	"	42.62	—	" + $Na_2WO_4.2H_2O$

CeAq = $Ce_2(WO_4)_3$.Hydrate; 1.1.11 = $Ce_2(WO_4)_3Na_2WO_4.11H_2O$; 1.3.16 = $Ce_2(WO_4)_3.3Na_2WO_4.16H_2O$; 1.5.23 = $Ce_2(WO_4)_3.5Na_2WO_4.23H_2O$.

Fusion-point data for mixtures of $Ce_2(WO_4)_3$ and $PbWO_4$ are given by Zambonini, 1913.

Cl **CHLORINE** Cl_2.

SOLUBILITY IN WATER.

(Winkler, 1912; Roozeboom, 1884, 1885, 1888.)

t°.	β'.	q.	t°.	Gms. Cl per 100 Gms. H_2O.	Solid Phase.
0	4.610	1.46	−0.24	0.492	Ice + Cl.8 aq.
3	3.947	1.25	0	0.507–0.560	Cl.8 aq.
6	3.411	1.08	2	0.644	"
9	3.031	0.96	4	0.732	"
9.6	2.980	0.94	6	0.823	"
12	2.778	0.88	8	0.917	"
10	3.095	0.980	9	0.965–0.908	"
15	2.635	0.835	20	1.85	"
20	2.260	0.716	28.7	3.69	" + 2 layers
25	1.985	0.630			
30	1.769	0.562			
40	1.414	0.451			
50	1.204	0.386			
60	1.006	0.324			
70	0.848	0.274			
80	0.672	0.219			
90	0.380	0.125			
100	0	0			

β' = vol. of Cl (reduced to 0° and 760 mm.) absorbed by 1 vol. H_2O at total pressure of 760 mm.

q = Gms. Cl per 100 gms. H_2O at a total pressure of 760 mm.

The coefficient of solubility of chlorine at 15°, determined by an aspiration method, is given as 51.7 for carbon tetrachloride, 39.6 for acetic anhydride, 36.7 for 99.84% acetic acid, 25.3 for 90 vol. % acetic acid, 16.43 for 75 vol. % acetic acid and 13.43 for 65 vol. % acetic acid. (Jones, 1911.)

SOLUBILITY IN WATER.

(Goodwin, 1882.)

The saturated aqueous solution of the chlorine was cooled until chlorine hydrate separated; the temperature was then gradually raised and portions withdrawn for analysis at intervals. The chlorine was determined by iodometric titration and the results calculated to volume of chlorine dissolved by unit volume of solvent at the given temperature and 760 mm. pressure. Slightly different results were obtained for solutions in contact with much, little, or no chlorine hydrate. The following results are taken from an average curve:

t°.	Solubility Coefficient.	t°.	Solubility Coefficient.	t°.	Solubility Coefficient.
2.5	1.76	11	3	25	2.06
5	2	12.5	2.75	30	1.8
7.5	2.25	15	2.6	40	1.35
10	2.7	20	2.3	50	1

SOLUBILITY OF CHLORINE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AND OF POTASSIUM CHLORIDE.

(Goodwin, 1882.)

t°.	Coefficient of Solubility in:				Results at 21°. (Mellor, 1901.)	
	HCl. (1.046 Sp. Gr.).	HCl (1.08 Sp. Gr.).	HCl (1.125 Sp. Gr.).	KCl (20 g. per 100 cc.)	Gms. HCl per 1000 cc.	Solubility of Cl. (Ostwald *l*, see p. 227.)
0	4.1	6.4	7.3	1.5	0.	2.2799
5	5.1	5.2	6.7	2	3.134	1.6698
10	4.1	4.5	6.1	2.2	9.402	1.5013
15	3.5	3.9	5.5	1.6	12.540	1.5292
20	3	3.4	4.7	1.2	31.340	1.8033
25	2.5	3	4	1	125.360	2.4473
30	2	2.4	...	0.9	219.380	3.1312
40	1.25	1.6	...	...	313.401	3.8224

Goodwin also gives results for solutions of NaCl, $CaCl_2$, $MgCl_2$, $SrCl_2$, Fe_2Cl_6, $CoCl_2$, $NiCl_2$, $MnCl_2$, $CdCl_2$, LiCl, and in mixtures of some of these, but the concentrations of the salt solutions are not stated.

SOLUBILITY OF CHLORINE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AND OF HYDROCHLORIC ACID.

(Oliveri-Mandala, 1920.)

The manner in which the results are reported is not perfectly clear. The solubility of chlorine in water is stated as 6.745 and 6.760 per cent Cl. These figures are evidently grams per liter and not grams per 100 grams sat. solution. Also in the case of the results for the aqueous sodium chloride solutions, the results for chlorine are stated to be in terms of gm. mols per liter when it is evident that they are really gms. per liter. Correcting these apparant errors, the results are as follows.

Results for aqueous solutions of Sodium Chloride at 20° and 762 mm. pressure.

Gm. mols. per liter NaCl.	Gm. mols. per liter Cl_2.
0.000	0.0953
0.777	0.0705
1.323	0.0594
1.965	0.0496
3.159	0.0373
3.597	0.0321

Results for aqueous solutions of Hydrochloric Acid at 20° and 760.5 mm. pressure.

Gm. mols. per liter HCl.	Gm. mols. per liter Cl_2.
0.00	0.0965
1.155	0.1010
1.872	0.1049
2.500	0.1092
3.000	0.1139
4.101	0.1243

Data for the solubility of chlorine in water, with reference to the hydrolysis which occurs, are given by Arkadiev, 1918.

SOLUBILITY OF CHLORINE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 25°

(Sherrill and Izard, 1928, 1931.)

The chlorine, prepared by the action of HCl on chromic acid was bubbled through the solution in an absorption train which was painted black to prevent decomposition of chlorine by light.

Gm. mols. per 1000 gms. H_2O	
HCl	Cl_2
0.00	0.0923
0.010	0.08264
0.100	0.06394
0.200	0.0619
0.496	0.0630
1.019	0.0665
1.991	0.0737
2.990	0.0824
3.989	0.0914
4.903	0.0978
5.180	0.1004
7.016	0.1150
8.163	0.1219
8.854	0.1281
9.805	0.1326

SOLUBILITY OF CHLORINE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AND AND OF SEVERAL SALTS AT 25°.

(Sherrill and Izard, 1931.)

In aqueous solutions of:

Sulfuric Acid		Barium Chloride		Potassium Chloride		Sodium Chloride	
Gm. mols. per 1000 gms. H_2O		Gm. mols. per 1000 gms. H_2O		Gm. mols. per 1000 gms. H_2O		Gm. mols. per 1000 gms. H_2O	
H_2SO_4	Cl_2	$BaCl_2$	Cl_2	KCl	Cl_2	NaCl	Cl_2
0.4995	0.06272	0.330	0.06216	0.500	0.06610	0.501	0.06575
1.0240	0.05617	0.667	0.05494	1.000	0.06109	0.998	0.05795
1.9686	0.04973	1.000	0.04924	2.013	0.05388	2.991	0.04161
3.0090	0.04550	1.333	0.04468	3.014	0.04865	3.989	0.03601
3.9934	0.04278			3.913	0.04724	4.989	0.03087
4.9901	0.04066						

SOLUBILITY OF CHLORINE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE.

(Kumpf, 1882; Kohn and O'Brien, 1898.)

t°.	Coefficient of Solubility in:			
	9.97% NaCl.	16.01% NaCl.	19.66% NaCl.	26.39% NaCl.
0	2.3	1.9	1.7	0.5
5	2	1.6	1.4	0.44
10	1.7	1.3	1.15	0.4
15	1.4	1.06	0.95	0.36
20	1.2	0.9	0.8	0.34
25	0.94	0.75	0.65	0.3
50	...	...	...	0.2
80	...	...	...	0.05

100 cc. of 6.2 per cent $CaCl_2$ solution dissolve 0.245 gm. Cl at 12°.
100 cc. of 6.2 per cent $MgCl_2$ solution dissolve 0.233 gm. Cl at 12°.
100 cc. of 6.2 per cent $MnCl_2$ solution dissolve 0.200 gm. Cl at 12°.
For coefficient of solubility see p. 227.

SOLUBILITY OF CHLORINE IN SEVERAL SOLVENTS. (Taylor and Hildebrand, 1923.)

Chlorine was bubbled slowly through the solvent untill equilibrium was reached and the dissolved chlorine was determined by titration. Time 1 1/2 hrs.

Solvent.	t°.	Partial pressure of Cl_2 in Mm.	Gms. Cl_2 per 1.0 gm. sat. sol.	Mol. per cent Cl_2. in experiment.	Mol. per cent Cl_2. at 1 atm. p.p.
Heptane	0	750	0.2036	26.5	27.0
Silicon tetrachloride ($SiCl_4$)	0	681	0.131	26.6	28.8
Carbon tetrachloride (CCl_4)	0	729	0.156	28.6	29.8
» »	19	680	0.0848	16.3	18.7
» »	40	557	0.0433	8.91	12.15
Ethylene dibromide ($C_2H_4Br_2$)	20	752	0.0813	19.0	19.2
» »	40	736	0.0469	11.51	11.9

SOLUBILITY OF CHLORINE IN CARBON TETRACHLORIDE.

t°	Ratio of Conc. of Cl_2 in the CCl_4 to gas phase;Ostwald Sol. Ex.	Authority
0	82.6	(Jakowkin, 1899.)
13	60.2	(Perkin, 1894.)
15	51.7	(Jones, 1911.)
19	32.0	(Schwab and Hautke, 1924.)

DISTRIBUTION OF CHLORINE BETWEEN CCl_4 AND GASEOUS PHASE AND BETWEEN CCl_4 AND WATER.

(Jakowkin, 1899.)

Results for CCl_4 + Gaseous Phase. Millimols Cl per Liter.		Results for dist. between CCl_4 and H_2O. 1st Series. Millimols per Liter.			2nd Series. Millimols per Liter.		
		H_2O Layer.			H_2O Layer.		
Gaseous Phase.	CCl_4 Phase.	Total Cl.	Unhydrolized Cl.	CCl_4. Layer.	Total Cl.	Unhydrolized Cl.	CCl_4. Layer.
0.1109	8.908	58.21	39.67	803.3	61.73	42.55	864.2
0.2666	22.46	38 36	22.97	464.6	42.62	26.36	335.1
0.5365	44.14	23.08	11.12	222.5	28.98	15.24	311.3
0.8800	75.09	10.10	2.707	52.93	21.70	9.94	202.7

Data for the effect of HCl upon the distribution between H_2O and CCl_4 are also given.

Freezing-point data are given for mixtures of chlorine and the following compounds:

Carbon tetrachloride (1) (14)
Chloroform (1) (2) (13)
Methyl Alcohol (1) (2)
Ethyl Alcohol (1) (2)
Methyl Acetate (2)
Ethyl Acetate (1) (2) (3)
Acetone (1) (3)
Ethyl Ether (1) (2)
Hydrochloric Acid (3)
Iodine (8)
Tin tetrachloride (1) (5)
Silicon tetrachloride (5)
Titanium tetrachloride (5)
Sulfur (9).(15)
Sulfur Dioxide (10) (11)
" " + Sulfuryl Chloride
Sulfuryl Chloride (11)
Stannic Chloride (2)
Toluene (2) (3)
Nitrosyl Chloride (6) (12)
Phosphorus oxy tri Chloride (16)
Ethylene Oxide (4)
Tellurium (7)

(1) Waentig and McIntosh, 1915; (2) Waentig and McIntosh, 1916; (3) Maas and McIntosh, 1912; (4) Maas and Boomer, 1922; (5) Biltz and Meinecke, 1923; (6) Trantz and Gerwig, 1925; (7) Damiens, 1923; (8) Stortenbecker, 1888, 1889; (9) Ruff and Fischer, 1903; (10) Smits and Mooy, 1910; (11) Vander Goot, 1913; (12) Boubnoff and Guye, 1911; Wheat II and Browne, 1936; (14) Wheat II and Browne, 1938; (15) Lowry, McHatton and Jones, 1927; (16) Rollet and Graf, 1933.

CHLORINE DIOXIDE $ClO_2.8H_2O \pm 1H_2O$.

SOLUBILITY IN WATER.

(Bray, 1905–06.)

t°.	Gms. ClO_2 per Liter.	Solid Phase.	t°.	Gms. ClO_2 per Liter.	Solid Phase.
−0.79 Eutec.	26.98	$ClO_2.8H_2O$+Ice	15.3	87.04	$ClO_2.8H_2O \pm 1H_2O$
0	27.59	$ClO_2.8H_2O \pm 1H_2O$	10.7 tr. pt.	107.9	" + liquid ClO_2
1	29.48	"	14	more than > 107.9	liquid ClO_2
5.7	42.10	"	10.7	116.7	"
10	60.05	"	1	more than > 108.6	"

The exact composition of the hydrate could not be determined on account of manipulative difficulties.

Data for the distribution of ClO_2 between H_2O and CCl_4 at 0° and 25° are given, also some results showing the effect of H_2SO_4, $KClO_3$ and of KCl on this distribution.

CHLORINE MONOXIDE Cl_2O.

100 volumes of water at 0° absorb 200 volumes of Cl_2O gas.

O **CHLORINE TRIOXIDE** Cl_2O_3.

SOLUBILITY IN WATER AT APPROX. 760 MM. PRESSURE.

(Brandan, 1869.)

t°.	8.5°.	14°.	21°.	93°.
Gms. Cl_2O_3 per 100 gms. H_2O	4.765	5.012	5.445	5.651

Garzarolli and Thurnbalk, 1881, say that Cl_2O_3 does not exist, and above figures are for mixtures of Cl_2O and Cl.

Co **COBALT** Co_2

The solubility of cobalt in mercury was found by Tammann and Kollmann, 1927, by a potentiometric method, to be 0.2×10^{-5} gm. mol. Co per gm. mol. Hg (= 0.00059 gm. Co per 100 gm. Hg) at 17°. Using cobalt amalgam prepared by electrolysis, Irvin and Russel, 1932, found for the upper limit of solubility only 0.00008 gm. Co per 100 gm. Hg.

SOLUBILITY OF COBALT BROMIDE IN WATER.

(Benrath and Schiffers, 1938.)

t°	Gms. $CoBr_2$ per 100 gms. sat. sol.	Gms. $CoBr_2$ per 100 gms. H_2O	Solid Phase	t°	Gms. $CoBr_2$ per 100 gms. sat. sol.	Gms. $CoBr_2$ per 100 gms. H_2O	Solid Phase
0	47.9	91.9	$CoBr_2.6H_2O$	50	66.8	201.2	$CoBr_2.4H_2O$
25	54.4	119.1	"	55	68.3	215.4	"
38	59.8	148.5	"	60	69.4	226.3	" + $CoBr_2.2H_2O$
40	60.9	155.6	"	61	69.6	228.2	$CoBr_2.2H_2O$
42	64.2	179.0	"	63	69.8	231	"
43	65.2	187.5	" + $CoBr_2.4H_2O$	75	70.3	237.0	"
47	66.4	197.5	$CoBr_2.4H_2O$	100	72.0	257.0	"

EQUILIBRIUM IN THE SYSTEM COBALT BROMIDE AMMONIUM BROMIDE AND WATER AT VARIOUS TEMPERATURES

(Benrath and Schiffers, 1933.)

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms sat. sol.		Solid Phase
	$CoBr_2$	$(NH_4)Br$			$CoBr_2$	$(NH_4)Br$	
0	45.0	5.8	Co6 + NH_4Br	50	62.2	9.8	1.2.2
"	36.0	9.3	NH_4Br	55	68.2	1.96	Co4
"	28.5	14.1	"	"	67.5	2.60	"
25	53.4	2.63	Co6	"	67.1	3.55	"
"	52.6	4.90	"	"	66.2	6.86	" + Co2
"	47.8	9.08	" + NH_4Br	"	65.6	8.95	1.2.2 + "
"	44.6	10.05	NH_4Br	"	64.6	9.40	" + "
"	37.7	13.24	"	"	51.9	16.08	" + NH_4Br
"	25.0	21.4	"	"	50.2	16.0	NH_4Br
"	10.76	33.6	"	"	37.1	19.0	"
"	6.30	37.9	"	"	27.7	25.1	"
"	2.45	41.7	"	"	18.22	32.8	"
38	50.0	11.4	Co6 + NH_4Br	"	9.01	41.5	"
40	58.3	2.82	Co6	"	3.85	46.7	"
"	50.2	11.52	" + NH_4Br	75	68.9	3.06	Co2
"	31.6	19.49	NH_4Br	"	64.8	12.86	" + 1.2.2
"	15.74	32.6	"	"	62.4	13.25	1.2.2
"	2.53	45.0	"	"	50.3	21.0	" + NH_4Br
42	62.7	7.60	Co6 + Co4 + 1.1.2	"	31.3	27.5	NH_4Br
"	63.2	3.92	Co4	"	19.19	41.8	"
47	65.4	2.45	C"	"	3.25	51.2	"
"	63.6	8.20	" + 1.2.2	100	69.8	5.40	Co2
"	63.0	8.7	1.2.3	"	65.8	14.4	" + 1.2.2
"	54.8	12.25	"	"	61.9	17.4	1.2.2
				"	41.0	34.5	" + NH_4Br
				"	23.3	40.9	NH_4Br
				"	9.88	50.4	

Br

Co6 = $CoBr_2.6H_2O$; Co2 = $CoBr_2 2H_2O$; 1.2.2 = $CoBr_2.2NH_4Br.2H_2O$

100 gms. methyl acetate (d_{18} = 0.935) dissolve 10.3 gms. $CoBr_2$ at 18°, d_{18} of sat. solution = 1.013. (Naumann 1909.)

SOLUBILITY OF COBALT BROMIDE IN METHYL ALCOHOL AND IN ETHYL ALCOHOL.

(Lloyd, Brown, Glynwyn, Bonnell, and Jones, 1928.)

Results for Methyl Alcohol

t°	Gms. $CoBr_2$ per 100 gms. CH_3OH	Solid Phase
20	43.0	$CoBr_2.6CH_3OH$
30	58.6	"
35	80.0	"
37	94.3	"
40	124.8	$CoBr_2.3CH_3OH$
50	141.9	" (?)
60	153.1	$CoBr_2.2CH_3OH$
70	169.0	"
80	190.6	"

Results for Ethyl Alcohol

t°	Gms. $CoBr_2$ per 100 gms. C_2H_5OH	Solid Phase
10	70.6	$CoCl_2.3C_2H_5OH$
20	77.1	"
30	84.9	"
40	95.9	"
50	105.0	"
60	120.8	"
70	127.1	$CoCl_2.2C_2H_5OH$
80	129.4	"

SOLUBILITY OF COBALT BROMIDE IN ABSOLUTE ACETONE.

(Bell, Rowlands, Bamford, Thomas and Jones, 1930.)

t°	Gms. $CoBr_2$ per 100 gms. CH_3COCH_3	Solid Phase	t°	Gms. $CoBr_2$ per 100 gms. CH_3COCH_3	Solid Phase
0	54.1	$CoBr_2.C_3H_6O$	27	68.7	$CoBr_2.C_3H_6O$
10	54.3	"	30	69.6	"
25	65.0	"	40	92.4	"

COBALT METHIONATE $CoCH_2O_6S_2.5H_2O$.

100 gms. H_2O dissolve 120.3 gms. $Co\ CH_2O_6S_2$ at 25°. (Baker and Terpstra, 1929.)

COBALT ACETATE $Co(CH_3COO)_2$.

100 gms. methyl alcohol dissolve 1.49 gm. $Co(CH_3COO)_2$ at 15° and 5.50 gms. at 66.4° (b.pt.). (Henstock, 1934.)

100 cc. anhydrous hydrazine dissolve 1.0 gm. cobalt acetate with evolution of gas at room temp. (Welsh and Broderson, 1915.)

CH **COBALT FUMARATE** $Co.C_4H_2O_4.4H_2O$.

100 gms. H_2O dissolve 0.88 gm. $Co\ C_4\ H_2\ O_4$ at 30°. (Weiss and Downs, 1923.)

COBALT MALATE $Co(COO.CH_2.CHOHCOO).2H_2O$.

100 cc. sat. solution in water contain 0.14 gm. Co = 0.453 gm. anhydrous salt at 10°. (Pickering, 1915.)

COBALT MALONATES.

SOLUBILITY OF COBALT MALONATES IN WATER.

(Lord, 1907.)

Salt.	Formula.	t°	Gms. Anhydrous Salt per 100 Gms. Sat. Sol.
Cobalt Malonate	$CoCH_2(COO)_2.2H_2O$	18	1.353
" Ammonium Malonate	$Co(NH_4)_2[CH_2(COO)_2]_2.4H_2O$	18	10.61
" Caesium "	$CoCs_2[CH_2(COO)_2]_2.4H_2O$	18	14.23
" Potassium "	$CoK_2[CH_2(COO)_2]_2.4H_2O$	18	4.26

COBALT CITRATES.

SOLUBILITY IN WATER.

(Pickering, 1915.)

Salt.	Formula.	t°.	Gms. per 100 cc. Sat. Sol. Co =	Gms. per 100 cc. Sat. Sol. Salt (anhydrous).
Cobalt Citrate (normal)	$Co_3[(COO.CH_2)_2C(OH)COO]_2.2H_2O$	10	0.08	0.267
Cobalt Hydrogen Citrate	$CoH[(COO.CH_2)_2C(OH)COO]$	10	0.20	0.906
Cobalt Potassium Citrate	$KCo[(COO.CH_2)_2C(OH)COO].4H_2O$	10	1.05	5.11
Cobalt Potassium Citrate	$K_4Co[(COO.CH_2)_2C(OH)COO]_2$	10	3.04	31

COBALT Nitroso phenyl **HYDROXYLAMINE** (Cupferronate) $Co[C_6H_5N(NO)O]_2$

One liter sat. solution in water contains 0.0013 gm. atoms Co (=0.077 gm. Co) at 18°. (Pinkus and Martin, 1927.)

COBALT BENZOATE, CHLORO BENZOATE, etc.

Solubility of Each in Water at 20°. (Ephraim and Pfister, 1928.)

Compound.	Formula.	Gms. anhydrous compound per 100 cc. sat. sol.
Cobalt benzoate...............	$(C_6H_5COO)_2Co.4H_2O$	1.013
» -4-chloro benzoate....	$(C_6H_4.Cl.COO)_2Co.4H_2O$	1.720
» -4-methoxy »	$(C_6H_4.OCH_3.COO)_2Co.3H_2O$	0.9934
» -4-nitro »	$(C_6H_4.NO_2.COO)_2Co.6H_2O$	0.893
» -4-oxy »	$(C_6H_4.OH.COO)_2Co.7H_2O$	1.254
» cinnamate.............	$C_{18}H_{14}O_4Co.2H_2O$	0.302

COBALT Benzene SULFONATE $(C_6H_5SO_3)_2Co.6H_2O$.

Solubility of Cobalt Benzene Sulfonate in Water.
(Ephraim and Segor, 1925; Ephraim and Pfister, 1925.)

t°........	17°.	20°.	38°.	50°.	68°.	80°.5.
Gms. $(C_6H_5SO_3)_2Co$ per 100 cc. sat. sol.	7.535	7.778	11.086	14.144	19.717	26.735

COBALT Xylol SELENATES and SULFONATE.

CH

Solubility of Each in Water. (Anschütz, Kallen and Riepenkröger, 1919.)

Compound.	Formula.	t°	Gms. anhydrous cmpd per 100 gms. H_2O.
Cobalt ortho xylol selenate..	$[(CH_3)_2.1.2.C_6H_3.4.SeO_3]_2Co.5H_2O$	18°	0.66
» para » ..	$[(CH_3)_2.1.4.C_6H_3.4.SeO_3]_2Co.9H_2O$	15°	1.38
» ortho » sulfonate.	$[(CH_3)_2.1.2.C_6H_3.4.SO_3]_2Co.5H_2O$	16°	2.10

Solubility of Several Cobalt Sulfonates in Water.
(Ephraim and Pfister, 1926.)

Compound.	Formula.	t°	Gms. anhydrous cmpd. per 100 cc. sat. sol.
Cobalt anthracene-1-sulfonate..........	$(C_{14}H_9SO_3)_2Co.6H_2O$	20	0.391
» » -2- »	$(C_{14}H_9SO_3)_2Co.6H_2O$	20	0.00519
» naphtalene-1- »	$(C_{10}H_7SO_3)_2Co.6H_2O$	17	6.417
» » -2- »	$(C_{10}H_7SO_3)_2Co.6H_2O$	20	0.209
» » » »	» »	32	0.312
» » » »	» »	45	0.455
» » » »	» »	59	0.737
» » » »	» »	74	1.216
» » » »	» »	82	1.568
» » -5-Chlor-1-Sulfonate..	$(C_{10}H_6SO_3Cl)_2Co.4H_2O$	20	0.709
» » -6-Oxy-2 » ..	$(C_{10}H_7SO_3)_2Co.6H_2O$	20	0.500
» 2.6.8 naphthylamine disulfonate.	$C_{10}H_5NH_2.(SO_3)_2Co$	15	27.96*
» 2.5.7 » » ..	» »	»	29.4*

*These determinations are by Braunschweig 1922, 1926; and refer to grams per 100 gms. of the sat. solution instead of gms. per 100 cc. sat. solution.

COBALT Pyridine NITRATE $Co(NO_2)_3.3C_5H_5N$.

100 gms. sat. solution of $Co(NO_2)_3.3C_5H_5N$ in pyridine contain 0.20 gm. Co at 0°, 0.29 gm. at 10°, 0.40 gm. at 20° and 0.49 gm. at 25°. (Le Boucher, 1926.)

COBALT HELIANTHATE $Co(C_{14}H_{14}N_3SO_3)_2.4H_2O$.

1000 cc. H_2O dissolve 0.036 gm. of the hydrated salt at 20-25°. (Stark and Dehn, 1918.)

COBALT CYANIDE $Co(CN)_2$

CN

One liter sat. solution of cobalt cyanide in water contains 3.77×10^{-4} gm. mols. $Co(CN)_2$ at 18° determined by the potentiometric method. (Masaki, 1931.)

COBALT THIOCYANATE $Co(SCN)_2.4H_2O$

One liter sat. solution of cobalt thiocyanate in water contains 0.341 gm. mols. $Co(SCN)_2$ at 18°(= 59.71 gms. $Co(SCN)_2$) determined by the potentiometric method. (Masaki, 1931.)

100 gms. sat. solution in water contain 50.7 gms. $Co(SCN)_2$ at 25°. (de Sweemer, 1932.)

Data for equilibrium in the systems $Co(SCN)_2 + KSCN + H_2O$ and $Co(SCN)_2 + Ni(SCN)_2 + H_2O$ at 25° are also given by de Sweemer, 1932.

100 gms. liquid sulfur dioxide dissolve 0.076 gm. $Co(SCN)_2$ at 0° Jander and Ruppolt, 1937.)

COBALT NITROPRUSSIATE $CoFe(CN)_5.NO.4H_2O$

One liter sat. solution of cobalt nitroprussiate in water contains 2.0×10^{-4} gm. mols. $CoFe(CN)_5.NO$ at 20°. (Tomicek and Kubik, 1937.)

COBALT Mercury THIOCYANATE $CoHg(SCN)_4$

CNS

SOLUBILITY OF COBALT MERCURY THIOCYANATE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE.

(Cuvelier, 1936.)

Weighed amounts of $CoHg(SCN)_4$ and measured volumes of standardized solutions of ammonium chloride were rotated in sealed tubes at a very gradually rising temperature and the point noted at which the last trace of solid just disappeared. The determinations can be made only with very finely divided $CoHg(SCN)_2$.

Normality of NH_4Cl	Gms. $CoHg(SCN)_2$ per 100 gms. sat. sol.	t° of solution	Normality of NH_4Cl	Gms. $CoHg(SCN)_2$ per 100 gms. sat. sol.	t° of solution
0.02344	0.1851	58.1	0.3750	0.7964	65.7
"	0.2146	61.5	"	0.9301	71.3
"	0.2823	67.7	0.7500	0.5661	37.2
"	0.3247	71.8	"	0.6446	41.8
0.046875	0.2250	55.5	"	0.7045	48.9
"	0.2887	61.4	"	0.8854	55.4
"	0.3608	67.9	"	0.9945	60.4
"	0.4313	73.8	"	1.048	62.7
"	0.4587	76.1	"	1.186	67.8
0.09375	0.3210	56.7	1.58	0.7201	32.8
"	0.3407	58.5	"	0.8241	40.4
"	0.4376	65.8	"	1.136	52.5
"	0.4774	69.0	"	1.158	53.4
"	0.4895	69.9	"	1.189	54.3
0.1875	0.3874	54.2	"	1.340	59.4
"	0.4402	57.5	"	1.491	63.9
"	0.5083	62.1	3.00	1.203	39.4
"	0.5743	67.0	"	1.286	43.3
"	0.6048	68.9	"	1.472	50.7
0.3750	0.4576	45.3	"	1.579	54.2
"	0.5037	47.9	"	1.864	63.4
"	0.5774	52.6	"	2.108	69.4
"	0.6448	56.8	"	2.335	74.5
"	0.7392	62.8	"	2.654	79.8

COBALT Potassium **CARBONATE** $CoK_2(CO_3)_2.4H_2O$.

Data for the solubility of this double salt in aqueous solutions of potassium carbonate and bicarbonate at 18° are given by Appleby and Lane, 1918. In the absence of $KHCO_3$ basic compounds precipitate before attainment of equilibrium. Results are given for solutions containing an excess of $KHCO_3$. The concentrations of cobalt were about 0.1 to 0.2 gm. per liter.

COBALT OXALATE $Co(COO)_2.2H_2O$.

SOLUBILITY OF COBALT OXALATE IN WATER AND IN AQUEOUS SOLUTIONS OF FORMIC ACID AT 25°.

(Ledrut and Hauss, 1932.)

COO

Solvent	Gms. $Co(COO)_2$ per liter sat. sol.
Water alone	0.0346
Aq. 25% HCOOH	0.0143
" 50% "	0.0158
" 75% "	0.0238
" 100% "	0.0413

One liter sat. solution of cobalt oxalate in water contains 0.0211 gm. $Co(COO)_2$ at 18°, determined by electrolytic conductivity (Scholder, 1927; Scholder, Gadenne and Niemann, 1927.)

100 gms. 95% formic acid dissolve 0.04 gm. $Co(COO)_2$ at 19.8°. (Aschan, 1913.)

COBALT CHLORIDE $CoCl_2.6H_2O$.

SOLUBILITY OF COBALT CHLORIDE IN WATER

Cl

The fairly closely agreeing results of the following investigators were plotted on cross section paper and the table below constructed from the average curve so obtained: Benrath, 1934; Benrath, 1927; Bassett and Sanderson, 1932; Cuvelier, 1931; Foote, 1923, 1927; Mazzetti, 1926 and Osaka and Yaginuma, 1928. The earlier results of Etard, 1891, 1894, are probably in error.

t°	Gms. $CoCl_2$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $CoCl_2$ per 100 gms. sat. sol.	Solid Phase
0	30.3	$CoCl_2.6H_2O$	55	47.6	$CoCl_2.4H_2O$
10	32.3	"	58	48.4	" + $CoCl_2.2H_2O$.
20	34.6	"	60	48.4	$CoCl_2.2H_2O$
25	36.0	"	70	48.8	"
30	37.4	"	80	49.4	"
40	41.0	"	90	50.3	"
49	46.0	" + $CoCl_2.4H_2O$	100	51.5	"
50	46.2	$CoCl_2.4H_2O$			

EQUILIBRIUM IN THE SYSTEM COBALT CHLORIDE, COBALT SULFATE AND WATER AT 25°.

(Langower, 1933.)

Gms. per 100 gms. sat. sol. $CoCl_2$	Gms. per 100 gms. sat. sol. $CoSO_4$	Solid Phase	Gms. per 100 gms. sat. sol. $CoCl_2$	Gms. per 100 gms. sat. sol. $CoSO_4$	Solid Phase
36.00	0.0	$CoCl_2.6H_2O$	9.45	16.4	$CoSO_4.7H_2O$
33.8	3.6	"	5.6	20.1	"
32.8	4.6	" + $CoSO_4.7H_2O$	3.0	22.5	"
26.8	6.1	$CoSO_4.7H_2O$	1.8	23.8	"
23.5	6.7	"	0.8	25.4	"
20.3	9.6	"	0.0	26.8	"
15.5	11.3	"			

The author also gives data for the reciprocal salt pair $CoCl_2$ + $K_2SO_4 \rightleftharpoons CoSO_4 + K_2Cl_2$ at 25°.

Cl

EQUILIBRIUM IN THE SYSTEM COBALT CHLORIDE, CAESIUM CHLORIDE AND WATER AT 25°.

(Foote, 1927.)

Gms. per 100 gms. sat. sol. $CoCl_2$	Gms. per 100 gms. sat. sol. CsCl	Solid Phase	Gms. per 100 gms. sat. sol. $CoCl_2$	Gms. per 100 gms. sat. sol. CsCl	Solid Phase
35.67	0.0	$CoCl_2.6H_2O$	12.76	32.6	1.2
35.73	1.65	" + 1.1.2	10.42	37.63	"
35.60	2.07	1.1.2	8.98	40.56	" + 1.3
32.58	3.62	"	7.75	42.76	1.3
30.82	6.12	"	0.45	64.50	"
31.09	5.03	" + 1.2	0.25	64.48	" + CsCl
22.57	16.22	1.2	0.0	65.61	CsCl

1.1.2 = $CoCl_2.CsCl.2H_2O$; 1.2 = $CoCl_2.2CsCl$; 1.3 = $CoCl_2.3CsCl$

Results for this same system, agreeing with the above, are given by Benrath, 1927.

SOLUBILITY OF COBALT CHLORIDE IN AQUEOUS SOLUTIONS OF COPPER CHLORIDE AT 25° AND VICE VERSA.

(Bassett, Henshall, Sergeant and Shipley, 1930.)

Gms. per 100 gms. sat. sol. $CuCl_2$	Gms. per 100 gms. sat. sol. $CoCl_2$	Solid Phase	Gms. per 100 gms. sat. sol. $CuCl_2$	Gms. per 100 gms. sat. sol. $CoCl_2$	Solid Phase
0.0	35.87	$CoCl_2.6H_2O$	25.62	17.48	$CuCl_2.2H_2O$
5.34	33.19	"	30.33	12.66	"
9.99	30.50	"	34.00	8.99	"
15.08	27.48	"	39.29	4.34	"
18.01	26.06	" + $CuCl_2.2H_2O$	44.00	0.0	"

COBALT CHLORIDE $CoCl_2.6H_2O$

EQUILIBRIUM IN THE SYSTEM COBALT CHLORIDE, FERRIC CHLORIDE AND WATER AT 25°.

(Osaka and Yaginuma, 1928.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$CoCl_2$	$FeCl_3$		$CoCl_2$	$FeCl_3$	
36.08	0.0	$CoCl_2.6H_2O$	6.58	43.95	$FeCl_3.6H_2O$
29.36	7.77	"	5.99	44.50	"
20.95	19.08	"	2.47	47.17	"
10.13	35.52	"	4.74	51.57*	$CoCl_2.2H_2O.FeCl_3.6H_2O$
7.99	41.07	"	0.0	49.42	$FeCl_3.6H_2O$
7.42	43.31	" $FeCl_3.6H_2O$			

Unstable

The authors also give data for the quarternary system $CoCl_2$ - $FeCl_3$ $NiCl_2$ + H_2O at 25°.

SOLUBILITY OF COBALT CHLORIDE IN AQUEOUS HYDROCHLORIC ACID SOLUTIONS AT 0°.

(Engel — Ann. chim. phys. [6] 7, 355, '89.)

C1

Milligram Mols. per 10 cc. Sol.		Sp. Gr. of Solutions.	Gms. per 100 Gms. Solution.		Gms. per 100 cc. Solution.	
½$CoCl_2$	HCl.		$CoCl_2$.	HCl.	$CoCl_2$.	HCl.
62.4	0	1.343	30.17	0.00	40.5	0
58.52	3.7	1.328	28.62	0.102	38.0	0.135
50.8	11.45	1.299	25.39	0.321	33.0	0.417
37.25	25.2	1.248	19.43	0.738	24.2	0.919
12.85	55 0	1.167	7.15	1.718	8.34	2.00
4.75	74.75	1.150	2.68	2.369	3.08	2.72
12.0	104.5	1.229	6.34	3.099	7.79	3.81
25.0	139.0	1.323	12.27	3.829	16.24	5.07

SOLUBILITY OF COBALT CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 0°.

(Foote, 1923.)

Gms per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms sat. sol.		Solid Phase.
$CoCl_2$.	HCl.		$CoCl_2$.	HCl.	
31.66	0.00	$CoCl_2.6H_2O$	6.34	29.38	$CoCl_2.6H_2O$
25.58	3.26	"	9.91	29.15	"
17.78	8.74	"	11.58	28.97	"
12.79	12.44	"	12.42	29.14	" + $CoCl_2.2H_2O$
5.97	19.01	"	12.88	28.84	" "
4.74	20 51	"	12.66	30.27	$CoCl_2.2H_2O$
2.69	25 66	"	15.11	33.03	"
3.07	27.27	"	15.12	33 86	"

The following additional determinations for this system are given by Bassett and Harry, 1930.

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms. sat. sol.		Solid Phase
	$CoCl_2$	HCl			$CoCl_2$	HCl	
-20	12.52	42.78	$CoCl_2.2H_2O$	0	13.68	32.80	$CoCl_2.2H_2O$
-15	11.40	41.10	"	0	15.54	30.24	"
0	11.55	29.39	"	0	15.85	36.04	"

SOLUBILITY OF COBALT CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 25°.

(Bassett and Harry, 1930.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$CoCl_2$	HCl		$CoCl_2$	HCl	
35.87	0.0	$CoCl_2.6H_2O$	17.84	24.50	$CoCl_2.2H_2O$
28.54	5.29	"	17.55	25.63	"
22.78	9.34	"	17.90	28.08	"
18.57	12.76	"	18.09	29.10	"
14.05	17.66	"	18.37	29.95	"
12.77	20.50	"	17.62	30.94	"
13.10	21.09	"	18.32	31.37	"
13.90	22.0	"	19.48	29.57	"
15.50	22.51	"	20.14	31.06	"
18.59	22.84	" + $CoCl_2.2H_2O$	21.00	31.10	"
18.18	23.45	$CoCl_2.6H_2O$			

EQUILIBRIUM IN THE SYSTEM COBALT CHLORIDE MERCURY CHLORIDE AND WATER AT 25°.

(Bassett and Harry, 1930.)

Cl

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$CoCl_2$	$HgCl_2$		$CoCl_2$	$HgCl_2$	
35.87	0.0	$CoCl_2.6H_2O$	18.02	57.81	1.1.4 + $HgCl_2$
30.69	15.14	"	15.14	56.54	$HgCl_2$
26.04	30.68	"	13.95	54.92	"
23.38	41.25	"	8.59	37.39	"
21.54	51.00	" + 1.1.4	6.70	30.25	"
20.96	51.76	1.1.4	4.33	21.56	"
19.50	54.34	"	0.0	6.90	"
18.34	56.95	"			

1.1.4 = $CoCl_2.HgCl_2.4H_2O$.

Results for this system at 25° are also given by Benrath, 1927, but this investigator failed to find the double salt.

SOLUBILITY OF COBALT CHLORIDE AT 20° IN AQUEOUS SOLUTIONS OF:

(Mazzetti, 1926.)

Potassium Chloride.			Sodium Chloride.		
Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
$CoCl_2$.	KCl.		$CoCl_2$.	NaCl.	
33.52	4.73	$CoCl_2.6H_2O$	34.98	0.00	$CoCl_2.6H_2O$
33.15	6.81	» + KCl	33.38	3.35	»
31.58	6.79	KCl	33.05	3.65	» + NaCl
29.17	7.19	»	32.84	3.91	NaCl
28.37	7.70	»	28.26	6.07	»
27.90	8.69	»	27.73	6.63	»
26.45	8.45	»	21.45	10.32	»
20.25	11.56	»	13.63	15.71	»
14.05	15.05	»	8.20	19.40	»
7.40	19.37	»	0.00	26.09	»

EQUILIBRIUM IN THE SYSTEM COBALT CHLORIDE, POTASSIUM CHLORIDE AND WATER AT 25°.

(Foote, 1927.)

Gms. per 100 gms. sat. sol. $CoCl_2$	KCl	Solid Phase	Gms. per 100 gms. sat. sol. $CoCl_2$	KCl	Solid Phase
35.07	0.0	$CoCl_2.6H_2O$	33.25	8.09	KCl
35.20	2.43	"	24.71	10.19	"
34.77	4.43	"	16.09	14.19	"
34.53	6.22	"	7.50	20.29	"
34.10	8.24	" + KCl	0.0	20.40	"

Results in agreement with the above are given by Benrath, 1927.

EQUILIBRIUM IN THE RECIPROCAL SALT PAIR $CoCl_2 + K_2SO_4 \rightleftarrows CoSO_4 + (KCl)_2$ AT 38°.

(Benrath and Ritter, 1930.)

Cl

Gms. per 100 gms. sat. sol. Cl_2	SO_4	K_2	Co	Solid Phase
13.30	0.72	15.08	0.0	KCl + K_2SO_4
13.60	1.04	13.20	1.95	" "
13.75	1.49	12.35	2.97	" "
13.33	1.80	12.13	3.43	" "
12.52	2.29	11.10	3.40	" "
13.85	2.01	11.85	3.80	" " + 1.1.6
13.78	1.90	11.35	4.04	" + 1.1.6
13.05	1.95	24.8	4.20	" "
14.25	2.02	11.10	4.68	" "
15.15	2.09	8.93	7.12	" "
14.0	2.20	8.28	6.70	" "
15.30	2.26	9.10	7.16	" "
0.01	10.25	6.00	1.78	K_2SO_4 + 1.1.6
2.27	7.35	6.22	1.72	" "
5.03	5.16	7.32	1.83	" "
10.90	2.59	10.50	2.73	" "
12.93	1.87	11.03	3.56	" "
26.7	0.0	4.50	18.15	KCl + $CoCl_4.6H_2O$
26.5	0.52	5.34	18.24	" "
26.3	1.14	3.45	18.4	" "
24.4	2.48	4.93	18.0	" " + $CoSO_4.6H_2O$
0.0	21.3	1.85	11.7	$CoSO_4.7H_2O$ + 1.1.6
7.9	11.68	2.06	12.08	" " + $CoSO_4.6H_2O$
19.30	2.91	0.0	18.30	$CoSO_4.6H_2O$ + $CoCl_2.6H_2O$

1.1.6 = Schönite $CoSO_4.K_2SO_4.6H_2O$.

A number of additional points are given in terms of mols. of dry salts and number of molecules of water per 1 mol. of anhydrous salt mixture.

The authors give similar results for the isotherms at 0°, 50°, 75° and 99.5°.

EQUILIBRIUM IN THE SYSTEM COBALT CHLORIDE, LITHIUM CHLORIDE AND WATER AT SEVERAL TEMPERATURES.

(Bassett and Sanderson, 1932.)

Gms. per 100 gms. sat. sol.		Solid	Gms. per 100 gms. sat. sol.		Solid	Gms. per 100 gms. sat. sol.		Solid
$CoCl_2$	LiCl	Phase	$CoCl_2$	LiCl	Phase	$CoCl_2$	LiCl	Phase
Results at 0°			Results at 25° (Con.)			Results at 45°		
29.50	0.0	Co6	15.53	33.85	2.7.18	32.93	12.78	Co2
6.92	21.30	"	13.08	35.44	"	29.76	15.84	"
4.75	25.67	"	10.75	36.98	"	26.13	20.33	"
7.71	31.90	"	9.00	38.31	"	25.52	28.56	"
11.06	31.73*	"	5.58	41.95	"			
13.81	31.32*	Co2	4.55	43.11	" + ss	Results at 60°		
13.87	29.48*	"+2.7.18	2.40	44.39	ss			
10.47	31.56	Co6+2.7.18	0.0	45.85	Li1	30.23	28.80	Co2
8.45	33.21	2.7.18				30.62	28.67	"+1.1.2
4.41	36.24	"	Results at 40°			28.62	30.57	1.1.2+2.
2.82	37.68	"				27.84	31.64	1.1.2
0.88	40.48	"+Li2	40.96	0.0	Co6			
0.00	40.87	Li2	37.31	3.33	"	Results at 80°		
			31.60	8.60	"			
Results at 25°			31.35	13.94	"	49.5	0.0	Co2
			30.85	14.04	"+Co2	33.23	17.19	"
35.87	0.0	Co6	22.40	25.10	Co2	31.67	26.67	"
26.81	7.82	"	23.35	28.19	"	32.84	28.44	"+1.1.2
17.11	18.61	"	25.71	30.06*	"	30.73	31.01	1.1.2
19.36	23.36	"	24.99	30.06	"+2.3.6	29.26	32.81	"
20.56	23.48	"+Co2	24.30	30.68	2.3.6	27.56	35.02	"
19.69	25.07	Co2	19.51	34.29	"	27.49	35.20	"
18.72	28.94	"	18.97	34.29	"	26.29	37.25	"+ss
20.32	31.06	"	16.36	36.75	"	25.85	37.48	ss
20.16	31.12	2.3.6	13.19	39.74	"+ss	24.99	37.93	"
19.20	32.19	"	16.04	38.66*	ss	24.38	38.23	"
17.25	33.24*	"	7.97	42.71	"	17.16	42.09	"
18.30	32.56	"+2.7.18	4.17	44.88	"	14.26	43.90	"
17.60	32.96	2.7.18	0.0	47.47	Li1	0.0	52.71	Li1

Cl

Co6 = $CoCl_2.6H_2O$; Co2 = $CoCl_2.2H_2O$; 2.3.6 = $2CoCl_2.3LiCl.6H_2O$; 2.7.18 = $2CoCl_2.7LiCl.18H_2O$; 1.1.2 = $CoCl_2.LiCl.2H_2O$; Li2 = $LiCl2H_2O$; Li1 = $LiClH_2O$; ss = Solid Solution.

This system was also studied at 25° by Benrath, 1927, but erroneous conclusions were drawn as a result, according to Bassett, of an insufficient number of determinations.

In a subsequent paper Hanna Benrath, 1938-9, gives results for 16 different temperatures and constructs the polythermic diagram for the syst A method of preparing the saturated solutions designed to avoid metastability was employed and it was found that after sufficient rotation the anomalous solid solutions reported by Bassett and Sanderson, 1932, gave place to cobalt chloride tetra hydrate which they failed to obtain In other respects however, equilibrium is easily attained and the remai ing results agree satisfactorily with those of Bassett and Sanderson.

The author gives the following values for solutions simultaneously saturated with two and with three salts.

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms. sat. sol.		Solid Phase
	$CoCl_2$	LiCl			$CoCl_2$	LiCl	
0	0.89	40.5	Li2 - D10	11	16.96	32.4	D10 + Co4 + Co6
0	9.08	32.2	Co6 - "	13	17.24	32.3	" + " - Co2
48	45.5	0.0	" - Co4	24	18.95	32.3	" + D4 - "
56.5	41.1	0.0	Co2 - "	57.5	29.5	28.0	D2 + " - "
100.	34.8	27.8	" - D2	20.	1.86	44.1	Li1 + Li2 + D10
100	28.4	35.1	Li - "	32.5	9.15	41.8	" - D4 + "
92.5	0.0	54.6	" - Li1	65	21.8	37.5	" + " - D2
20	0.0	45.3	Li2 + "	87.5	26.8	37.4	" - Li - "

Co6 = $CoCl_2.6H_2O$; Co4 = $CoCl_2.4H_2O$; Co2 = $CoCl_2.2H_2O$; Li2 = $LiCl.2H_2O$; Li1 = $LiCl.H_2O$; Li = LiCl; D10 = $CoCl_2.4LiCl.10H_2O$; D4 = $CoCl_2.2LiCl.4H_2O$; D2 = $CoCl_2.LiCl.2H_2O$.

EQUILIBRIUM IN THE SYSTEM COBALT CHLORIDE, MAGNESIUM CHLORIDE AND WATER AT 25°.

(Bassett and Harry, 1930.)

C1

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$CoCl_2$	$MgCl_2$		$CoCl_2$	$MgCl_2$		$CoCl_2$	$MgCl_2$	
35.87	0.0	Co6	12.43	28.89	Co6+1.1.8	7.10	32.52	Mg6
28.78	6.20	"	11.61	29.72	1.1.8	6.65	32.80	"
19.16	15.40	"	10.54	30.54	"	4.97	33.55	"
12.56	22.70	"	10.00	31.00	"	3.93	34.30	"
11.09	28.78	"	8.95	31.06	"+Mg6	2.57	34.83	"
12.08	29.04	"	8.64	31.95.	Mg6	0.0	36.20	"

Co6 = $CoCl_2.6H_2O$; Mg6 = $MgCl_2.6H_2O$; 1.1.8 = $CoCl_2.MgCl_2.8H_2O$.

The analyses of the saturated solutions were made with considerable difficulty. The previous determinations of Benrath, 1927, at 25° were insufficient in number and accuracy to enable him to recognize the double compound $CoCl_2.MgCl_2.8H_2O$.

SOLUBILITY OF COBALT AMMONIUM CHLORIDES IN WATER.

(Kurnakoff — J. russ. phys. chem. Ges. 24, 629, '93; J. Chem. Soc. 64, ii, 509, '93.)

Salt.	Grams per 100 Grams H_2O at:		
	0°.	16.9°.	46.6°.
$CoCl_3.5NH_3$	0.232	...	1.031
$CoCl_3.5NH_3.H_2O$	16.12	24.87	...
$CoCl_3.6NH_3$	4.26	...	12.74

SOLUBILITY OF MIXTURES OF AMMONIUM CHLORIDE AND COBALT CHLORIDE IN WATER AT 25°.

(Foote, 1912.)

Gms per 100 Gms Sat. Sol.		Gms per 100 Gms Solid Residue			Solid Phase.
NH_4Cl	$CoCl_2$	NH_4Cl	$CoCl_2$	H_2O	
17.90	15.63	...	3.2	...	Mixed crystals of $NH_4Cl+CoCl_2.2H_2O$
13.59	25.19	83.01	13.52	3.47	
8.75	34.28	35.12	50.66	14.22	
7.45	35.24	34.02	49.64	16.31	Mixed crystals + $CoCl_2.6H_2O$
7.62	34.61	7.07	55.27	37.66	

EQUILIBRIUM IN THE SYSTEM COBALT CHLORIDE, AMMONIUM CHLORIDE AND WATER AT 25°.

(Benrath, 1927.)

Dissolved Gm. mols.		Gm. mols. H_2O to dissolve 1 gm. mol. $CoCl_2$ + NH_4Cl	Dissolved Gm. mols.		Gm. mols. H_2O to dissolve 1 gm. mol. $CoCl_2$ + NH_4Cl
$CoCl_2$	NH_4Cl		$CoCl_2$	NH_4Cl	
1.00	0.0	12.65	0.423	0.577	8.15
0.843	0.157	10.7	0.346	0.654	8.28
0.748	0.252	9.95	0.257	0.743	8.23
0.672	0.328	8.62	0.134	0.866	8.01
0.658	0.342	8.39	0.000	1.00	7.44

THE SYSTEM AMMONIUM CHLORIDE + COBALT CHLORIDE + WATER AT 60°.

(Clendinnen, 1922.)

The temperature 60° was chosen in order to avoid the presence of hydrates higher than the dihydrate and thus simplify the study of the series of mixed crystals which are formed. Both the saturated solutions and the solid phases were analyzed.

Cl

d of sat. sol.	Gms. per 100 gms. sat. sol.		% NH_4Cl in mixed crystals (extrapolated).	*d* of sat. sol.	Gms. per 100 gms. sat. sol.		% NH_4Cl in mixed crystals (extrapolated).
	NH_4Cl.	$CoCl_2$.			NH_4Cl.	$CoCl_2$.	
1.164	29.10	10.11	96.2	1.580	3.44	47.44	12.7
1.240	25.25	17.53	88.8	1.575	2.59	48.06	8.0
1.329	21.32	25.86	67.6	1.592	2.21	48.21	6.7
1.362	18.15	30.66	55.8	1.587	1.79	48.37	2.6
1.380	17.74	31.24	52.7 (unstable)	1.585	0.90	48.62	1.1
–	14.96	34.84	45.2 »	–	16.87	30.91	40.0
1.454	13.08	37.05	37.9 »	1.401	14.21	33.66	40.0
1.482	10.36	40.14	31.0	1.414	13.57	34.36	38.8
1.504	9.04	41.42	29.4	–	12.93	35.02	38.8
1.530	6.90	43.56	25.0	–	12.56	35.64	38.8
1.559	5.02	45.74	21.2	–	11.80	37.01	38.4

EQUILIBRIUM IN THE SYSTEM COBALT CHLORIDE, SODIUM CHLORIDE AND WATER AT 25°.

(Foote, 1927.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$CoCl_2$	NaCl		$CoCl_2$	NaCl	
35.67	0.0	$CoCl_2.6H_2O$	25.82	7.82	NaCl
34.59	2.01	"	16.00	14.11	"
33.22	4.23	"	7.17	20.73	"
32.92	4.69	" + NaCl	0.0	26.50	"
31.62	4.58	NaCl			

EQUILIBRIUM IN THE SYSTEM COBALT CHLORIDE, SODIUM CHLORIDE AND WATER AT 98°.

(Benrath, 1927.)

Dissolved Gm. mols.		Gm. mols. H_2O to dissolve 1 gm. mol. $CoCl_2$ + NaCl	Dissolved Gm. mols.		Gm. mols. H_2O to dissolve 1 gm. mol. $CoCl_2$ + NaCl
$CoCl_2$	NaCl		$CoCl_2$	NaCl	
1.00	0.00	6.67	0.310	0.690	8.32
0.9063	0.0937	6.15	0.170	0.830	8.48
0.8046	0.1954	5.44	0.107	0.893	8.56
0.7460	0.2540	5.14	0.030	0.970	8.58
0.7210	0.2790	5.49	0.000	1.000	8.33
0.547	0.453	7.56			

EQUILIBRIUM IN THE SYSTEM COBALT CHLORIDE, SODIUM CHLORIDE AND WATER AT SEVERAL TEMPERATURES.

(Benrath and Neumann, 1938-9.)

t°	Gms. per 100 gms. sat. sol.		Solid Phase
	$CoCl_2$	NaCl	
25	35.3	1.8	$CoCl_2.6H_2O$
"	33.2	4.0	"
"	33.0	4.5	" + NaCl
"	23.8	9.15	NaCl
"	18.6	12.20	"
"	13.5	15.62	"
"	7.02	20.00	"
"	2.64	25.2	"
38	38.8	2.63	$CoCl_2.6H_2O$
"	38.3	3.34	" + NaCl
"	27.8	7.61	NaCl
"	17.35	12.7	"
"	9.15	18.1	"
45	42.9	2.64	$CoCl_2.6H_2O$ + NaCl
50	46.0	1.8	$CoCl_2.4H_2O$
"	46.0	2.5	"
"	45.1	2.64	" + NaCl
50	13.0	17.3	NaCl
"	7.3	21.2	"
"	4.93	23.3	"
51	45.2	2.61	$CoCl .4H_2O$ + NaCl
60	49.1	0.27	$CoCl_2.2H_2O$
"	48.3	2.02	"
"	47.5	2.42	"
100	50.3	2.30	$CoCl_2.2H_2O$
"	50.1	3.63	"
"	49.4	4.99	"
"	48.6	5.30	"
"	50.0	5.76	" + NaCl
"	44.4	6.44	NaCl
"	37.2	9.04	"
"	24.9	14.16	"
"	9.90	21.7	"

EQUILIBRIUM IN THE SYSTEM COBALT CHLORIDE, NICKEL CHLORIDE AND WATER AT 25°.

Cl

(Osaka and Yaginuma, 1928.)

Gms. per 100 gms. sat. sol.		Solid Phase
$CoCl_2$	$NiCl_2$	
36.08	0.0	$CoCl_2.6H_2O$
32.06	4.31	$(Co.Ni)Cl_2.6H_2O$
26.17	10.45	"
23.42	13.39	"
14.87	22.51	"
11.83	26.13	$(Co.Ni)Cl_2.6H_2O$
7.66	30.63	"
6.28	31.91	"
4.38	34.36	"
0.0	38.88	$NiCl_2.6H_2O$

These chlorides form a complete series of solid solutions with six molecules of water of crystallization.

EQUILIBRIUM IN THE SYSTEM COBALT CHLORIDE, RUBIDIUM CHLORIDE AND WATER AT 25°.

(Foote, 1927.)

Gms. per 100 gms. sat. sol.		Solid Phase
$CoCl_2$	RbCl	
35.67	0.0	Co6
35.20	3.38	"
35.11	5.98	" + 1.1.2
34.92	6.20	" "
34.58	6.83	1.1.2
34.29	7.79	1.1.2 + 1.2.2
34.43	7.56	" "
31.74	9.34	1.2.2
28.89	12.31	"
16.09	30.52	"
11.37	38.83	1.2.2 + RbCl
11.62	38.03	" "
5.41	43.58	RbCl
0.0	48.57	"

Co6 = $CoCl_2.6H_2O$; 1.1.2 = $CoCl .RbCl.2H_2O$; 1.2.2 = $CoCl_2.2RbCl.2H_2O$.

This system was also studied by Benrath, 1927, at 25 but the double salt, CoCl RbCl.2H O, which exists over a very narrow range of concentration, could not be identified.

EQUILIBRIUM IN THE SYSTEM COBALT CHLORIDE, THORIUM CHLORIDE AND WATER.

(Bassett, Gordon and Henshall, 1937.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$CoCl_2$	$ThCl_4$		$CoCl_2$	$ThCl_4$	
Results at 0°			Results at 25° (Con.)		
0.55	55.20	$CoCl_2.6H_2O+ThCl_4.8H_2O$	7.85	42.46	$CoCl_2.6H_2O$
0.0	55.67	$ThCl_4.8H_2O$	4.21	54.25	"$+ThCl_4.8H_2O$
			3.34	55.17	$ThCl_4.8H_2O$
Results at 25°			1.97	56.25	"
22.47	18.50	$CoCl_2.6H_2O$	0.0	58.00	"
17.34	26.26	"			

EQUILIBRIUM IN THE SYSTEM COBALT CHLORIDE, ZINC CHLORIDE AND WATER AT 25°.

(Bassett and Harry, 1930.)

This is a very complex system due to the ease of hydrolysis of zinc chloride and the formation of solid solutions of the two salts. A special procedure for the preparation of the mixtures was necessary and the saturated solutions were analyzed only with considerable difficulty. The several determinations of Benrath, 1927, upon this system at 25° fall fairly near the curve drawn from the present results.

Cl

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$CoCl_2$	$ZnCl_2$		$CoCl_2$	$ZnCl_2$		$CoCl_2$	$ZnCl_2$	
35.87	0.0	Co6	13.77	59.92	SSB	12.32	64.03	SSD
32.03	9.26	"	12.91	61.15	"	10.18	66.98	"
29.35	21.75	"	12.28	63.08	"	9.59	67.72	"
30.86	26.74	"	12.40	63.38	"	9.48	67.46	"
31.20	27.91	"+Co2	12.61	63.40	"+SSC	5.96	73.07	"
31.08	28.43	Co2	15.78	59.54	SSC	5.37	73.82	"
29.77	32.16	"	12.63	63.40	"	4.19	77.38	"
29.40	33.62	"	12.16	64.00	"	4.70	77.67	SSE
29.48	33.31	"+SSA	7.35	69.88	"	0.61	80.02	SSC+SSE
28.22	33.31	SSA	5.69	72.07	"	0.0	80.88	Zn1-1/3
26.09	37.86	"	3.97	74.50	"	2.60	78.58	Zn(1)
22.20	43.09	"	2.76	76.09	"	0.0	81.5	"
19.56	47.00	"	2.34	76.98	"	2.45	79.02	Zn(2)
17.45	50.00	"	0.43	80.19	"	—	81.5	"
12.34	59.29	"	0.0	81.78	Zn1-2/3	2.06	79.20	"(3)
13.19	60.10	"	17.23	57.95	SSC+SSD	—	81.41	"
13.51.	60.09	"+SSB	15.36	60.09	SSA+SSD			

Co6 = $CoCl_2.6H_2O$; Co2 = $CoCl_2.2H_2O$; Zn1-1/3 = $ZnCl_2 1\text{-}1/3H_2O$; Zn1-2/3 = $ZnCl_2.1\text{-}2/3H_2O$.

SSA = Solid Solution A = $[Zn(H_2O)_6]^{\cdot\cdot}[ZnCl_4]''$(= $ZnCl_2.3H_2O$) and $[Co(H_2O)_6]^{\cdot\cdot}[ZnCl_4]''$.

SSB = Solid Solution B = $[Zn_2(H_2O)_{10}]^{\cdot\cdot\cdot\cdot}[ZnCl_4]''$(= $ZnCl_2.2.5H_2O$) and $[Co_2(H_2O)_{10}]^{\cdot\cdot}[ZnCl_4]_2''$.

SSC = Solid Solution C = $[Zn_2(H_2O)_{10}]^{\cdot\cdot}[Zn_2Cl_6]_2''$(= $ZnCl_2.1\text{-}2/3H_2O$) and $[Co_2(H_2O)_{10}]^{\cdot\cdot\cdot\cdot}[Zn_2Cl_6]_2''$

SSD = Solid Solution D = $[Zn_2(H_2O_6]^{\cdot\cdot}[ZnCl_4]_2''$(= $ZnCl_2.1\tfrac{1}{2}H_2O$) and $[Co_2(H_2O)_6]^{\cdot\cdot\cdot\cdot}[ZnCl_4]_2''$.

SSE = Solid Solution E = $[Zn(H_2O)_4][Zn_2Cl_6]''$(= $ZnCl_2 1\text{-}1/3H_2O$) and $[Co(H_2O)_4]^{\cdot\cdot}[Zn_2Cl_6]''$.

(1) $ZnCl_2$ (Hexagonal plates) (2) $ZnCl_2$ (octohedra)
(3) $ZnCl_2$ (long double pyramids)

EQUILIBRIUM IN THE SYSTEM COBALT CHLORIDE, STRONTIUM CHLORIDE AND WATER AT 25° AND AT 50°.

(Bassett, Gordon and Henshall, 1937.)

Results at 25°			Results at 50°		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$CoCl_2$	$SrCl_2$		$CoCl_2$	$SrCl_2$	
35.87	0.0	$CoCl_2.6H_2O$	49.50	0.0	$CoCl_2.2H_2O$
32.57	4.28	"	42.16	10.71	"
29.21	9.00	"	41.02	12.25	"
26.90	12.19	"+$SrCl_2.6H_2O$	31.98	22.16	"+$SrCl_2.2H_2O$
26.57	12.31	" "	33.77	22.30	" "
24.55	13.69	$SrCl_2.6H_2O$	24.45	29.24	$SrCl_2.2H_2O$
24.17	14.50	"	18.05	34.12	"
10.83	24.93	"	0.0	47.50	"
0.0	35.07	"			

This system was also studied by Benrath, 1927, at 25° with results agreeing satisfactorily with the above.

SOLUBILITY OF COBALT CHLORIDE IN AQUEOUS ALCOHOL AT 11.5°.

(Bödtker — Z. physik. Chem. 22, 509, '97.)

10 gms. of $CoCl_2.6H_2O$ were added to 20 cc. of alcohol and in addition the amounts of $CoCl_2$ shown in the second column. The solutions were shaken 2 hours, 5 cc. withdrawn, and the amount of dissolved $CoCl_2$ determined by evaporation and weighing. C1

Vol. % Alcohol.	Gms. $CoCl_2$ Added.	Gms. per 5 cc. Solution.		Vol. % Alcohol.	Gms. $CoCl_2$ Added.	Gms. per 5 cc. Sol.	
		H_2O.	$CoCl_2$.			H_2O.	$CoCl_2$.
91.3	0.0	1.325	1.168	99.3	0.612	0.764	1.459
98.3	0.0	1.134	1.214	99.3	0.813	0.688	1.568
98.3	0.0	1.068	1.181	99.3	1.022	0.634	1.713
99.3	0.0	1.045	1.199	99.3	1.240	0.553	1.831
99.3	0.194	0.899	1.204	99.3	1.446	0.483	1.943
99.3	0.400	0.829	1.325	99.3	1.650	0.500	2.183

100 gms. sat. solution in alcohol (0.792 Sp. Gr.) contain 23.66 gms. $CoCl_2$, Sp. Gr. = 1.0107. (Winkler — J. pr. Chem. 91, 207, '64.)

SOLUBILITY OF ANHYDROUS COBALT CHLORIDE IN PURE METHYL AND IN PURE ETHYL ALCOHOL.

(Lloyd, Brown, Glynwyn, Bonnel and Jones, 1928.)

Results for Methyl Alcohol			Results for Ethyl Alcohol		
t°	Gms. $CoCl_2$ per 100 gms. CH_3OH	Solid Phase	t°	Gms. $CoCl_2$ per 100 gms. C_2H_5OH	Solid Phase
20	38.5	$CoCl_2.3CH_3OH$	0	45.0	$CoCl_2.3C_2H_5OH$
25	43.6	"	10	48.6	"
28	46.5	"	20	54.4	"
30	48.8	"	30	62.6	"
35	55.5	"	40	67.4	$CoCl_2.2C_2H_5OH$
37	58.9	"	50	65.1	"
38	58.8	$CoCl_2.2CH_3OH$	60	66.8	"
40	58.2	"	70	72.9	"
50	58.9	"	80	70.3	"

SOLUBILITY OF ANHYDROUS COBALT CHLORIDE IN ABSOLUTE ACETONE

(Bell, Rowlands, Bamford, Thomas, and Jones, 1930.)

t°	Gms. CoCl per per 100 gms. CH_3COCH_3	Solid, Phase	t°	Gms. $CoCl_2$ per 100 gms. CH_3COCH_3	Solid Phase
0	4.47	$CoCl_2.C_3H_6O$	25	3.71	$CoCl_2$
10	3.32	"	30	4.51	"
20	2.89	$CoCl_2$	40	6.01	"
22.5	3.40	"	50	7.25	"

SOLUBILITY OF COBALT CHLORIDE IN ORGANIC SOLVENTS.

Solvent.	t°.	Gms. per 100 Gms. Solvent. $CoCl_2$.	Gms. per 100 Gms. Solvent. $CoCl_2.2H_2O$	Authority.
Acetone	0	9.11	17.16	(von Laszczynski, 1894.)
"	22.5	9.28	17.06	(von Laszczynski, 1894.)
"	25	8.62	...	(Krug and McElroy, 1892.)
"	18	2.75	...	(Naumann, 1904.)
Ethyl Acetate	14	0.08	...	(von Laszczynski, 1894.)
" "	79	0.26	...	"
Ether, Abs.	...	0.021	0.201	(Bödtker, 1897.)
Glycol	...	10.7 (per 100 g. sol.)		(de Coninck, 1905.)
Acetonitrile	18	4.08	...	(Naumann and Schier, 1914.)
Methyl Acetate	18	0.369*	...	(Naumann, 1909.)
95% Formic Acid	20.5	6.2	...	(Aschan, 1913.)
Anhy. Hydrazine	±15	1	...	(Welsh and Broderson, 1915.)

* d_{18} sat. sol. = 0.938.

Cl

SOLUBILITY OF COBALT CHLORIDE IN PYRIDINE.

(Pearce and Moore, 1913.)

t°.	Gm $CoCl_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gm. $CoCl_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gm. $CoCl_2$ per 100 Gms. Sat. Sol.	Solid Phase.
−48.2	0	C_5H_5N	34.6	0.749	1.4	74.8	2.037	1.2
−50.3 Eutec.	...	" + 1.6	37.6	0.754	"	78.2	2.276	"
−45	0.4185	1.6	44.6	0.950	"	79.8	2.428	"
−30	0.4205	"	47.2	1.020	"	88	3.284	"
−19.6	0.4208	"	51	1.110	"	90 tr. pt.	...	" + $CoCl_2$
−10	0.4310	"	55	1.192	"	96.5	7.251	$CoCl_2$
0	0.4307	"	60	1.324	"	98.8	7.936	"
15 tr. pt.	...	1.6 + 1.4	64.2	1.460	"	106	12.540	"
23	0.569	1.4	68	1.572	"	110	14.165	"
25	0.575	"	70 tr. pt	...	" + 1.2			

1.6 = $CoCl_2.6C_5H_5N$. 1.4 = $CoCl_2.4C_5H_5N$. 1.2 = $CoCl_2.2C_5H_5N$.

100 gms. liquid sulfur dioxide dissolve 0.013 gm. $CoCl_2$ at 0°. (Jander and Ruppolt, 1937.)

100 gms. sat. solution of Co Cl_2 in selenium oxychloride (Se O Cl_2) contain 0.17 gm. Co Cl_2 at 25°.
(Wise, 1923.)

COBALT Triethylene diamine CHLORIDE
COBALT Diaminocyclopentane per CHLORATES

Data for the solubility of these compounds in water are give respectively by Rostkovski, 1927, and Jaeger and Bluemendal, 1928.

Fusion-point data are given for the following mixtures:

$CoCl_2$ + $FeCl_3$ (Ferrari, Celeri and Giorgi, 1929.)
" + LiCl (Ferrari and Baroni, 1928.)
" + $PbCl_2$ (Ferrari and Colla, 1933.)
" + $SnCl_2$ (" " " ")
" + $SrCl_2$ (Ferrari and Inganini, 1930.)
" + $ZnCl_2$ (" " " " ; Bassett and Bedwell, 1931.)

COBALT CHLORATE $Co(ClO_3)_2$.

C10

SOLUBILITY IN WATER.

(Meusser, 1902.)

t°.	Gms. $Co(ClO_3)_2$ per 100 Gms. Solution.	Mols. $Co(ClO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Co(ClO_3)_2$ per 100 Gms. Solution.	Mols. $Co(ClO_3)_2$ per 100 Mols. H_2O	Solid Phase.
−12	29.97	3.41	Ice	18	64.19	14.28	$Co(ClO_3)_2.4H_2O$
−21	53.30	9.08	$Co(ClO_3)_2.6H_2O$	21	64.39	14.51	"
−19	53.61	9.20	"	35	67.09	16.10	"
0	57.45	10.75	"	47	69.66	18.29	"
10.5	61.83	12.90	"	61	76.12	25.39	"

Density of solution saturated at 18° = 1.861.

COBALT PerCHLORATE $Co(ClO_4)_2.9H_2O$.

SOLUBILITY IN WATER.

(Goldblum and Terlikowski, 1912.)

t°.	Gms. $Co(ClO_4)_2$ per 100 Gms. H_2O	Solid Phase.	t°.	Density Sat. Sol.	Gms. $CO(ClO_4)_2$ per 100 Gms. H_2O.	Solid Phase.
−10.9	32.67	Ice	0	1.564	100	$Co(ClO_4)_2.5H_2O$
−30.7	58.16	"	7.5	1.566	101.9	"
−62.2 Eutec.	...	Ice+$Co(ClO_4)_2.9H_2O$	18	1.567	103.8	"
−30.7	83.2	$Co(ClO_4)_2.9H_2O$	26	1.581	113.4	"
−21.3	90.6	"	45	1.588	115	"

SOLUBILITY OF COBALT PERCHLORATE IN SEVERAL SOLVENTS.

(Chaney and Mann, 1931.)

The determinations were made by adding at room temperature successive small amounts of solvent to a weighed amount of the salt until upon vigorous shaking the last trace of perchlorate just disappeared.

Solvent	Gms. $Co(ClO_4)_2$ per 100 cc. solvent
Water	292 (Salvadori, 1912.)
Furfural (C_4H_3OCHO) d^{25}_{4} = 1.1550	60
Cellosolve (monoethylether of ethylene glycol)	110

COBALT Hexa Antipyrine Per CHLORATE $[Co(COC_{10}H_{12}N_2)_6](ClO_4)_2$.

100cc. sat. solution in water contain 6.62 gm. $[Co(COC_{10}H_{12}N_2)_6](ClO_4)_2$ at 20°. (Wilke-Dörfurt and Schliephake, 1929.)

COBALT FLUORIDE $CoF_2.4H_2O$

SOLUBILITY IN WATER AND IN AQ. 3% HF SOLUTION.

(Kurtenacker, Finger and Hey, 1933.)

Results for H_2O		Results for Aq. 3% HF solutions			
t°	Gms. CoF_2 per 100cc. sat. sol.	t°	Gms. per 100 gms. sat. sol.	t°	Gms. per 100 gms. sat. sol.
20	1.36	20	3.35	80	3.90
25	1.415	40	3.48	90	4.61
		50	3.60	100	5.43

Solid Phase $CoF_2.4H_2O$ in all cases.
The result at 25° by Carter, 1928.
At higher concentrations of HF the solubility increases rapidly; at 20° in 11.5% HF there is 5.9% CoF_2 and in 13.5% HF, 9.6% CoF_2

EQUILIBRIUM IN THE SYSTEM COBALT FLUORIDE, POTASSIUM FLUORIDE AND WATER AT 20° AND AT 50°.

(Kurtenacker, Finger and Hey, 1933.)

F

Resu Results at 20°			Results at 50°		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
CoF_2	KF		CoF_2	KF	
0.86	1.2	Mixed Crystals	0.012	4.3	Mixed Crystals
0.18	1.6	"	0.005	11.0	"
0.11	2.3	"	—	15.5	"
0.013	13.8	"	—	23.2	"
0.005	20.8	"	—	27.3	"
—	32.6	"	—	35.8	"

EQUILIBRIUM IN THE SYSTEM COBALT FLUORIDE, AMMONIUM FLUORIDE AND WATER AT 20° AND AT 50°.

(Kurtenacker, Finger, and Hey, 1933.)

Results at 20°			Results at 50°		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
CoF_2	NH_4F		CoF_2	NH_4F	
0.34	2.9	$CoF_2.4H_2O$	0.40	3.6	$CoF_2.4H_2O$
0.21	9.7	"	0.08	14.5	$CoF_2.2NH_4F.2H_2O$
0.08	12.4	$CoF_2.2NH_4F.2H_2O$	0.06	17.3	"
0.02	18.4	"	0.03	22.6	"
0.015	20.8	"	0.015	24.8	"
0.010	24.1	"	0.014	27.6	"
0.009	34.3	"	0.013	29.5	"

COBALT Hexa Antipyrine Boro FLUORIDE $[Co(COC_{10}H_{12}N_2)_6](BF_4)_2$.

100 cc. sat. solution in water contains 13.1 gm. $[Co(COC_{10}H_{12}N_2)_6](BF_4)_2$ at 20°. (Wilke-Dörfurt and Mureck, 1929)

COBALT IODIDE CoI_2.

SOLUBILITY IN WATER.

(Etard — Compt. rend. 113, 699, '91; Ann. chim. phys. [7] 2, 537, '94.)

The accuracy of these results is doubtful.

t°.	Gms. CoI_2 per 100 Gms. Solution.	Solid Phase.	t°.	Gms. CoI_2 per 100 Gms. Solution.	Solid Phase.
−20	55.5	$CoI_2.H_2O$ (green)	25	67.5	$CoI_2.H_2O$ (olive)
0	58.0	"	30	70.0	"
10	61.5	"	40	75.0	$CoI_2.H_2O$ (yellow)
15	63.2	"	50	79.0	"
20	65.2	"	80	80.0	"
25	67	"	110	81.0	"

100 gms. liquid sulfur dioxide dissolve 0.382 gm. CoI_2 at 0°. (Jander and Ruppolt, 1937.)

COBALT IODATE $Co(IO_3)_2$.

SOLUBILITY IN WATER.

(Meusser — Ber. 34, 2435, '01.)

t°.	Solid Phase: $Co(IO_3)_2.4H_2O$. G.	M.	$Co(IO_3)_2.2H_2O$. G.	M.	$Co(IO_3)_2$. G.	M.
0	0.54	0.028	0.32	0.014	...	...
18	0.83	0.038	0.45	0.020	1.03	0.046
30	1.03	0.046	0.52	0.023	0.89	0.040
50	1.46	0.065	0.67	0.030	0.85	0.030
60	1.86	0.084	...	...	...	...
65	2.17	0.098	...	...	...	...
75	...	...	0.84	0.038	0.75	0.033
100	...	...	1.02	0.045	0.69	0.031

G = Gms. $Co(IO_3)_2$ per 100 gms. solution. M = Mols. $Co(IO_3)_2$ per 100 Mols. H_2O.

SOLUBILITY OF COBALT IODATE IN AQUEOUS SALT SOLUTIONS AT 30°.

(Trimble, 1936.)

Results for aqueous solutions of:

Sodium Chloride: d of sat. sol.	Gm. mols. per 1000 gms. sat. sol. NaCl	$Co(IO_3)_2$	Sodium Iodate: d of sat. sol.	Gm. mols. per 1000 gms. sat. sol. $NaIO_3$	$Co(IO_3)_2$	Cobalt Sulfate: d of sat. sol.	Gm. mols. per 1000 gms. sat. sol. $CoSO_4$	$Co(IO_3)_2$
1.006	0.0	0.01165	1.0006	0.0	0.01165	1.0006	0.0	0.01165
1.0007	0.0029	0.0119	1.0006	0.0044	0.0102	1.0008	0.0026	0.0113
1.0008	0.0052	0.0120	1.0007	0.0076	0.0093	1.0011	0.0052	0.0111
1.0009	0.0069	0.0121	1.0008	0.0087	0.0090	1.0012	0.0161	0.0111
1.0010	0.0111	0.0124	1.0011	0.0127	0.0080	1.0019	0.0123	0.0107
1.0011	0.0140	0.0125	1.0014	0.0174	0.0069	1.0020	0.0129	0.0106
1.0016	0.0267	0.0131	1.0017	0.0204	0.0063	1.0034	0.0235	0.0102
1.0020	0.0355	0.0134	1.0026	0.0280	0.0050	1.0037	0.0258	0.0101
1.0029	0.0532	0.0139	1.0037	0.0360	0.0040	1.0076	0.0516	0.0095
1.0054	0.0941	0.0149	1.0056	0.0483	0.0030	1.0117	0.0774	0.0094
1.0085	0.1449	0.0158	1.0135	0.0999	0.0010	1.0155	0.1032	0.0093

The solid phase was $Co(IO_3)_2.2H_2O$ in all cases.

COBALT AMINES.

SOLUBILITY IN WATER AT ORDINARY TEMPERATURE. (Lal De, 1917.)

Name of Isomeride.	Formula.	Gms. Isomeride per liter Sat. Sol.
Triamine Cobalt Nitrate	$[(NH_3)_3Co(NO_2)_3]$	2.882
1.2 Dinitrotetraamine cobaltitetranitrodiamine cobaltiate	$\left[Co{}^{(NO_2)_2}_{(NH_3)_4}\right]^{I} - \left[Co{}^{(NO_2)_4}_{(NH_3)_2}\right]^{I}$	3.68
1.6 Dinitrotetraamine cobaltitetranitrodiamine cobaltiate	" "	0.398
Hexa-amine cobaltihexanitrocobaltiate	$[Co(NH_3)_6]^{III} - [Co(NO_2)_6]^{III}$	0.0215

NH

COBALT DOUBLE SALTS.

SOLUBILITY IN WATER.

(Jörgensen — J. pr. Chem. [2] 18, 205, '78; 19, 49, '79; Kurnakoff — J. russ. phys. chem. Ges. 24, 629, '92.)

Name.	Formula.	t°.	Gms. Salt per 100 Gms. H₂O.
Chloro purpureo cobaltic bromide	$CoCl(NH_3)_5Br_2$	14.3	0.467
Bromo purpureo cobaltic bromide	$CoBr(NH_3)_5Br_2$	16	0.19
Chloro tetra amine cobaltic chloride	$CoCl(NH_3)_4(OH_2)Cl_2$		2.50
Chloro purpureo cobaltic chloride	$CoCl(NH_3)_5Cl_2$	0	0.232
Chloro purpureo cobaltic chloride	$CoCl(NH_3)_5Cl_2$	15.5	0.41
Chloro purpureo cobaltic chloride	$CoCl(NH_3)_5Cl_2$	46.6	1.03
Luteo cobaltic chloride	$Co(NH_3)_6Cl_3$	0	4.26
Luteo cobaltic chloride	$Co(NH_3)_6Cl_3$	46.6	12.74
Roseo cobaltic chloride	$Co(NH_3)_5(OH_2)Cl_3$	0	16.12
Roseo cobaltic chloride	$Co(NH_3)_5(OH_2)Cl_3$	16.2	24.87
Chloro purpureo cobaltic iodide	$CoCl(NH_3)_5I_2$	19.2	2.0
Chloro purpureo cobaltic nitrate	$CoCl(NH_3)_5(NO_3)_2$	15	1.25
Chloro purpureo cobaltic sulphate	$CoCl(NH_3)_5SO_4.2H_2O$	17.3	0.75
Nitrato purpureo cobaltic nitrate	$Co(NO_3)(NH_3)(NO_3)_2$	16	0.36

COBALT (and Other Metal) AMMONIUM COMPOUNDS.

In connection with an exhaustive study of the theory of the solubility of salts and of the application of thermodynamic functions to solutions, Brönsted and his associates (1919-1926) have published an extensive series of determinations of the solubility of metal ammonium compounds in water and in various salt solutions. These results are of especial importance in connection with the principles they are intended to elucidate, but on account of the complex character of the compounds and the restricted conditions of the experiments, the results are believed not to be of sufficient general interest to be quoted completely in the present compilation of quantitative solubility data. With few exceptions the determinations are published in easily accessible journals and can readily be found by those especially interested in this group of compounds. In the present case only such of the results as refer to water as the solvent will be quoted. Fortunately, the most of these are given in a single paper by Brönsted and Petersen, 1921. The data for the solubility in aqueous salt solutions will be found in the other papers listed under Brönsted's name in the authors index.

In general, saturation was obtained by agitating the highly purified compounds repeatedly with fresh portions of water untill a constant solubility was found. On account of the high velocity of solution of metal ammonium compounds, relatively short periods of time were required for saturation. This permitted determinations for several of the salts which are transformed slowly in aqueous solution. In the most recent experiments, saturated solutions were prepared by percolating a column of the solid 10-12 cm. in height with solvent flowing at a rate of about 1.5 liters per 24 hours. The first portions of the percolate were discarded. Relatively large volumes of saturated solution were used for analysis. The analytical method consisted in adding an excess of fixed alkali and estimating the liberated ammonia by absorption in 0.05 normal H_2SO_4, using methyl red as indicator.

SOLUBILITY OF CROCEO COBALTIC NITRATE IN WATER.

(Brönsted, 1919, 1922.)

This salt exists in two modifications. The more stable of these is the β modification. It is a light brown crystal powder while the α modification consists of citrine needle shaped crystals. Both varieties have one molecule of water of crystallization.

t°.	Gms. mols. $[Co(NO_2)_2(NH_3)_4]NO_3$ per liter sat. sol. α Modification.	β Modification.	Solid Phase in both cases.
0......	0.00546	0.00501	$[Co(NO_2)_2(NH_3)_4]NO_3.H_2O$
5.02...	–	0.00645	»
10.06...	–	0.00821	»
15.07...	–	0.01040	»
20.00...	0.01483	0.01306	»

Data are also given for the solubility of the two forms of this compound in a large number of aqueous salt solutions.

SOLUBILITY OF COBALT (AND OTHER METAL) AMMONIUM COMPOUNDS IN WATER.

(Brönsted and Petersen, 1921.)

Compound	Formula.	Gm. mols. cmpd. per 1000 cc. sat. sol. at 0°.	20°.
Cesium tetranitro-diammine cobaltiate	$Cs[Co(NH_3)_2(NO_2)_4]$	0.00531	0.01720
Cesium tetrathio cyanato-diammine chromiate	$Cs[Cr(NH_3)_2(SCN)_4]$	0.00079	0.00258
Potassium tetranitro-diammine cobaltiate	$K[Co(NH_3)_2(NO_2)_4]$	0.0240	-
Silver » » »	$Ag[Co(NH_3)_2(NO_2)_4]$	0.000772	0.00210
» oxalo-dinitro » »	$Ag[Co(NH_3)_2(NO_2)_2C_2O_4]$	0.00278	0.00822
Thallous tetranitro » »	$Tl[Co(NH_3)_2(NO_2)_4]$	0.00251	0.00789
» oxalo-dinitro » »	$Tl[Co(NH_3)_2(NO_2)_2C_2O_4]$	0.00420	0.00977
$(CH_3)_4N$ tetranitro » »	$(CH_3)_4N[Co(NH_3)_2(NO_2)_4]$	0.00749	0.0197
Carbanato-tetrammine-cobaltic tetrathiocyanato cobaltic sulfate	$[Co(NH_3)_4CO_3][Co(SCN)_4SO_4]$	-	0.070
Carbanato-tetrammine-cobaltic tetrathiocyanato cobaltic chromiate	$[Co(NH_3)_4CO_3][Co(SCN)_4CrO_4]$	0.00185	0.00555
Carbanato-tetrammine-cobaltic tetranitro-diammine cobaltiate	$[Co(NH_3)_4CO_3][Co(NH_3)_2(NO_2)_4]$	0.00366	0.0124
Crocco (¹) bromide	$[Co(NH_3)_4(NO_2)_2]Br$	0.012	-
» chloride	$[Co(NH_3)_4(NO_2)_2]Cl$	0.0222	0.043
» dioxalo-diammine cobaltiate	$[Co(NH_3)_4(NO_2)_2][Co(NH_3)_2(C_2O_4)_2]$	0.000066	-
» » -triammine »	$[Co(NH_3)_4(NO_2)_2][Co(NH_3)_3(C_2O_4)_2]$	0.00059	-
» hexachloro platinate	$[Co(NH_3)_4(NO_2)_2]_2PtCl_6$	0.00233	-
» perchlorate	$[Co(NH_3)_4(NO_2)_2]ClO_4$	0.0124	0.0290
» picrate β	$[Co(NH_3)_4(NO_2)_2]C_6H_2O(NO_2)_3$	-	0.00704
» selenate	$[Co(NH_3)_4(NO_2)_2]_2SeO_4$	-	0.0092
» sulfate	$[Co(NH_3)_4(NO_2)_2]_2SO_4$	0.00096	0.00411
» tetrachloro-aurate	$[Co(NH_3)_4(NO_2)_2]AuCl_4$	-	0.017
» tetranitro-diammine cobaltiate	$[Co(NH_3)_4(NO_2)_2][Co(NH_3)_2(NO_2)_4]$	0.000096	0.000355
» tetrathiocyanato-diammine chromiate	$[Co(NH_3)_4(NO_2)_2][Cr(NH_3)_2(SCN)_4]$	0.000057	0.000143
Flavo (²) tetranitro-diammine cobaltiate	$[Co(NH_3)_4(NO_2)_2][Co(NH_3)_2(NO_2)_4]$	0.000949	0.0033
Flavo tetrathiocyanato-diammine chromiate α	$[Co(NH_3)_4(NO_2)_2][Cr(NH_3)_2(SCN)_4]$	0.000322	0.00100
Flavo tetrathiocyanato-diammine chromiate β	» »	-	0.00073
Flavo chloride	$[Co(NH_3)_4(NO_2)_2]Cl$	-	0.034
Oxalo-tetrammine-cobaltic hexathiocyanato chromiate	$[Co(NH_3)_4(C_2O_4)]_3[Cr(SCN)_6]$	0.00053	-
Oxalo-tetrammine-cobaltic nitrate	$[Co(NH_3)_4(C_2O_4)]NO_3$	0.0066	0.018
» » » perchlorate	$[Co(NH_3)_4(C_2O_4)]ClO_4$	0.0051	0.0140
Oxalo-tetrammine-cobaltic trioxalo cobaltiate	$[Co(NH_3)_4(C_2O_4)]_3[Co(C_2O_4)_3]$	0.00083	-
Oxalo-tetrammine-cobaltic tetra nitro-diammine cobaltiate	$[Co(NH_3)_4(C_2O_4)][Co(NH_3)_2(NO_2)_4]$	0.00103	-
Prasco (³) bromide	$[Co(NH_3)_4Cl_2]Br$	0.00632	-
» chlorate	$[Co(NH_3)_4Cl_2]ClO_3$	0.0180	-
» chloride	$[Co(NH_3)_4Cl_2]Cl$	0.0141	-
» dioxalo-diammine cobaltiate	$[Co(NH_3)_4Cl_2][Co(C_2O_4)_2(NH_3)_2]$	0.000171	-
» hexacyano ferriate	$[Co(NH_3)_4Cl_2]_3[Fe(CN)_6]$	0.000121	-
» iodate	$[Co(NH_3)_4Cl_2]IO_3$	0.00441	-
» nitrate	$[Co(NH_3)_4Cl_2]NO_3$	0.00383	-
» picrate	$[Co(NH_3)_4Cl_2]C_6H_2O(NO_2)_3$	0.00021	-
» thiocyanate (rhodonide)	$[Co(NH_3)_4Cl_2]SCN$	0.00289	-
Sulfato-pentammine cobaltic nitrate	$[Co(NH_3)_5SO_4]NO_3$	-	0.026

(¹) Crocco = Croceo cobaltic or dinitro-tetrammine cobaltic (trans).
(²) Flavo = Flavo cobaltic or dinitro-tetrammine cobaltic (cis).
(³) Praseo = Praseo cobaltic or dichloro-tetrammine cobaltic.

SOLUBILITY OF COBALT (AND OTHER METAL) AMMONIUM COMPOUNDS IN WATER.

(Brönsted and Petersen, 1921.)

Compound.	Formula.	Gm. mols. cmpd. per 1000 cc. sat. sol. at	
		0°.	20°
Magnesium dinitro-oxalo-diammine cobaltiate	$Mg[Co(NH_3)_2(NO_2)_2(C_2O_4)]_2$	0.00348	–
Bromo-pentammine cobaltic bromide	$[Co(NH_3)_5Br]Br_2$	0.00275	–
» » chloride	$[Co(NH_3)_5Br]Cl_2$	0.00542	0.011
» » nitrate	$[Co(NH_3)_5Br](NO_3)_2$	–	0.010
» rhodium chloride	$[Rh(NH_3)_5Br]Cl_2$	–	0.015
Chloro-aquo-tetrammine cobaltic chloride	$[Co(NH_3)_4(H_2O)Cl]Cl_2$	0.057	0.11
Chloro pentammine chromium	$[Cr(NH_3)_5Cl]X_2$	0.00066	–
» » chloride	$[Cr(NH_3)_5Cl]Cl_2$	0.0149	0.030
» » nitrate	$[Cr(NH_3)_5Cl](NO_3)_2$	–	0.055
» » oxalate	$[Cr(NH_3)_5Cl]C_2O_4$	0.00125	–
» cobaltic bromide	$[Co(NH_3)_5Cl]Br_2$	0.00725	–
» » chloride	$[Co(NH_3)_5Cl]Cl_2$	0.00914	0.018
» » iodate	$[Co(NH_3)_5Cl](IO_3)_2$	0.00200	–
» » hexachloro Pt.	$[Co(NH_3)_5Cl]PtCl_6$	0.000091	–
» » nitrate	$[Co(NH_3)_5Cl](NO_3)_2$	–	0.046
» » oxalate	$[Co(NH_3)_5Cl]C_2O_4$	0.00036	–
» » sulfate	$[Co(NH_3)_5Cl]SO_4$		0.29
Chloro pentammine cobaltic tetra-nitro-cobaltiate	$[Co(NH_3)_5Cl][Co(NH_3)_2(NO_2)_4]_2$	0.000173	0.000637
Chloro-pentammine rhodium chloride	$[Rh(NH_3)_5Cl]Cl_2$	0.00945	0.020
Thiocyanato-pentammine chromium chloride	$[Cr(NH_3)_5SCN]Cl_2$	–	0.040
» cobaltic »	$[Co(NH_3)_5SCN]Cl_2$	–	0.039
» » chromate	$[Co(NH_3)_5SCN]CrO_4$	0.00107	–
» » iodate	$[Co(NH_3)_5SCN](IO_3)_2$	–	0.00505
» » sulfate	$[Co(NH_3)_5SCN]SO_4$	–	0.0290
Xantho (¹) chloride	$[Co(NH_3)_5NO_2]Cl_2$	–	0.11
» chromate	$[Co(NH_3)_5NO_2]CrO_4$	0.000258	0.000547
» nitrate	$[Co(NH_3)_5NO_2](NO_3)_2$	0.0170	0.038
» oxalate	$[Co(NH_3)_5NO_2]C_2O_4$	0.000161	0.000432
» tetra nitro diammine cobaltiate	$[Co(NH_3)_5NO_2][Co(NH_3)_2(NO_2)_4]_2$	0.00031	0.00099
» tetra thiocyanato diammine chromate	$[Co(NH_3)_5NO_2][Co(NH_3)_2(SCN)_4]_2$	0.000392	0.001284
Luteo (²) cobaltic chloride	$[Co(NH_3)_6]Cl_3$	–	0.26
» » sulfate	$[Co(NH_3)_6]Cl.SO_4$	0.01055	–
» » hexacyano chromiate	$[Co(NH_3)_6][Cr(CN)_6]$	0.000028	–
» » » cobaltiate	$[Co(NH_3)_6][Co(CN)_6]$	0.000007	0.000016
» » » ferriate	$[Co(NH_3)_6][Fe(CN)_6]$	0.000009	0.000022
» » iodate	$[Co(NH_3)_6](IO_3)_3$	0.00181	0.00458
» » nitrate	$[Co(NH_3)_6](NO_3)_3$	0.0202	0.052
» » sulfate	$[Co(NH_3)_6]_2(SO_4)_3$	0.0090	0.020
» » tetranitro cobaltiate	$[Co(NH_3)_6][Co(NH_3)_2(NO_2)_4]_3$	0.000043	–
» » trioxalo »	$[Co(NH_3)_6][Co(C_2O_4)_3]$	0.000019	–
Roseo (³) » hexacyano ferriate	$[Co(NH_3)_5H_2O][Fe(CN)_6]$	0 000172	–
» » sulfate	$[Co(NH_3)_5H_2O]_2(SO_4)_3$	–	0.016
» » tetrathiocyanato-diammine chromiate	$[Co(NH_3)_5H_2O][Cr(NH_3)_2(SCN)_4]_3$	0.00006	–
Iso-rhodano (⁴) pentammine cobaltic sulfate	$[Co(NH_3)_5Rh]SO_4$	0.01177	–

(¹) Xantho cobaltic or nitro-pentammine cobaltic.
(²) Luteo cobaltic or hexammine cobaltic.
(³) Roseo cobaltic or aquo-pentammine cobaltic.
(⁴) Brönsted, 1920

SOLUBILITY OF COBALT AMMONIUM COMPOUNDS IN WATER AT 20°.

(Brönsted, 1923.)

Compound.	Formula.	Gms. mols. cmpd. per 1000 cc. sat. sol.
Oxalotetrammine cobaltic-tetrathiocyanato diammine chromiate	$[Co(NH_3)_4C_2O_4]$ $[Cr(NH_3)_2(CNS)_4]$	0.00139
Oxalotetrammine cobaltic-oxalodinitrodiammine cobaltiate	$[Co(NH_3)_4C_2O_4]$ $[Co(NH_3)_2(NO_2)_2(C_2O_4)]$	0.00067
Nitrothiocyanato-tetra ammine cobaltic-oxalodinitro diammine cobaltiate	$[Co(NH_3)_4(CNS)(NO_2)]$ $[Co(NH_3)_2(NO_2)_2(C_2O_4)]$	0.000449
Oxalotetrammine cobaltic persulfate	$[Co(NH_3)_4(C_2O_4)]_2S_2O_8$	0.000755
Oxalotetrammine cobaltic dithionate	$[Co(NH_3)_4(C_2O_4)]_2S_2O_6$	0.000201
Luteocobaltic-hexacyano-cobaltiate (¹)	$[Co(NH_3)_6][CO(CN)_6]$	0.00001375 (18°)

(¹) Brönsted and Brumbaugh, 1926.

SOLUBILITY OF CHLORO-PENTAMMINE COBALT CHLORIDE IN WATER.

(Lamb and Simmonds, 1921.)

Formula.	t°.	$d\frac{t°}{4}$ of sat. sol.	Gms. $[Co(NH_3)_5Cl]Cl_2$ per 1000 cc. sat. sol.	Gms. $[Co(NH_3)_5Cl]Cl_2$ per 100 gms. H_2O.
$[Co(NH_3)_5Cl]Cl_2$	0.0	1.00096	2.244	0.2228
»	29.7	0.9994	6.047	0.6088
»	50.0	0.9945	10.01	1.025

NH

SOLUBILITY OF SEVERAL COBALT AMMONIUM COMPOUNDS IN WATER.

(Benrath, 1926; Benrath and Wurzburger, 1924.)

Compound.	Formula.	t°.	Gms. Co per 100 gms. H_2O.
Chloro pentammine cobalt (3) chloride	$[Co(NH_3)_5Cl]Cl_2$	25	0.1337*
» (3) sulfate	$[Co(NH_3)_5Cl]SO_4$	25	0.243
Hexammine cobalt (3) nitrate	$[Co(NH_3)_6]NO_3$	30	0.450
» (3) sulfate	$[Co(NH_3)_6]_2(SO_4)_3.5H_2O$	25	0.342
» »	»	45	0.552

* This value was obtained by constant shaking for one day. After a period of 10 days it rose to 0.176 gm. Co per 100 gms. H_2O. The authors also give data for the solubility of the above compounds in aqueous solutions of HCl, KCl, $HgCl_2$, H_2SO_4 and HNO_3. Double compounds are formed in some cases.

SOLUBILITY OF SEVERAL COBALT AMMONIUM COMPOUNDS IN WATER AT 20°.

(Ephraim and Flügel, 1924.)

Compound.	Formula.	Per 1000 cc. sat. sol. Gms. Co.	Per 1000 cc. sat. sol. Gms. atoms. Co
Sulfato-aquo-tetrammine cobaltic sulfate	$[Co(NH_3)_4H_2O(SO_4)]_2SO_4.3H_2O$	–	0.1254
» » » chloride	$[Co(NH_3)_4H_2O(SO_4)]Cl$	–	0.2726
» » » perchlorate	$[Co(NH_3)_4H_2O(SO_4)]ClO_4$	–	0.1508
» » » nitrate	$[Co(NH_3)_4H_2O(SO_4)]NO_3$	–	0 0712
» » » bromide	$[Co(NH_3)_4H_2O(SO_4)]Br$	–	0.0677
» » » picrate	$[Co(NH_3)_4H_2O(SO_4)]C_6H_2N_3O_7$	–	0.0093
Sulfato pentammine chloride	$[Co(NH_3)_5SO_4]Cl$	17.77	0.2881
» » iodide	[»]I	2.19	0.0371
» » picrate	[» $]C_6H_2N_3O_7.2H_2O$	0.100	0.00169
» » chromate	[» $]_2CrO_4$	0.609	0.0103
» » bichromate	[» $]_2Cr_2O_7$	0.315	0.00534
» » chlorate	[» $]ClO_3$	3.90	0.0661
» » perchlorate	[» $]ClO_4$	2.15	0.0364
» » silicofluoride	[» $]_2SiF_6$	8.62	0.1461
» » sulfate	[» $]_2SO_4$	20.44	0.3464
» » bromide	[»]Br	2.95	0.0500
» » nitrate	[» $]NO_3$	1.61	0.0273
Roseo iodo sulfate	$[Co(NH_3)_5H_2O]ISO_4$	(18°) 0.9625	= 0.0163 *n*

SOLUBILITY OF COBALT HEXAMMINE SALTS IN WATER AT 17°.5. (9° ?)

(Ephraim and Mosimann, 1922.)

Compound.	Formula.	Per liter sat. sol. Gms. Co.	Per liter sat. sol. Gm. mols. salt.
Cobalthexammine chloride	$[Co(NH_3)_6]Cl_3$	11.8	0.20
» bromide	» Br_3	2.404	0.04
» iodide	» I_3	0.819	0.015
» nitrate	» $(NO_3)_3$	1.974	0.033
» sulfate	» $_2(SO_4)_3$	1.792	0.015
» perchlorate	» $(ClO_4)_3$	0.794	0.013
» chlorate	» $(ClO_3)_3$	12.71	0.215
» chromate	» $_2(CrO_4)_3$	0.0647	0.00055
» bichromate	» $_2(Cr_2O_7)_3$	0.0332	0.00029
» oxalate	» $_2(C_2O_4)_3$	0.0816	0.00069
» phosphate	» PO_4	0.329	0.00055
» naphtalene β sulfonate	» $(C_{10}H_7SO_3)_3$	0.346	0.00059
» picrate	» $[O.C_6H_2(NO_2)_3]_3$	0.247	0.00042

The saturated solutions were prepared by agitation for not more than 2 hours, on account of the rapidity of decomposition, which was greater in the case of the chlorate and perchlorate than with the other salts. The temperature is given both as 17°.5 and as 9°. In a later paper by Ephraim (1923) exactly the same results are given for the temperature 18°.

SOLUBILITY OF COBALT AMMONIUM COMPOUNDS IN WATER.

(Ephraim, 1923.)

Formula.	t°.	Gm. mols. cmpd. per liter.	Formula.	t°.	Gm. mols. cmpd. per liter.
$[Co(NH_3)_5Cl](ClO_4)_2$	19	0.0917	$[Co(NH_3)_5I]Br_2$	20	0.00076
» $(NO_3)_2$	19	0.0434	» $[O.C_6H_2(NO_2)_3]_2$	20	0.00005
» I_2	19	0.0418	$[Co(NH_3)_5NO_2]Cl_2$*	19	0.1064
» SO_4	19	0.0344	» I_2 (hairy cryst.)	19	0.0945
» Br_2	19	0.0178	» I_2 (octoh. cryst.)	19	0.0846
» Cl_2	19	0.0170	» $(ClO_4)_2$	19	0.0525
» Cr_2O_7	19	0.0050	» SO_4	19	0.0442
» $[C_{10}H_7SO_3]_2.6H_2O$	19	0.00126	» Br_2	19	0.0436
» SiF_6	19	0.00111	» $(NO_3)_2$	19	0.0368
» S_2O_3	19	0.00102	» SiF_6	19	0.00259
» C_2O_4	19	0.00074	» Cr_2O_7	19	0.0018
» CrO_4	19	0.00041	» $[C_{10}H_7SO_3]_2.3H_2O$	19	0.00073
» $[O.C_6H_2(NO_2)_3]_2$	19	0.00017	» CrO_4	19	0.00062
$[Co(NH_3)_5Br](ClO_4)_2.H_2O$	20	0.0837	» $[O.C_6H_2(NO_2)_3]_2$	19	0.00050
» SO_4	20	0.0246	» C_2O_4	19	0.00042
» $(NO_3)_2$	20	0.0107	$[Co(NH_3)_5NO_3](ClO_3)_2$**	18	0.0970
» Cl_2	20	0.0106	» Cl_2	18	0.0279
» I_2	20	0.0101	» $(ClO_4)_2$	18	0.0278
» Br_2	20	0.00614	» I_2	18	0.0271
» SiF_6	20	0.00278	» Br_2	18	0.0159
» $[C_{10}H_7SO_3]_2.6H_2O$	20	0.0007	» $(NO_3)_2$	18	0.0122
» C_2O_4	20	0.0005	» SO_4	18	0.0050
» CrO_4	20	0.0004	» C_2O_4	18	0.0043
» $[O.C_6H_2(NO_2)_3]_2$	20	0.0003	» SiF_6	18	0.0038
$[Co(NH_3)_3I]Cl_2$	20	0.0154	» Cr_2O_7	18	0.00103
» SO_4	20	0.00529	» $[C_{10}H_7SO_3]_2.3H_2O$	18	0.00086
» $(ClO_3)_2$	20	0.00244	» CrO_4	18	0.00061
» $(NO_3)_2$	20	0.00217	» $[O.C_6H_2(NO_2)_3]_2$	18	0.00059
» I_2	20	0.0020			

* Xantho salts = Nitro pentammine cobaltic salts. ** Nitrato pentammine cobaltic salts.

SOLUBILITY OF COBALT AMMONIUM COMPOUNDS IN WATER. (Ephraim, 1923.)

Formula.	t°.	Gm. mols. cmpd. per liter.	Formula.	t°.	Gm. mol. cmpd. per liter.
$[Co(NH_3)_5H_2O]Cl_3$	17.5	0.859	$[Co(NH_3)_5H_2O]_2(Cr_2O_7)_3$	17.5	0.00037
» Br_3	17.5	0.346	» $[O.C_6H_2(NO_2)_3]_3$	17.5	0.00024
» $(ClO_4)_3$	17.5	0.207	$[Co(NH_3)_5(H_2O)_2]Cl_3$	22	1.83
» I_3	17.5	0.155	» Br_3	22	1.67
» $(NO_3)_3$	17.5	0.153	» $(NO_3)_3$	22	1.03
» $_2(SO_4)_3$	17.5	0.047	» $_2(SO_4)_3$	22	0.1752
» $_2(CrO_4)_3$	17.5	0.0019	» $(C_{10}H_7SO_3)_3.6H_2O$	22	0.007
» $(C_{10}H_7SO_3)_3.3H_2O$	17.5	0.00064			

SOLUBILITY OF DINITRO TETRAMMINE COBALTI FLAVO AND CROCEO SALTS IN WATER. (Ephraim, 1923.)

Flavo Salts (cis compounds) At 23°. Formula.	Gm. mols. cmpd. per liter.	Croceo Salts (trans compounds) At 18°. Formula.	Gm. mols. cmpd. per liter.
cis $[Co(NH_3)_4(NO_2)_2]Cl$	0.260	trans $[Co(NH_3)_4(NO_2)_2]Cl$	0.0397
» » Br	0.193	» » Br	0.0268
» » NO_3	0.132	» » ClO_3	0.0253
» » I	0.090	» » ClO_4	0.0242
» » ClO_4	0.0586	» » I	0.0198
» » $C_{10}H_7SO_3$	0.00895	» » $_2Cr_2O_7$	0.0160
» » $_2SiF_6$	0.00725	» » NO_3	0.0119
» » $_2SO_4$	0.00725	» » SiF_6	0.0110
» » $_2Cr_2O_7$	0.00332	» » $O.C_6H_2(NO_2)_3$	0.00561
» » $_2CrO_4$	0.00258	» » $_2SO_4$	0.00364
» » $O.C_6H_2(NO_2)_3$	0.00158	» » $_2CrO_4$	0.00310

Data for the solubility of **Nitro Rhodano Tetrammine Cobalti Chloride**, $[Co(NH_3)_4NO_2(SCN)]Cl$, in aqueous 0.1 normal solutions of HCl, LiCl, NaCl, KCl and CsCl are given by Gütelberg and Pedersen, 1926. This compound was chosen even though it could not be prepared completely pure, just as is the case with the larger number of metal ammoniates. Also, it is not completely stable in solution. It was found that the solubility increases with time of rotation about 1 per cent per hour. From determinations after various periods of rotation the solubility at 0 time of rotation was estimated to be 0.012 gm. mols. per 1000 gms. H_2O at 20°.

SOLUBILITY OF COBALT AMMONIUM COMPOUNDS IN WATER AT 25°.

(Strock and McCutcheon, 1931.)

Compound	Formula	Gms. compound per 100cc. sat. sol.
Cobalt tetraammine oxalato sulfate	$[\overset{C_2O_4}{Co}(NH_3)_4]_2SO_4$	0.7712
" " " dichromate	[" " $]_2Cr_2O_7.H_2O$	0.0734
" " " chromate	[" $]_2CrO_4$	0.03156
" " "perchlorate	[" $]ClO_4.H_2O$	0.4403(20°)
" " carbonato sulfate	$[\overset{CO_3}{Co}(NH_3)_4]_2SO_4$	6.061

SOLUBILITY OF CROCEO AND LUTEO COBALTIC SALTS IN WATER.

(Hansen and Williams, 1930.)

Compound	Formula	t°	Gm. mols. compound per liter sat. sol.
Croceo tetranitro diammine cobaltiate	$[Co(NH_3)_4(NO_2)_2][Co(NH_3)_2(NO_2)_4]$	20	0.00037
Croceo sulfate	$[Co(NH_3)_4(NO_2)_2]_2SO_4$	25	0.002447
Luteo iodate	$[Co(NH_3)_6](IO_3)_3$	25	0.00527

The authors also give results for the solubility of the above compounds in aqueous solutions of NaCl and of ethyl alcohol.

COBALT AMMONIUM COMPOUNDS

SOLUBILITY OF A SERIES OF COBALT AMINES, EACH DETERMINED SEPARATELY IN WATER AND IN METHYL ALCOHOL AT 20°.

(Brönsted, Delbanco and Volquartz, 1932.)

Compound	Formula	Gm. mols. compound per liter:	
		H_2O	CH_3OH
Cobalt, chloro pentammine chloride	$[Co(NH_3)_5Cl]Cl_2$	0.01785	0.000052
" " " bromide	" " Br_2	0.0161	0.000084
" " " iodide	" I_2	0.0464	0.0011
" " " nitrate	" $(NO_3)_2$	0.0460	0.000286
" bromo " chloride	$[Co(NH_3)_5Br]Cl_2$	0.0108	0.000043
" " " bromide	" Br_2	0.0060	0.0000466
" " " iodide	" I_2	0.0138	0.000391
" " " nitrate	" $(NO_3)_2$	0.0102	0.000093
" nitrato " chloride	$[Co(NH_3)_5NO_3]Cl_2$	0.0331	0.000065
" " " bromide	" Br_2	0.0260	0.000098
" " " iodide	" I_2	0.0338	0.00043
" " " nitrate	" $(NO_3)_2$	0.010	0.000048
" xantho " chloride	$[Co(NH_3)_5NO_2]Cl_2$	0.1078	0.0002
" " " bromide	" Br_2	0.046	0.00018
" " " iodide	" I_2	0.097	0.0018
" " " nitrate	" $(NO_3)_2$	0.0396	0.000231
K Tetra nitro diammine cobaltiate	$[Co(NH_3)_2(NO_2)_4]^-$ K	0.0651	0.00338
Rb " " " "	" Rb	0.0250	0.00117
Cs " " " "	" Cs	0.0170	0.000815
Croceo" " " "	" $[Co(NH_3)_4(NO_2)_2]$	0.000352	0.000322
Nitrorhodano" " "	" $[Co(NH_3)_4NO_2SCN]$	0.00184	0.000192
Flavo " " " "	" $[Co(NH_3)_4(NO_2)_2][Co(NH_3)_2(NO_2)_4]$	0.00325	0.000192
Tri nitro " " cobalt	$[Co(NH_3)_2(NO_2)_3]$	0.00593	0.00066
Croceo cobalt chloride	$[Co(NH_3)_4(NO_2)_2]Cl$	0.0441	0.000602
" " bromide	" Br	0.0281	0.001145
" " iodide	" I	0.0185	0.001126
" " chlorate	" ClO_3	0.0292	0.00061
" " bromate	" BrO_3	0.0162	0.00012
" " iodate	" IO_3	0.0291	0.00170
" " acetate	" CH_3COO	0.0412	0.000372
" " propionate	" C_2H_5COO	0.0252	0.00036
" " butyrate	" C_3H_7COO	0.1280	0.00194
" " Cl acetate	$[Co(NH_3)_4(NO_2)_2]_2ClCH_3COO$	0.0190	0.00039
" " Br "	" Br "	0.0331	0.000675
" " I "	" I "	0.116	0.00331
" " tetra nitro cobaltiate	" $[Co(NO_2)_4]$	0.000352	0.0000322
" " picrate	" $C_6H_2O(NO_2)_2$	0.0061	0.0019
" " salicylate	" C_6H_4OHCOO	0.0411	0.00631
" " m nitro benzoate	" $C_6H_4NO_2COO$	0.0203	0.0027
" " sulfate	" SO_4	0.00249	0.000015
Nitro Rhodano tetraamonium chloride	$[Co(NH_3)_4NO_2SCN]Cl$	0.00337	0.00117
" " " bromide	" Br	0.0541	0.00307
" " " perchlorate	" ClO_4	0.0248	0.00453
" " " tetra nitro cobaltiate	" $[Co(NO_2)_4]$	0.00184	0.000354
" " " picrate	" $C_6H_2O(NO_2)_2$	0.000615	0.00542

Results are also given showing the effect of various salts upon the solubility of the above compounds in methyl alcohol.

COBALT AMMONIUM COMPOUNDS

SOLUBILITY OF COBALT AMMONIUM COMPOUNDS IN WATER AT 25°.

Compound	Formula	Gm. mols. compound per liter sat. sol.
Luteo ferricyanide	$Co(NH_3)_6Fe(CN)_6$	0.00003 (1)(2)
" cobalti cyanide	$Co(NH_3)_6Co(CN)_6$	0.000022 (2)
" tetranitro diamino cobaltiate	$Co(NH_3)_6[Co(NH_3)_2(NO_2)_4]_3$	0.000164 (2)(3)
" di " " oxalo "	$Co(NH_3)_6[Co(NH_3)_2NO_2C_2O_4]_3$	0.0000827 (2)(3)
" " " " " "	" " (18°)	0.0000492 (4)
" " " " " "	" " (20°)	0.0000642 (4)
Iso Thiocyanate pentamin cobaltic nitrate	$\left[Co\begin{matrix}(SCN)\\(NH_3)_5\end{matrix}\right](NO_3)_2$	0.003444 (5)
" " " " iodide	" I_2	0.00088 (5)

(1) LaMer, King and Mason, 1927; (2) La Mer and Cook, 1929; (3) La Mer and Mason, 1927; (4) Bronsted and Volquartz, 1928; (5) Partington and Stonehill, 1936; see also O'Neill and Partington, 1934. In addition to the solubility in water at 25° most of the authors also give results for the solubilities of the compounds in various aqueous salt solutions.

NH

The solubility of cobalt chloro pentammine sulfate, $[Co(NH_3)_5Cl]SO_4$, in aqueous solutions of sulfuric acid at 35° and at 50° is reported by Liou Qui Tao and Wang Shik Mo, 1936. The analytical results are not given but it is stated that they do not agree with those of Benrath, 1926. The solid phases up to a concentration of 1.5 mol. H_2SO_4 per liter is $[Co(NH_3)_5Cl]SO_4.2H_2O$, and at concentration from 1.8 to 5.0 mol. H_2SO_4 it is $[Co(NH_3)_5Cl]SO_4.1/3H_2SO_4.2H_2O$.

SOLUBILITY OF LUTEO COBALTIC SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 35°.

(Sakar and Barat, 1930.)

Gms. H_2SO_4 per 100 gms. aq. solvent	Gm. Co per 100 gm. sat. sol.	Solid Phase	Gms. H_2SO_4 per 100 gms. aq. solvent	Gm. Co per 100 gm. sat. sol.	Solid Phase
0.0	0.4013	$[Co(NH_3)_6]_2(SO_4)_3$	20.0	0.5217	$[Co(NH_3)_6]_2(SO_4)_3\cdot 2H_2SO_4$
0.75	0.7041	"	30.0	0.1632	"
1.5	1.1121	"	40.0	0.1125	"
2.0	1.2806	"	50.0	0.1760	"
2.3	1.2063	$[Co(NH_3)_6]_2(SO_4)_3\cdot H_2SO_4$	60.0	0.4629	"
3.0	1.0911	"	61.0	0.4037	$2[Co(NH_3)_6]_2(SO_4)_3\cdot 3H_2SO_4\cdot 10H_2O$
5.0	0.8103	"	62.0	0.3208	
7.5	0.7540	"	65.0	0.1980	"
10.0	0.7472	"	70.0	0.0980	"
15.00	0.7827	"	75.0	0.0512	"
17.1	0.7196	$[Co(NH_3)_6]_2(SO_4)_3\cdot 2H_2SO_4$	80.0	0.0415	"

HEXA CYANO COBALTIC ACID, METHYL ALCOHOLATE AND ETHYL ALCOHOLATE SOLUBILITY OF EACH SEPARATELY IN METHYL AND IN ETHYL ALCOHOL.

(Holzl, 1931.)

The compounds were prepared by conducting dry hydrochloric acid gas in an absolute methyl or ethyl alcohol solution of Hexa cyano cobaltic acid $[Co(CN)_6]H_3$. The crystalline precipitates thus obtained had the compositions respectively: $[Co(CN)_6]H_3.2CH_3OH$ and $[Co(CN)_6]H_3.3C_2H_5OH$.

Results for the methyl alcoholate in commercial and in abs. CH_3OH

t°	Gms. salt per 100cc. sat. sol. a	Gms. salt per 100cc. sat. sol. b	t°	Gms. salt per 100cc. sat. sol. a	Gms. salt per 100cc. sat. sol. b
− 10	28.2	—	25	79.9	60.4
− 5	34.1	—	35	94.5	—
− 2	40.9	—	45	116.0	80.5
0	—	35.8	53	140.0	—
+ 5	49.9	—	60	180.0	—
15	64.3	—	65	207.0	120.0

a = commercial abs. methyl alcohol
b = CH_3OH boiled and distilled from CaO
Solid Phase = $Co(CN)_6H(HOHCH_3)_2$ in all cases.

Results for the ethyl alcoholate in abs. C_2H_5OH

t°	Gms. alcoholate per 100 cc sat. sol. in C_2H_5OH
0	2.47
25	3.99
45	6.29
55	7.27
65	9.50
75	12.68

Solid Phase = $[Co(CN)_6]H_3.3C_2H_5OH$ in all cases.

COBALT NITRITE $Co(NO_2)_2$

SOLUBILITY OF COBALT NITRITE IN WATER.

(Le Boucher, 1928.)

t°	Gms. $Co(NO_2)_2$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Co(NO_2)_2$ per 100 gms. sat. sol.	Solid Phase
0	0.076	?	20	0.40	?
5	0.15	"	25	0.49	"
10	0.24	"	30	0.60	"
15	0.32	"	40	0.84	"

COBALT RUBIDIUM NITRITE $Rb_3Co(NO_2)_6.H_2O$.

100 gms. H_2O dissolve 0.005 gm. of the salt. (Rosenbladt, 1886.)

COBALT NITRATE $Co(NO_3)_2$.

SOLUBILITY IN WATER.

(Funk — Wiss. Abh. p. t. Reichanstalt 3, 439, '00.)

t°.	Gms. $Co(NO_3)_2$ per 100 Gms. Solution.	Mols. $Co(NO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Co(NO_3)_2$ per 100 Gms. Solution.	Mols. $Co(NO_3)_2$ per 100 Mols. H_2O.	Solid Phase
−26	39.45	6.40	$Co(NO_3)_2.9H_2O$	41	55.96	12.5	$Co(NO_3)_2.6H_2O$
−20.5	42.77	7.35	"	56	62.88	16[illegible]	"
−21	41.55	6.98	$Co(NO_3)_2.6H_2O$	55	61.74	15.8	$Co(NO_3)_2.3H_2O$
−10	43.69	7.64	"	62	62.88	16.7	"
− 4	44.85	7.99	"	70	64.89	18.2	"
0	45.66	8.26	"	84	68.84	21.7	"
+18	49.73	9.71		91	77.21	33.3	"

Density of solution saturated at 18° = 1.575.

COBALT NITRATE

The following more recent determinations of the solubility of Cobalt Nitrate in water are lower than those given by Funk, 1900.

t°	Gms. $Co(NO_3)_2$ per 100 gms. sat. sol.	Solid Phase	Authority
15	47.7	$Co(NO_3)_2 6H_2O$	Wilcox and Bailey, 1927
20	49.33	"	" "
20	49.75	"	Cuvelier, 1931
25	50.7	"	Wilcox and Bailey, 1927
25	50.57	"	Waldman and Klatchko-Gourwitch, 1935.
30	52.7	"	Wilcox and Bailey, 1927.
54.5 tr.pt.	—	" $+Co(NO_3)_2.3H_2O$	Waldman and Klutchko-Gourwitch, 1935.
80	67.86	$Co(NO_3)_2.3H_2O$	Waldman and Klutchko-Gourwitch, 1935.

NO

SOLUBILITY OF COBALT NITRATE IN AQUEOUS SOLUTIONS OF COPPER NITRATE AND VICE VERSA.

(Wilcox and Bailey, 1927.)

d_{20} of sat. sol.	Gms. per 100 gms. sat. sol. $Co(NO_3)_2$	Gms. per 100 gms. sat. sol. $Cu(NO_3)_2$	Solid Phase
	Results at 14°		
—	47.5	0.0	$Co(NO_3)_2.6H_2O$
—	44.3	5.2	"
—	28.7	25.8	"
—	22.8	34.1	"
—	19.0	36.5	1.6.42
—	16.7	34.8	"
—	16.0	38.9	"
—	14.0	41.5	"
—	11.1	45.6	$Cu(NO_3)_2.6H_2O$
—	5.9	47.0	"
—	0.0	52.5	"
	Results at 20°		
1.598	49.3	0.0	$Co(NO_3)_2.6H_2O$
1.610	41.2	9.9	"
1.613	38.9	13.1	"
1.640	34.2	20.3	"

d_{20} of sat. sol.	Gms. per 100 gms. sat. sol. $Co(NO_3)_2$	Gms. per 100 gms. sat. sol. $Cu(NO_3)_2$	Solid Phase
	Results at 20° (Con.)		
1.705	24.5	33.7	$Co(NO_3)_2.6H_2O$
1.773	17.9	43.1	"
—	16.7	45.0	"
—	10.8	49.4	$Cu(NO_3)_2.6H_2O$
1.707	8.9	49.8	"
—	0.0	55.6	"
	Results at 30°		
—	52.7	0.0	$Co(NO_3)_2.6H_2O$
—	44.7	9.2	"
—	29.2	27.1	"
—	22.2	37.9	"
—	16.5	45.7	$Cu(NO_3)_2.6H_2O$
—	13.0	48.4	"
—	5.3	54.9	"
—	0.0	61.4	"

1.6.42 = $Co(NO_3)_2.6Cu(NO_3)_2.42H_2O$

SOLUBILITY OF COBALT NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID.

(Waldman and Klatchko-Gourvitch, 1935.)

Results at 25°			Results at 80°		
Gms. HNO_3 per 100 gms. aq. solvent	Gms. $Co(NO_3)_2$ per 100 gms. sat. sol.	Solid Phase	Gms. HNO_3 per 100 gms. aq. solvent	Gms. $Co(NO_3)_2$ per 100 gms. sat. sol.	Solid Phase
0.0	50.57	$Co(NO_3)_2 \cdot 6H_2O$	0.0	67.86	$Co(NO_3)_2 \cdot 3H_2O$
1.25	49.35	"	2.53	67.40	"
2.41	47.90	"	3.85	67.28	"
6.15	44.88	"	5.15	67.64	"
14.05	38.00	"	6.20	66.10	"
19.76	34.02	"	8.67	64.80	"
24.81	30.00	"	9.50	63.82	"
30.87	26.87	"	10.27	63.68	"

SOLUBILITY OF COBALT NITRATE IN GLYCOL.

(de Coninck, 1905.)

OH

100 grams saturated solution contain 80 gms. cobalt nitrate.

COBALT HYDROXIDE (ic) $Co(OH)_3$.

1000 cc. ordinary distilled H_2O, containing a little CO_2, dissolve 0.00318 gm. $Co(OH)_3$ at 20°. (Almkvist, 1918.)

COBALT Hexammine Per**RHENATE** $[Co(NH_3)_6](ReO_4)_3 \cdot 2H_2O$

ReO

One liter of water saturated at 20° with cobalt hexammine perrhenate dihydrate contains 0.469 gm. $[Co(NH_3)_6](ReO_4)_3$. (Wilke-Dörfurt and Gunzert, 1933.)

COBALT Dihydro **SULFIDE** $Co(SH)_2$

One liter of water saturated with cobalt dihydrosulfide contain 0.00021 gm. $Co(SH)_2$ at about 20°. (Mickwitz, 1931.)

COBALT Hydroxy **SULFHYDRATE** $Co(SH)(OH)$

One liter of water saturated with cobalt hydroxy sulfhydrate contain 0.00005 gm. $Co(SH)(OH)$ at about 20°. (Mickwitz, 1931.)

COBALT SULFIDE CoS

S

Attention is called by Kolthoff, 1931, to the incorrectness of the results of Weigel, 1906, for the solubility of CoS in water. He considers that the figures are of small or no practical importance and suggests that the relation between the solubility and the hydrogen ion and hydrogen sulfide concentration be expressed by the reaction constant applied in the state of equilibrium.

1000 cc. aq. 2.0 normal H_2SO_4, saturated with H_2S at 1 atmosphere pressure dissolve 0.0156 gm. CoS at 20°. (Moser and Behr, 1924.)

SOLUBILITY OF COBALT SULFATE IN WATER.

(Koppel, Wetzel, 1906; Benrath and Tiemann, 1934; Benrath, 1931.)

t°	Gms. $CoSO_4$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $CoSO_4$ per 100 gms. sat. sol.	Solid Phase
-2.7 (Eutec.)	19.03	Ice+$CoSO_4.7H_2O$	50	34.25	$CoSO_4.6H_2O$
0	20.3	$CoSO_4.7H_2O$	60	35.5	"
10	23.4	"	70	38.2	"
20	26.5	"	71 (tr. pt.)	38.4	"+$CoSO_4.2H_2O$
25	28.0	"	75	36.7	$CoSO_4.2H_2O$
30	29.6	"	80	35.0	"
40	32.8	"	90	31.2	"
44 (tr. pt.)	34.0	"+$CoSO_4.6H_2O$	100	28.0	"

The solubility of cobalt sulfate in water has also been determined by Rohmer, 1934, and special attention given to the metastable region above 64°.2. In this region saturation can be reached before transformation to a lower hydrate begins, but the duration of the existence of the tetra hydrate is only a few hours.

The following detailed results are given in a subsequent paper, Rohmer, 1939.

SO

t°	Gms. $CoSO_4$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $CoSO_4$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $CoSO_4$ per 100 gms. sat. sol.	Solid Phase
-0.9	9.0	Ice	64.2	36.7*	Co6	101.	43.2*	Co4
-1.4	12.6	"	65	37.0*	"	72.9	38.9	" + Co2
-2.1	16.2	"	70.4	38.2*	"	77	38.9*	Co2
-2.7	18.8	" + Co7	75.8	39.5*	"	78	38.9*	"
0	19.8	Co7	78	40.0*	"	80	38.8*	"
10	27.7	"	80	40.4*	"	88	38.8*	"
15	24.2	"	83.8	41.4*	"	93	38.7*	"
20	25.6	"	87.8	42.3*	"	96	38.7*	"
25	27.2	"	90.0	43.0*	"	61.3	37.5*	Co1
30	28.7	"	95	44.6*	"	64.2	36.7	" + Co6
35	30.3	"	80.4	40.5	" + Co4	66	36.4	Co1
40	31.5	"	83	40.8*	Co4	70	35.4	"
43.3	37.9	" + Co6	84	40.8*	"	80	33.0	"
50	33.8	Co6	90.4	41.5*	"	90	30.3	""
60.2	35.9	"	94.8	42.1*	"	100	27.8	"
						101.2 (b.pt.)	27.2	"

* Metastable

Co7 = $CoSO_4.7H_2O$; Co6 = $CoSO_4.6H_2O$; Co4 = $CoSo_4.4H_2O$; Co2 = $CoSO_4.2H_2O$; Co1 = $CoSO_4.H_2O$.

EQUILIBRIUM IN THE SYSTEM COBALT SULFATE, COPPER SULFATE AND WATER.

(Crockford and Brawley, 1932.)

Results at 0°			Results at 25°		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$CoSO_4$	$CuSO_4$		$CoSO_4$	$CuSO_4$	
19.82	0.0	$CoSO_4.7H_2O$	27.16	0.0	$CoSO_4.7H_2O$
19.09	0.59	Solid solution	25.24	1.76	Solid solution
17.64	1.57	"	23.25	3.71	"
15.02	3.14	"	18.55	7.45	"
10.67	6.66	"	15.03	11.61	"
7.89	9.53	"	13.88	12.91	"+$CuSO_4.5H_2O$
5.94	11.95	"+$CuSO_4.5H_2O$	9.70	14.68	$CuSO_4.5H_2O$
4.05	12.33	$CuSO_4.5H_2O$	5.07	16.66	"
2.80	12.55	"	1.14	18.18	"
1.00	12.78	"	0.0	18.45	"
0.0	12.87	"			

SOLUBILITY OF COBALT SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 12.5°.

(Monte-marynini and Losana, 19PH.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 10C gms. sat. sol.		Solid
	H_2SO_4	$CoSO_4$			H_2SO_4	$CoSO_4$	
1.2832	00.0	24.52	$CoSO_4.7H_2O$	1.3825	47.92	3.24	$CoSO_4.2H_2O$
1.2703	9.88	16.94	"	1.4614	56.21	1.06	"+$CoSO_4$
1.2782	21.56	11.08	$CoSO_4.6H_2O$	1.5451	65.72	0.24	$CoSO_4$
1.3186	27.72	9.96	"	1.6426	73.48	0.04	"
1.3276	31.26	9.86	"	1.7652	84.51	0.25	$CoSO_4.H_2SO_4$
1.3680	39.67	6.98	"+$CoSO_4.H_2O$	1.8448	98.80	0.68	"

SOLUBILITY OF COBALT SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT SEVERAL TEMPERATURES.

(Klatchko-Gourvitch and Gandganov, 1936.)

Gms. per 100 gms. sat. sol.		Solid Phase
H_2SO_4	$CoSO_4$	
Results at 0°		
0.0	19.55	$CoSO_4.7H_2O$
2.78	17.73	"
5.94	16.10	"
11.88	11.40	"
20.78	7.86	"
35.03	4.04	"
41.14	3.62	$CoSO_4.6H_2O$
49.14	3.01	"
50.9	2.95	$CoSO_4.3H_2O$
51.1	2.64	"
60.21	1.86	"
70.43	0.988	"
Results at 20°		
0.0	26.5	$CoSO_4.7H_2O$
2.43	23.76	"
7.1	20.55	"
10.2	18.6	"
18.01	14.5	"
20.9	13.55	"
21.3	12.98	"
24.2	11.9	"
26.8	11.2	"
29.18	10.22	$CoSO_4.6H_2O$
32.	9.45	"
34.4	8.9	"
37.86	8.3*	"
39.2	8.6*	"
41.27	8.95*	"
41.8	9.25*	"
37.6	7.36	$CoSO_4.3H_2O$
38.5	6.13	"
42.7	3.7	"
44.	3.1	"
48.9	1.8	"

Gms. per 100 gms. sat. sol.		Solid Phase
H_2SO_4	$CoSO_4$	
Results at 40°		
0.0	32.75	$CoSO_4.7H_2O$
3.56	29.65	"
8.74	25.98	"
10.52	25.04	"
15.7	25.17*	"
7.7	27.5*	$CoSO_4.6H_2O$
13.71	22.97	"
19.67	20.13	"
21.93	19.2	"
24.85	18.2	"
30.48	16.8	"
34.72	13.62	$CoSO_4.3H_2O$
35.8	11.03	"
37.8	7.2	"
39.9	5.0	"
50.8	1.06	$CaSO_4.H_2O$
54.6	0.74	"
58.75	0.32	"
Results at 80°		
0.0	40.15	$CoSO_4.4H_2O$
0.08	39.2	"
2.9	37.08	"+$CoSO_4.3H_2O$
4.32	31.67	$CoSO_4.3H_2O$
7.55	26.75	"
11.57	23.51	"
17.7	20.6	"
19.8	20.4	"+$CoSO_4.H_2O$
20.8	19.5	$CoSO_4.H_2O$
26.89	14.4	"
28.7	13.2	"
32.57	10.3	"
39.25	5.99	"
44.4	4.4	"

SO

* Metastable

SOLUBILITY OF COBALT SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT SEVERAL TEMPERATURES.

(Rohmer, 1930.)

The author questions the accuracy of the preceding results of Klatchko - Gourvitch and Gandganov, 1935, due to the short time (4 hours) allowed for attainment of equilibrium and errors of the method of analysis. He also finds that the tetra hydrate and tri hydrate of cobalt sulfate do not exist as stable solid phases.

SO

Gms. per 100 gms. sat. sol. H_2SO_4	Gms. per 100 gms. sat. sol. $CoSO_4$	Solid Phase
Results at 0°		
0.0	19.8	Co7
9.9	13.2	"
19.3	8.2	"
29	5.4	"
33.6	4.6	"
42.0	4.0	" + Co6
48.0	3.9	Co1 + "
44.1	3.1	"
51.5	0.9	"
55.1	0.3	"
91.4	0.0	" + Co
5.2	45.6*	Co7
7.3	49.3*	"
3.9	42.0*	Co6
4.6	47.1*	"
5.3	49.3*	"
Results at 25°		
0.0	27.1	Co7
5.2	22.8	"
9.4	20.4	"
16.8	16.7	"
20.8	15.0	"
22.5	14.6	" + Co6
23.8	13.9	Co6
30.2	11.3	"
31.0	11.0	" + Co1
40.7	4.3	Co1
43.7	3.0	"
Results at 25° (con.)		
47.2	1.6	Co1
50.6	0.9	"
54.1	0.4	"
76.4	0.0	"
89.6	0.	" + Co
97.0	0.	Co
35.5	10.3*	Co6
38.4	10.8*	"
39.8	11.9*	"
Results at 40°		
0.0	31.5	Co7
2.4	29.6	"
3.6	28.9	" + Co6
7.0	26.7	Co6
10.8	24.5	"
15.6	21.8	"
22.1	18.9	" + Co1
23.9	16.7	Co1
28.3	13.1	"
33.1	9.3	"
41.8	4.0	"
47.0	1.8	"
86.3	0.0	" + Co
96.1	0.0	Co
23.4	18.3*	Co6
31.6	17.4*	"
25.9	17.6*	Co4
26.0	17.6*	Co2
Results at 70°		
0	35.2	Co1
5.1	30.6	"
16.6	21.5	"
30.0	10.3	"
41.3	3.7	"
52.0	0.2	"
79.8	0.0	" + Co
96.1	0.0	Co
0	38.0*	Co6
5.3	34.5*	"
9.2	32.8*	" + Co4
12.6	30.3*	Co4
2.6	36.3*	Co6 + Co2
9.7	30.1*	Co2
13.5	27.0*	"
17.0	24.3*	"
Results at 78°		
0	34.0	Co1
12.1	25.3	"
0	39.3*	Co6
7.0	36.0*	"
0.0	40.4*	Co4
4.7	37.0*	Co6
6.4	35.7*	Co4
11.3	32.2*	"
0.0	39.8*	Co2
13.9	29.1*	"

* Metastable

Co7 = $CoSO_4.7H_2O$; Co6 = $CoSO_4.6H_2O$; Co4 = $CoSO_4.4H_2O$; Co2 = $CoSO_4.2H_2O$; Co1 = $CoSO_4.H_2O$; Co = $CoSO_4$.

COBALT SULFATE

EQUILIBRIUM IN THE SYSTEM COBALT SULFATE, POTASSIUM SULFATE AND WATER AT 25°.

(Caven and Johnston, 1928.)

Gm. mols. per 1000 gms. H_2O K_2SO_4	Gm. mols. per 1000 gms. H_2O $CoSO_4$	Solid Phase	Gm. mols. per 1000 gms. H_2O K_2SO_4	Gm. mols. per 1000 gms. H_2O $CoSO_4$	Solid Phase
0.0	2.433	$CoSO_4.7H_2O$	0.388	0.950	1.1.6
0.190	2.536	"	0.531	0.458	"
0.212	2.557	" + 1.1.6	0.780	0.239	" + K_2SO_4
0.240	2.205	1.1.6	0.737	0.150	K_2SO_4
0.321	1.372	"	0.680	0.00	"
0.361	1.095	"			

EQUILIBRIUM IN THE SYSTEM COBALT SULFATE, POTASSIUM SULFATE AND WATER AT VARIOUS TEMPERATURES.

(Benrath, 1932.)

t°	Gms. per 100 gms. H_2O K_2SO_4	Gms. per 100 gms. H_2O $CoSO_4$	Solid Phase	t°	Gms. per 100 gms. H_2O K_2SO_4	Gms. per 100 gms. H_2O $CoSO_4$	Solid Phase
0	7.27	1.23	K + 1.1.6	55	15.75	8.15	K + 1.1.6
"	2.45	20.3	Co7 + 1.1.6	60	13.0	11.56	Co6 + 1.1.6
"	4.12	3.67	1.1.6	68	4.55	37.2	Co6+Co1+1.1.6
25	11.55	3.14	K + 1.1.6	69	5.4	37.0	Co1 + 1.1.6
"	2.57	27.65	Co7 + 1.1.6	80	10.11	31.49	Co1 + 1.1.6
"	7.73	6.88	1.1.6	88	16.84	20.41	K + 1.1.6
39	2.87	33.0	Co7+Co6+1.1.6	"	13.45	26.45	Co1 + 1.1.6
40	13.99	4.88	K + 1.1.6	94	15.27	23.05	Co1 + K + 1.1.6
46	3.45	33.15	Co6 + 1.1.6	100	17.8	24.67	Co1 + K
"	11.08	9.87	1.1.6				

K = K_2SO_4; Co6 = $CoSO_4.6H_2O$; Co7 = $CoSO_4.7H_2O$; 1.1.6 = $CoSO_4.K_2SO_4.6H_2O$

From the polytherm constructed from the above results the following values for the solubility of the double salt, $CoSO_4.K_2SO_4.6H_2O$, in water were obtained.

t°	Gms. $CoK_2(SO_4)_2$ per 100 gms. H_2O	t°	Gms. $CoK_2(SO_4)_2$ per 100 gms. H_2O	t°	Gms. $CoK_2(SO_4)_2$ per 100 gms. H_2O
0	8.5	30	19.4	60	32.5
10	11.7	40	23.4	70	38.7
20	15.5	50	27.7	80	47.8

100 gms. H_2O sat. at 25° with 1.1.6 dissolve 12.88 gms. $CoK_2(SO_4)_2$. (Locke, 1902.)

COBALT SULFATE

SOLUBILITY OF MIXTURES OF COBALT POTASSIUM SULFATE, $CoK_2(SO_4)_2.6H_2O$, AND COPPER POTASSIUM SULFATE $CuK_2(SO_4)_2.6H_2O$, IN WATER AT 0° AND AT 77.8°.

(Ploinesma, 1928.)

Results at 0°

d. of sat. sol.	Gms. per 1000 cc. sat. sol.		Percent Co salt in solid phase
	$CoK_2(SO_4)_2.6H_2O$	$CuK_2(SO_4)_2.6H_2O$	
1.0719	106.81	0.0	100.00
1.0673	87.06	11.40	78.59
1.0612	65.31	25.43	59.15
1.0601	56.68	31.19	50.54
1.0566	44.15	39.48	41.26
1.0538	33.30	46.32	30.33
1.0524	22.09	53.71	18.40
1.0488	13.46	58.33	10.96
1.0462	0.00	67.67	0.00

Results at 77.8°

SO

d. of sat. sol.	$CoK_2(SO_4)_2.6H_2O$	$CuK_2(SO_4)_2.6H_2O$	Percent Co salt in solid phase
1.0879	133.80	0.00	100.00
1.0852	124.47	5.90	90.44
1.0825	110.20	14.79	79.60
1.0796	94.53	25.30	70.25
1.0760	82.36	32.18	58.73
1.0730	73.90	37.08	52.87
1.0703	58.54	46.92	40.47
1.0668	44.02	56.02	29.16
1.0639	29.49	66.14	20.11
1.0617	17.21	74.48	12.22
1.0587	0.00	85.99	0.00

SOLUBILITY OF COBALT SULFATE IN AQUEOUS SOLUTIONS OF AMMONIUM SULFATE AT 25°.

(Craven and Gardner, 1935.)

Gm. mols. per 1000 gms. H_2O		Solid Phase	Gm. mols. per 1000 gms. H_2O		Solid Phase
$CoSO_4$	$(NH_4)_2SO_4$		$CoSO_4$	$(NH_4)_2SO_4$	
2.441	0.0	$CoSO_4.7H_2O$	0.9069	0.4655	1.1.6
2.430	0.2868	" + 1.1.6	0.5916	0.5989	"
2.352	0.3156	1.1.6	0.1581	1.375	"
1.744	0.3522	"	0.0967	2.534	"
1.678	0.3986	"	0.0606	3.061	"
1.054	0.4488	"	0.0370	4.689	"
0.9419	0.4677	"	0.00	5.826	$(NH_4)_2SO_4$

1.1.6 = $CoSO_4.(NH_4)_2SO_4.6H_2O$

EQUILIBRIUM IN THE SYSTEM COBALT SULFATE, AMMONIUM SULFATE AND WATER AT VARIOUS TEMPERATURES.

(Benrath, 1932.)

t°	Gms. per 100 gms. H_2O		Solid Phase	t°	Gms. per 100 gms. H_2O		Solid Phase
	$CoSO_4$	$(NH_4)_2SO_4$			$CoSO_4$	$(NH_4)_2SO_4$	
0	0.28	40.95	1.1.6+$(NH_4)_2SO_4$	55	12.60	10.73	1.1.6
0	4.80	4.09	1.1.6	55	34.02	4.14	"+Co6
0	19.33	2.12	"+Co7	68	35.68	5.05	"+ " +Co1
25	0.16	43.9	1.1.6+$(NH_4)_2SO_4$	80	2.02	47.75	"+$(NH_4)_2SO_4$
25	7.40	6.28	1.1.6	80	17.45	14.85	1.1.6
25	27.23	2.76	"+Co7	80	31.82	7.94	"+Co1
39	35.75	3.38	"+ " Co6	100	4.76	47.5	"+$(NH_4)_2SO_4$
46	35.0	4.04	"+Co6	100	23.18	19.72	"
55	0.70	46.4	"+$(NH_4)_2SO_4$	100	26.58	12.48	"+Co1

1.1.6 = $CoSO_4.(NH_4)_2SO_4.6H_2O$; Co7 = $CoSO_4.7H_2O$; Co6 = $CoSO_4.6H_2O$; Co1 = $CoSO_4.H_2O$

SO

SOLUBILITY OF COBALT AMMONIUM SULFATE $CoSO_4.(NH_4)_2SO_4.6H_2O$ IN WATER.

(Tobler — Liebig's Annalen 95, 193, '55; v. Hauer — J. pr. Chem. 74, 433, '58; at 25°, Locke — Am Ch. J. 27, 459, '01.)

t°.	Gms. $(NH_4)_2Co(SO_4)_2$ per 100 Gms.		t°.	Gms. $(NH_4)_2Co(SO_4)_2$ per 100 Gms.	
	Water.	Solution.		Water.	Solution.
0	6.0	5.7	40	22.0	18.0
10	9.5	8.7	50	27.0	21.3
20	13.0	11.5	60	33.5	25.1
25	14.72	12.8	70	40.0	28.6
30	17.0	14.5	80	49.0	32.9

NOTE. — The determinations reported by the above named investigators were plotted on cross-section paper and although considerable variations were noted, an average curve which probably represents very nearly the true conditions was drawn through them, and the above table made from this curve.

From the polytherm constructed from his results, Benrath, 1932, obtained the following values for the solubility of the double salt, $CoSO_4.(NH_4)_2SO_4.6H_2O$, in Water.

t°	Gms. $Co(NH_4)_2(SO_4)_2$ per 100 gms. H_2O	t°	Gms. $Co(NH_4)_2(SO_4)_2$ per 100 gms. H_2O	t°	Gms. $Co(NH_4)_2(SO_4)_2$ per 100 gms. H_2O
0	9.8	40	23.1	80	47.7
10	12.5	50	27.7	90	58.0
20	15.5	60	33.5	100	75.1
30	19.0	70	39.5		

SOLUBILITY OF MIXTURES OF COBALT AMMONIUM SULPATE, $CoSO_4.(NH_4)_2SO_4.6H_2O$, AND COPPER AMMONIUM SULPATE, $CuSO_4(NH_4)_2SO_4.6H_2O$, IN WATER.

(Bertlschowra, 1928.)

Results at 0°.

d. of sat. sol.	Gms. per 1000 cc. sat. sol.		Percent Co salt in solid phase
	$Co(NH_4)_2(SO_4)_2.6H_2O$	$Cu(NH_4)_2(SO_4)_2.6H_2O$	
1.0640	111.65	0.00	100.00
1.0687	101.36	16.14	90.06
1.0758	77.68	50.70	69.14
1.0809	56.92	80.87	52.86
1.0836	49.49	92.28	43.22
1.0863	35.53	110.93	32.80
1.0886	22.56	127.89	24.13
1.0905	15.70	138.11	14.27
1.0931	0.0	162.82	0.00

Results at 8°

d. of sat. sol.	$Co(NH_4)_2(SO_4)_2.6H_2O$	$Cu(NH_4)_2(SO_4)_2.6H_2O$	Percent Co salt in solid phase
1.0757	130.78	0.00	100.00
1.0757	112.78	27.76	85.68
1.0846	105.76	40.45	77.29
1.0923	77.75	82.50	57.91
1.0960	69.22	96.99	48.70
1.0985	51.75	120.61	30.42
1.1027	34.93	144.14	25.91
1.1059	28.44	157.65	18.44
1.1094	12.09	178.04	9.43
1.1112	0.00	197.62	0.00

SO

SOLUBILITY OF COBALT SULPATE IN AQUEOUS SOLUTIONS OF SODIUM SULPATE AT 25° AND VICE VERSA.

(Craven and Gardner, 1933.)

Gm. mols. per 1000 gms. H_2O		Solid Phase	Gm. mols. per 1000 gms. H_2O		Solid Phase
$CoSO_4$	Na_2SO_4		$CoSO_4$	Na_2SO_4	
2.433	0.00	$CoSO_4.7H_2O$	1.891	1.356	1.1.4
2.406	0.1983	"	1.665	1.663	"
2.372	0.4220	"	1.517	2.035	"
2.327	0.7565	"	1.510	2.092	" + $Na_2SO_4.10H_2O$
2.275	1.075	" + 1.1.4	1.119	2.069	$Na_2SO_4.10H_2O$
2.266	1.096	1.1.4	0.750	2.044	"
			0.0	1.988	"

1.1.4 = $CoSO_4.Na_2SO_4.4H_2O$

SOLUBILITY OF COBALT SULFATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE AT 97° AND VICE VERSA.

(Benrath and Benrath, 1929.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$CoSO_4$	Na_2SO_4			$CoSO_4$	Na_2SO_4	
1.408	34.33	0.0	$CoSO_4.H_2O$	1.368	20.48	14.00	1.1.4
1.409	31.21	2.96	"	1.340	17.84	15.94	"
1.395	27.21	7.09	"	1.332	14.96	18.89	"
1.372	23.10	11.40	"	—	11.43	22.23	"
1.448	28.91	9.01	"+(?)	1.318	6.38	27.05	"+Na_2SO_4
1.424	28.13	10.34	1.1.4	1.301	4.80	28.08	Na_2SO_4
1.408	24.07	11.76	"+$CoSO_4.H_2O$	1.237	0.0	30.50	"
1.375	21.28	13.31	1.1.4				

1.1.4 = $CoSO_4.Na_2SO_4.4H_2O$

SOLUBILITY OF MIXTURES OF $CoSO_4.7H_2O$ AND $Na_2SO_4.10H_2O$ IN WATER.

(Koppel; Wetzel.)

t°.	Gms. per 100 Gms. Solution.		Gms. per 100 Gms. H_2O.		Mols. per 100 Mols. H_2O.		Solid Phase.
	$CoSO_4$.	Na_2SO_4.	$CoSO_4$	Na_2SO_4.	$CoSO_4$.	Na_2SO_4.	
0	16.56	7.63	21.85	10.07	2.54	1.27	$CoSO_4.7H_2O$ + $Na_2SO_4.10H_2O$
5	17.46	9.59	23.94	13.15	2.77	1.67	"
10	17.90	11.73	25.41	16.67	2.94	2.11	"
20	17.59	16.43	26.65	24.91	3.09	3.15	$CoNa_2(SO_4)_2.4H_2O$
25	17.06	15.70	25.36	23.32	2.95	2.97	"
30	15.94	14.93	23.15	21.61	2.70	2.74	"
35	15.73	14.52	22.54	20.85	2.62	2.64	"
40	14.87	14.22	20.98	20.05	2.46	2.53	"
18.5	18.75	15.61	28.61	23.82	3.32	3.02	$CoNa_2(SO_4)_2.4H_2O$ + $CoSO_4.7H_2O$
20	19.30	15.10	29.42	23.01	3.41	2.92	"
25	20.30	13.60	30.74	20.58	3.56	2.61	"
30	21.67	12.05	32.70	18.17	3.79	2.30	"
35	22.76	10.43	34.06	15.61	3.95	1.98	"
40	24.05	9.16	35.01	13.72	4.81	1.74	"
18.5	16.87	16.97	25.50	25.65	2.96	3.25	$CoNa_2(SO_4)_2.4H_2O$ + $Na_2SO_4.10H_2O$
20	15.41	18.12	23.18	27.26	2.69	3.45	"
25	10.63	23.26	16.07	35.17	1.86	4.46	"
30	6.01	28.67	9.20	43.74	1.07	5.54	"
35	4.56	32.14	7.19	50.79	0.835	6.44	$CoNa_2(SO_4)_2.4H_2O$ + Na_2SO_4
40	4.72	31.78	7.45	50.10	0.864	6.34	"

SO

The following additional data for this system are given by Benrath, 1931.

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms. sat. sol.		Solid Phase
	$CoSO_4$	Na_2SO_4			$CoSO_4$	Na_2SO_4	
60	33.85	4.11	Co6 + 1.1.4	75	34.4	2.9	Co1
60	29.71	7.27	1.1.4	75	32.95	6.60	" + 1.1.4
60	11.57	19.98	"	75	14.12	17.58	1.1.4
60	5.27	27.82	"+Na_2SO_4	75	6.90	28.75	" + Na_2SO_4
65	35.00	4.52	"+Co1	100	20.15	15.15	" + Co1

Co1 - $CoSO_4.H_2O$; Co6 = $CoSO_4.6H_2O$; 1.1.4 = $CoSO_4.Na_2SO_4.4H_2O$.

EQUILIBRIUM IN THE SYSTEM COBALT SULFATE, NICKEL SULFATE AND WATER.

(Benrath and Thiemann, 1934.)

Mol. percent $CoSO_4$ in sat. sol.	Gm. mols. H_2O to dissolve 1 gm. mol $CoSO_4 + NiSO_4$	Solid Phase
Results at 0°		
100.	33.8	Co7
55.8	27.1	"
53.5	26.8	" + Ni7
51.3	27.2	Ni7
45.9	27.8	"
36.3	28.5	"
0.0	30.8	"
Results at 17.5°		
100.	25.0	Co7
93.7	24.9	"
73.3	23.4	"
50.0	21.4	"
46.7	21.1	" + Ni7
45.9	27.8	Ni7
30.8	22.1	"
12.4	23.1	"
0.0	23.5	"
Results at 30°		
100.	20.4	Co7
78.0	20.1	"
69.1	18.77	" + (NiCo)6
63.4	18.56	(NiCo)6
55.0	18.6	"
40.0	18.06	"
29.9	18.8	Ni6α
17.62	19.19	"
9.40	19.5	"
0.0	19.75	Ni7
Results at 50°		
100.	16.53	Co6
94.3	16.22	(NiCo)6
80.2.	16.12	"
55.5	16.31	"
43.3	16.14	"
33.7	16.19	"
20.15	16.10	"
12.90	16.30	"
4.24	16.34	"
2.31	16.46	"
0.0	16.56	Ni6α
Results at 70°		
100.	13.93	Co6
80.2	13.79	(NiCo)6
50.3	14.00	"
32.9	14.03	"
12.55	14.15	"
3.33	14.15	"
0.0	14.33	Ni6β
Results at 90°		
100.	18.96	Co1
71.5	15.13	(NiCo)1
51.8	13.58	"
39.5	11.61	"
39.2	11.50	(NiCo)6
27.0	11.93	"
9.73	12.09	"
0.0	12.12	Ni6β

Results are also given for the temperatures, 26°, 35.5°, 41.5°, 79.3° and 98.5°.

Co7 = $CoSO_4.7H_2O$; Co6 = $CoSO_4.6H_2O$; Ni7 = $NiSO_4.7H_2O$; Ni6α = $NiSO_4.6H_2O$α; (NiCo)6 = Mixed crystals of $CoSO_4.6H_2O + NiSO_4.6H_2O$β; (NiCo)6 = Mixed crystals of $CoSO_4.H_2O + NiSO_4.H_2O$. From the polytherm constructed from the numerical results the following limiting points of the system were obtained:

t°	Mol. percent $CoSO_4$ in sat. sol.	Gm. mols. H_2O to dissolve 1 gm. mol. $CoSO_4 + Ni_2SO_4$	Solid Phase
0	53.6	26.9	Co7 + Ni7
41.5	100.0	17.55	Co7 + Co6
31.5	0	19.4	Ni7 + Ni6α
52.5	0	16.3	Ni6 + Ni6β
71.0	100	13.8	Co6 + Co1
103 (?)	0	10.6	Ni6β + Ni1
21	46.5	19.5	Co7 + Ni7 + (CoNi)6β
26	35.0	19.5	Ni7 + Ni6α + (CoNi)6β

Later very painstaking determinations of 14 isotherms of this system between 0° and 61° by Rohmer, 1939, in which special attention was paid to the crystallographic identification of the solid phases, confirm in general the above results of Benrath and Thiemann. The same solid phases were found and the two points located at which the solution is simultaneously saturated with three solid phases. The observed temperatures of these points were, however, 23.4° and 33.4° instead of 21° and 26° reported by Benrath and Thiemann. There were also other points rectified or clarified by the experiments of Rohmer.

EQUILIBRIUM IN THE SYSTEM COBALT SULFATE, RUBIDIUM SULFATE AND WATER.

(Benrath, 1932.)

t°	Gms. per 100 gms. H_2O		Solid Phase	t°	Gms. per 100 gms. H_2O		Solid Phase
	$CoSO_4$	Rb_2SO_4			$CoSO_4$	Rb_2SO_4	
0	1.89	3.25	1.1.6	69	1.33	40.97	1.1.6 + Rb_2SO_4
0	19.85	1.2	" + Co7	69	9.73	16.8	1.1.6
25	0.26	33.54	" + Rb_2SO_4	69	37.2	5.6	" + Co6 + Co1
25	3.96	6.81	1.1.6	88	12.96	22.35	1.1.6
25	27.63	2.47	" + Co7	88	28.46	13.79	" + Co1
40	36.65	3.0	" + " + Co6	100	4.21	47.17	" + Rb_2SO_4
44.5	6.38	11.04	1.1.6	100	14.88	25.57	1.1.6
60	8.45	14.6	"	100	25.35	19.10	" + Co1

1.1.6 = $CoSO_4.Rb_2SO_4.6H_2O$; Co7 = $CoSO_4.7H_2O$; Co6 = $CoSO_4.6H_2O$
Co1 = $CoSO_4.H_2O$.

From the polytherm constructed from the above results the following values for the solubility of the double salt, $CoSO_4.Rb_2SO_4.6H_2O$ in water were obtained.

t°	Gms. $CoRb_2(SO_4)_2$ per 100 gms. H_2O	t°	Gms. $CoRb_2(SO_4)_2$ per 100 gms. H_2O	t°	Gms. $CoRb_2(SO_4)_2$ per 100 gms. H_2O
0	5.1	40	18.7	80	45.0
10	7.5	50	24.2	90	55.0
20	10.8	60	30.3	100	70.0
30	14.5	70	37.1		

EQUILIBRIUM IN THE SYSTEM COBALT SULFATE, THALLIUM SULFATE AND WATER.

(Benrath and Thiemann, 1932.)

t°	Gms. per 100 gms. H_2O		Solid Phase	t°	Gms. per 100 gms. H_2O		Solid Phase
	$CoSO_4$	Tl_2SO_4			$CoSO_4$	Tl_2SO_4	
0	1.45	3.20	1.1.6+Tl_2SO_4	78.5	32.02	14.07	1.1.6 + Co1
"	20.40	2.40	" + Co7	84.5	19.27	21.91	" + Tl_2SO_4
25	0.85	5.42	Tl_2SO_4	"	29.8	16.15	" + Co1
"	3.17	6.0	" + 1.1.6	100	2.78	17.47	Tl_2SO_4
"	3.64	5.58	1.1.6	"	7.83	20.22	"
"	5.64	4.75	"	"	17.94	25.94	"
"	23.54	3.14	"	"	21.16	26.89	"
"	26.6	2.96	" + Co7	"	23.09	28.47	" +Co1
"	26.7	2.18	Co7	"	26.97	13.48	Co1
36	4.27	7.37	1.1.6+Tl_2SO_4	39.5	31.7	4.04	Co7+Co6+1.1.6
"	28.79	3.07	" + Co7	69.5	37.3	7.48	Co1+ " + "
50	7.37	11.3	" + Tl_2SO_4	94	24.4	25.9	" + Tl_2SO_4+"
"	32.53	5.04	" + Co6				

Co7 = $CoSO_4.7H_2O$; Co6 = $CoSO_4.6H_2O$; Co1 = $CoSO_4.H_2O$; 1.1.6 = $CoSO_4.Tl_2SO_4.6H_2O$.

SOLUBILITY OF ANHYDROUS COBALT SULFATE IN ABSOLUTE METHYL AND ETHYL ALCOHOLS.

(Gibson, Driscoll and Jones, 1929.)

Results for Methyl Alcohol			Results for Ethyl Alcohol		
t°	Gms. CoSO per 100 gms. CH_3OH	Solid Phase	t°	Gms. $CoSO_4$ per 100 gms. C_2H_5OH	Solid Phase
15	0.300	$CoSO_4$	15	0.017	$CoSO_4$
25	0.418	"	25	0.018	"
35	0.419	"	45	0.023	"
45	0.372	"	55	0.026	"
55	0.267				

SOLUBILITY OF COBALT SULPHATE IN METHYL AND ETHYL ALCOHOL AND IN GLYCOL.

SO

Solvent.	t°.	Gms. per 100 Gms. Solvent.		Observer.
		$CoSO_4$.	$CoSO_4.7H_2O$.	
Methyl Alcohol (abs.)	3	...	42.8	(de Bruyn—Z. physik. Ch. 10, 784, '92.)
" "	15	...	50.9	"
" "	18	1.04	54.5	"
" (93.5%)	3	...	13.3	"
" (50%)	3	...	1.8	"
Ethyl Alcohol (abs.)	3	...	2.5	"
Glycol	..	(per 100 gms. solution) 3.1		(de Coninck—Bull. acad. roy. Belgique, 359, '05.)

Fusion-point data for mixtures of $CoSO_4 + Li_2SO_4$, $CoSO_4 + K_2SO_4$ and $CoSO_4 + Na_2SO_4$ are given by Calcagni and Marotta, 1913.

CASSIOPEIUM SULFATE $Cp_2(SO_4)_3.8H_2O$ (**LUTETIUM SULFATE**)

100 gms. sat. solution of Cassiopeium Sulfate in water contain 32.10 gm. $Cp_2(SO_4)_3$ at 20 and 14.48 gms. at 40 . (Jackson and Rienacker, 1930.)

CHROMIUM Cr_2

The approximate percentage solubility of Chromium in Mercury is less than 5×10^{-5}. (Irvin and Russel, 1932.)

CHROMIUM ACETATE $Cr(CH_3COO)_3.H_2O$

SOLUBILITY OF ANHYDROUS CHROMIUM ACETATE IN METHYL ALCOHOL AND IN ACETONE.

(Henstock, 1934.)

Solvent	t°	Gms. $Cr(CH_3COO)_3$ per 100 gms. of solvent
Methyl Alcohol CH_3OH	15°	4.76
" " "	66.9 (b.pt.)	8.66
Acetone CH_3COCH_3	15	0.20

CHROMIUM THIOCYANATE $Cr(CNS)_3$.

Data for the distribution of $Cr(CNS)_3$ between water and ether at 0°-30° are given by Hantzsch and Vagt, 1901.

CHROMIUM Hexa Urea **CHLORIDE** etc.

SOLUBILITY OF EACH SEPARATELY IN WATER AT 20°.
(Wilke-Dörfurt and Niederer, 1929.)

Compound	Formula	Gm. Mols. Compound per liter sat. sol.
Chromium Hexa Urea:		
Chloride	$[Cr(OCN_2O_4)_6]Cl_3 3H_2O$	0.20
Bromide	" $Br_3.3H_2O$	0.20
Iodide	" I_3	0.075
Nitrite	" $(NO_2)_3$	0.16
Nitrate	" $(NO_3)_3$	0.10
Perchlorate	" $(ClO_4)_3$	0.006
Chloride Sulfate	" $ClSO_4$	0.048
Boro fluoride	" $(BF_4)_3$	0.005
Chlorate	" $(ClO_3)_3$	0.15
Thiosulfate	" $(S_2O_3)_3.3H_2O$	0.006
Bichromate	" $(Cr_2O_7)_3$	0.0015
Silico fluoride	[" $]_2(SiF_6)_3.6H_2O$	0.004
Cobalti cyanide	" $Co(CN)_6.4H_2O$	0.0008
Sulfate perchlorate	" $SO_4ClO_4.H_2O$	0.01
" borofluoride	" $SO_4BF_4.H_2O$	0.01
" fluoro sulfonate	" $SO_4SO_3F.3H_2O$	0.01
" iodide	" $SO_4I.2H_2O$	0.015
" bromide	" $SO_4Br.2H_2O$	0.03
" nitrate	" $SO_4NO_3.H_2O$	0.01
" chlorate	" $SO_4ClO_3.3H_2O$	0.01
Bichromate bromide	" $Cr_2O_7Br.H_2O$	0.006
" nitrate	" $Cr_2O_7.H_2O$	0.01
" perchlorate	" $Cr_2O_7.ClO_4$	0.007
" borofluoride	[" $]_2Cr_2O_7(BF_4)_4$	0.003
" di sulfate	[" $]_2Cr_2O_7(SO_4)_2.5H_2O$	0.0025
Nickel cyanide chloride	" $Ni(CN)_4\ Cl.2H_2O$	0.08
Perrhenate	" $(ReO_4)_3$	0.0154(1)
Permanganate	" $(MnO_4)_3$	0.084(2)
Flurosulfonate	" $(SO_3F)_3$	0.063(2)
Ammine Perrhenate	$[Cr(NH_3)_6]\ (ReO_4)_3.2H_2O$	0.00073(1)
" Permanganate	" $(MnO_4)_3$	0.0035(2)(17.5°)
" Boro fluoride	" $(BF_4)_3$	0.0412(2)(17.5°)
Antipyrine Perchlorate	$[Cr(COC_{10}H_{12}N_2)_6]\ (ClO_4)_3$	0.065(3)

C1

(1) Wilke-Dörfurt and Gundzert, 1933. The solubility of Cr hexa urea perrhenate in alcohol at 20° is 0.0057 gm. mol. per liter. (2) Weinhardt, 1926. (3) This result in terms of gms. per 100cc sat. sol. Wilke-Dörfurt and Schliephake, 1929.

CHROMIUM Hexa Antipyrine **CHLORATE** etc.

C10

SOLUBILITY OF EACH SEPARATELY IN WATER AT 20°.
(Wilke-Dörfurt and Mureck, 1929.)

Compound	Formula	Gms. Compound per 100cc sat. sol.
Chromium Hexa Antipyrine:		
Chlorate	$[Cr(COC_{10}H_{12}N_2)_6](ClO_3)_3$	4.3
Boro fluoride	" $(BF_4)_3$	0.043
Bi chromate	" $(Cr_2O_7)_3$	0.06
Thiocyanate	" $(SCN)_3$	3.1
Ferricyanide	" $[Fe(CN)_6]$	0.07
Picrate	" $[O(NO_2)_3C_6H_2]_3$	0.0015

CHROMIUM HELIANTHATE $Cr(C_{14}H_{14}N_3SO_3)_3.6H_2O$.

1000 cc. H_2O dissolve 0.176 gms. of the hydrated salt (= 0.15 gm. helianthine) at 20-25°. (Stark and Dohn, 1918.)

CHROMI-HEXAMINE SALTS $[Cr(NH_3)_6]X_3$.

SOLUBILITY OF EACH IN WATER AT 17°.5. (Ephraim and Mosimann, 1922.)

On account of the rapidity of decomposition of the salts, the saturated solutions were prepared by shaking for a period of not more than two hours.

Salt.		Formula.	Per 1000 cc. sat. sol. Gms. Cr.	Per 1000 cc. sat. sol. Gm. mols. salt
Chromi-Hexamine	Chloride....	$[Cr(NH_3)_6]Cl_3$	21.9	0.42
»	Bromide.....	$[Cr(NH_3)_6]Br_3$	6.12	0.118
»	Iodide.......	$[Cr(NH_3)_6]I_3$	2.25	0 043
»	Nitrate.	$[Cr(NH_3)_6][NO_3]_3$	3.74	0.072
»	Bichromate..	$[Cr(NH_3)_6][Cr_2O_7]_3$	0.26	0.005
»	Sulfate.	$[Cr(NH_3)_6]_2[SO_4]_3$	2.43	0.046
»	Phosphate. .	$[Cr(NH_3)_6]_2[PO_4]_3$	0.1676	0.0032
»	Oxalate.....	$[Cr(NH_3)_6]_2[C_2O_4]_3$	0.0876	0.00084
»	Picrate......	$[Cr(NH_3)_6][O.C_6H_2(NO_2)_3]_3$	0.0190	0.00037
»	Naphtalene β Sulfonate	$[Cr(NH_3)_6][C_{10}H_7SO_3]_3$	0.0352	0.00069
»	Chlorate....	$[Cr(NH_3)_6][ClO_3]_3$	3.25	0.062
»	Perchlorate .	$[Cr(NH_3)_6][ClO_4]_3$	1.03	0.0199

CHROMIUM DOUBLE SALTS.

SOLUBILITY IN WATER.

(Jörgensen, 1879, 1884, 1890; Struve, 1899.)

Name of Salt.	Formula.	t°.	Gms. per 100 Gms. H_2O.
Chlorotetraamine Chromium Chloride	$CrCl(NH_3)_4(OH_2)Cl_2$	15	6.3
Chloropurpureo Chromium Chloride	$CrCl(NH_3)_5Cl_2$	16	0.65
Luteo Chromium Nitrate	$Cr(NH_3)_6(NO_3)_3$	?	2.6
Chloropurpureo Chromium Nitrate	$CrCl(NH_3)_5(NO_3)_2$	17.5	1.4
Chromic Potassium Molybdate	$3K_2O.Cr_2O_3.12MoO_3.20H_2O$	17	2.5

Cl CHROMIUM CHLORIDES $CrCl_3.6H_2O$.

SOLUBILITY OF THE GREEN AND THE VIOLET MODIFICATIONS IN WATER AT 25°.

(Olie Jr., 1906.)

The solubility of hydrated chromium chloride depends upon the inner composition of the solution, that is, the relative amounts of the green and the violet modification of the salt present in the saturated solution. These are determined by precipitating with silver nitrate. A freshly prepared solution of the green chloride yields only one-third of its chlorine in the cold, hence the composition of this modification, according to Werner, is represented by the formula $[Cr(H_2O)_4Cl_2]Cl.2H_2O$. The violet chloride is considered to have the composition, $[Cr(H_2O)_6]Cl_3$. A determination of the amount of each present involves precipitating one portion of the solution at 0° with silver nitrate and another portion (for total Cl) at the boiling point. Experiments were first made with aqueous solutions of different percentage composition of the two modifications. These were agitated at 25° and analyzed at intervals until equilibrium was reached. The time for equilibrium varied from 18 to 40 days according to the concentrations present. The effect of temperature and of the presence of HCl on the transition of the green chloride was also studied.

The equilibrium in saturated solutions at 25° was determined by rubbing the hydrated chromium chloride with a little water previously cooled to 0° to a thin mush. This was then agitated at 25° and portions removed at successive intervals of time and analyzed. The results show the total chloride and per cent present as the green modification.

25 Gms. Green Salt + 10 Gms. H_2O.			25 Gms. Violet Salt + 10 Gms. H_2O.			25 Gms. Violet Salt + 10 cc. of 35% Sol. of the Green Salt.		
Time of Agitation.	Gms. $CrCl_3$ per 100 Gms. Sat. Sol.	Per cent of Green Salt.	Time of Agitation.	Gms. $CrCl_3$ per 100 Gms. Sat. Sol.	Per cent of Green Salt.	Time of Agitation.	Gms. $CrCl_3$ per 100 Gms. Sat. Sol.	Per cent of Green Salt.
¼ hr.	58.36	91.7	½ hr.	61.99	1.53	1½ hr.	65.49	15.95
4 hrs.	63.27	75.2	1 day	63.88	8.46	2 days	70.47	26.81
1 day	68.50	62.36	4 days	70.68	30.89	5 "	76.38	39.34
3 days	68.95	57.22	7 "	72.11	37.28	8 "	73.26	34.20
19 days	68.58	57.38	26 "	70.62	51.54	12 "	71.14	58.60

In a later paper Olie Jr. (1907) gives additional results at 29°, 32° and 35°.
100 cc. anhydr. hydrazine dissolve 13 gms. $CrCl_3$ at room temp. (Welsh & Broderson, '15.)

Data for the change in the critical solution temperature of systems composed of water and butyric acid, water and isobutyric acid, etc., caused by the addition of various amounts of violet chromium chloride and green chromium chloride, are given by Howard and Patterson, 1926.

CHROMIUM Per CHLORATE $Cr(ClO_4)_3.9H_2O$

ClO

Solubility of Chromium PerChlorate in Water.

(Sibers and Neumann, 1907.)

t°	d $^{15}_{15}$ of sat. sol.	Gms. $Cr(ClO_4)_3$ per 100 gms. sat. sol.	Solid Phase
0	—	50.99	$Cr(ClO_4)_3.9H_2O$
5	—	52.88	"
10	—	55.10	"
15	1.6463	55.31	"
25	—	57.73	"

CHROMIUM HYDROXIDE $Cr_2O_3.9H_2O$.

OH

Solubility of Chromium Hydroxide in Aqueous Solutions of Sodium Hydroxide at Room Temperature.

(Erich Müller. 1924; Fricke and Windhausen, 1924.)

Müller gives data for the effect upon the equilibrium, of time, temperature, concentration of sodium hydroxide and amount of chromium hydroxide present. The results show that chromium hydroxide is a solid solution in which simple and polymeric molecules are present in homogeneous mixture.

The following results by Fricke and Windhausen give a curve, the ascending branch of which (up to concentrations of 10 normal Na OH) corresponds to the formation of mono sodium chromite. Analyses of the solid phase for the descending curve corresponded to $Cr_2O_3.3Na_2O.8H_2O$ + retained Na OH.

Normality of Na OH	Gms. Cr_2O_3 per 100 cc. sat. sol.	Normality of Na OH.	Gms. Cr_2O_3 per 100 cc. sat. sol.	Normality of Na OH.	Gms. Cr_2O_3 per 100 cc. sat. sol.
0.9	0.25	8.56	2.52	12.01	1.51
1.71	0.5	9.89	2.89	13.26	1.09
3.65	1.10	10.00	2.68	14.15	0.80
5.10	1.58	10.20	2.48	15.60	0.40
7.25	2.09	11.06	1.90	17.42	*

* Almost colorless solution.

Three days were allowed for equilibrium. Experiments are also given for chromium hydroxide which had been altered by contact with concentrated K OH for increasing lengths of time.

CHROMOUS HYDROXIDE $Cr(OH)_2$

The pH of precipitation of $Cr(OH)_2$ from very dilute solutions of $CrSO_4$ was found to be 5.6 and from this the solubility product of $Cr(OH)_2$ calculated to be approximately 2.0×10^{-20} at 18 .(Bennett, 1932.)

CHROMIUM TRIOXIDE CrO_3.

0

Solubility in Water.

(Büchner, and Prins, 1912-13, Kremann. Daimer and Bennesch, 1911; Koppel and Blumenthal, 1907; and Mylius and Funk, 1900.)

t°.	Gms. CrO_3 per 100 Gms. Sat. Sol.	Solid Phase.	t°	Gms CrO_3 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. CrO_3 per 100 Gms. Sat. Sol.	Solid Phase.
− 0.9	3.6	Ice	− 43.5	49.1	Ice	50	64.55	CrO_3
− 1.9	7.8	"	− 60	53.3	"	65	64.83	"
− 3.7	11.5	"	−155	60.5	" $+CrO_3$	82	66	"
− 4.8	14.1	"	− 20	61.7	CrO_3	90	68.5	"
−10.95	24.9	"	0	62.24	"	100	67.4	"
−11.7	25.2	"	+ 18	62.45	"	115	68.4	"
−18.75	33.5	"	24.8	62.88	"	122	70.7	"
−25.25	39.2	"	40	63.50		193-196	100	decomposition

Density of solution sat. at 18° = 1.705.

100 cc. anhydrous hydrazine dissolve 1 gm. CrO_3 with evolution of gas and production of a black precipitate at room temp. (Welsh and Broderson, 1915)

More recent determinations of the solubility of chromium trioxide in water by Rakowsky and Tarascenkow, 1928, gave the following results.

t°	Gms. CrO_3 per 100 gms. sat. sol.	t°	Gms. CrO_3 per 100 gms. sat. sol.
0	61.94	60	63.78
20	62.58	80	65.47
40	63.12	100	66.54

CHROMIUM TRIOXIDE CrO_3.

SOLUBILITY OF CHROMIUM TRIOXIDE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 25° AND 45°. (Mumford and Gilbert, 1923.)

Results at 25°.

d_{4}^{25} of sat. sol.	Gms. per 100 gms. sat. sol. HNO_3.	Gms. per 100 gms. sat. sol. CrO_3.
1.704	0.0	62.85
1.684	2.28	60.31
1.661	5.95	56.57
1.640	9.37	52.51
1.606	13.25	48.10
1.570	19.30	41.97
1.528	26.79	34.32
1.481	35.35	25.54
1.434	46.91	14.63
1.402	59.11	4.88
1.409	68.49	0.95
1.440	74.47	0.27
1.456	82.90	0.06
1.466	86.56	0.10
1.475	89.17	0.18
1.503	92.63	1.89
1.557	91.36	8.29

Results at 45°.

d_{4}^{45} of sat. sol.	Gms. per 100 gms. sat. sol. HNO_3.	Gms. per 100 gms. sat. sol. CrO_3
1.695	0.0	63.51
1.676	2.05	61.27
1.654	5.58	57.93
1.619	11.47	51.71
1.569	19.53	43.41
1.490	33.29	29.57
1.409	50.69	13.15
1.384	65.74	2.47
1.416	73.81	0.88
1.450	81.55	0.44
1.481	88.35	0.60
1.512	91.83	3.39
1.581	88.06	9.42

The solid phase was CrO_3 in all cases.

EQUILIBRIUM IN THE SYSTEM CHROMIUM TRIOXIDE, SULFUR TRIOXIDE AND WATER.

(Rakowsky and Tarassenkow, 1926.)

Gm. mols. per 100 gm. mols. sat. sol. CrO_3	Gm. mols. per 100 gm. mols. sat. sol. SO_3	Solid Phase
Results at 0°		
22.67	0.0	CrO_3
10.19	7.36	"
3.32	12.09	"
0.75	16.51	"
0.10	23.22	"
0.22	27.30	"
0.65	29.61	"
2.46	32.43	"
3.28	33.18	"
10.93	35.22	"
1.23	30.97	$CrO_3.SO_3$
0.82	31.40	"
0.58	33.18	"
0.33	35.52	"
0.17	40.48	"
0.09	44.40	"
Results at 20°		
23.15	0.0	CrO_3
20.57	1.87	"
18.93	2.68	"
15.72	4.41	"
12.73	6.00	"
10.55	7.38	"
8.08	8.95	"
5.40	10.53	"
3.59	12.19	"
1.90	14.44	"
Results at 20° (Con.)		
0.87	16.77	CrO_3
0.43	18.56	"
0.22	19.88	"
0.10	23.04	"
0.14	25.73	"
0.41	28.92	"
1.83	32.57	"
4.48	34.91	"
8.48	37.89	"
1.44	31.73	$CrO_3.SO_3$
1.33	32.05	"
0.69	34.07	"
0.37	37.36	"
0.29	38.97	"
0.11	46.44	"
Results at 40°		
23.57	0.0	CrO_3
10.95	7.31	"
3.81	12.15	"
1.03	16.51	"
0.12	22.84	"
0.23	26.94	"
1.48	31.83	"
3.58	34.01	"
4.21	34.93	"
6.14	36.52	"
1.66	32.15	$CrO_3.SO_3$
Results at 40° (Con.)		
1.33	33.14	$CrO_3.SO_3$
1.02	34.25	"
0.62	36.81	"
0.32	42.28	"
0.29	42.83	"
Results at 75°		
2.22	33.66	$CrO_3.SO_3$
1.46	37.02	"
0.92	40.97	"
0.30	49.89	"
Results at 100°		
26.38	0.0	CrO_3
13.38	7.13	"
6.98	11.20	"
0.64	20.08	"
0.31	24.01	"
1.67	31.86	"
2.47	32.59	"
3.45	33.79	"
4.97	35.13	"
2.74	36.44	$CrO_3.SO_3$
2.30	36.83	"
1.57	39.30	"
1.30	41.90	"

EQUILIBRIUM IN THE SYSTEM CHROMIUM TRIOXIDE, SULFUR TRIOXIDE AND WATER.

(Gilbert, Buckley and Masson, 1922.)

The mixtures were rotated in sealed tubes in a thermostat. Equilibrium was approached from above and from below. The solid phases were determined by direct analysis and by the « rest method ».

RESULTS AT 25°.

$d_{\frac{25}{4}}$ of sat. sol.	Mol. per cent SO_3.	Mol. per cent CrO_3.	Solid Phase.	$d_{\frac{25}{4}}$ of sat. sol.	Mol. per cent SO_3.	Mol. per cent CrO_3.	Solid Phase.
–	0.0	25.73	CrO_3	1.786	32.64	1.62	CrO_3
1.669	1.55	20.69	»	1.788	33.17	1.58	$CrO_3.SO_3$
1.626	3.34	17.41	»	1.803	33.14	1.02	»
1.579	5.73	13.20	»	1.806	34.29	0.97	»
1.520	7.51	9.70	»	1.799	35.41	0.80	»
1.496	9.99	6.13	»	1.801	36.14	0.54	»
1.460	12.61	3.38	»	1.818	38.11	0.71	»
1.479	15.89	1.17	»	1.837	38.81	1.12	»
1.580	22.15	0.14	»	1.814	37.79	0.43	»
1.610	23.22	0.11	»	1.812	38.69	0.50	»
1.680	26.43	0.23	»	1.823	38.97	0.36	»
1.690	27.56	0.28	»	–	45.80	0.44	$CrO_3.SO_3.H_2O$*
1.690	28.17	0.28	»	1.834	47.01	0.20	»
1.728	29.35	0.55	»	1.841	51.78	0.14	»
1.756	31.42	0.97	»	1.915	57.50	0.40	»
1.771	31.93	1.23	»	–	58.94	0.88	»

RESULTS AT 45°.

$d_{\frac{45}{4}}$ of sat. sol.	Mol. percent SO_3.	Mol. percent CrO_3.	Solid Phase.	$d_{\frac{45}{4}}$ of sat. sol.	Mol. percent SO_3.	Mol. percent CrO_3.	Solid Phase.
–	5.25	13.79	CrO_3	–	35.40	1.06	$CrO.SO_3$
–	16.73	1.00	»	–	37.07	0.63	»
–	22.01	0.17	»	1.797	38.10	0.60	»
1.751	31.05	1.16	»	1.814	42.26	0.38	»
–	33.55	1.15	$CrO.SO_3$	–	45.67	0.30	$CrO.SO_3.H_2O$*

* The composition of this solid phase was not determined with certainty.

SOLUBILITY OF CHROMIUM TRIOXIDE IN SULFURIC ACID AT 23°.

(Meyer and Stateczny, 1922.)

Per cent H_2SO_4.	d_{23} of H_2SO_4.	d_{23} of sat. sol. of CrO_3 in H_2SO_4.	Concentration *.	Per cent CrO_3.
20.4	1.139	1.510	49.19	29.25
39.6	1.296	1.511	21.55	14.23
60.7	1.501	1.516	1.53	1.01
75.8	1.672	1.680	0.82	0.49
79.6	1.717	1.730	1.37	0.79
84.9	1.772	1.788	1.65	0.92
85.1	1.774	1.796	2.22	1.24
90.3	1.814	1.832	1.88	1.03
92.5	1.820	1.822	0.20	0.11
97.2	1.832	1.840	0.84	0.46
97.6	1.833	1.840	0.78	0.42
99.9	1.831	1.835	0.43	0.23
99.95	1.830	1.833	0.30	0.16
100.00	1.829	1.831	0.15	0.076

* No explanation is given by the authors of the terms implied by this heading.

SOLUBILITY OF CHROMIUM TRIOXIDE IN SELENIC ACID AT 23°.

(Meyer and Stateczny, 1922.)

Per cent H_2SeO_4.	d_{23} of H_2SeO_4.	d_{23} of sat. sol. of CrO_3 in H_2SeO_4.	Concentration*.	Per cent. CrO_3.
55.1	1.581	1.730	14.95	8.65
81.2	2.142	2.145	0.35	0.16
87.9	2.325	2.330	0.67	0.29
96.2	2.525	2.253	0.43	0.17
98.5	2.590	2.599	0.90	0.35

* No explanation is given by the authors of the terms implied by this heading.

Data for the freezing-points of mixtures of CrO_3 and H_2SO_4 are given by Meyer and Stateczny, 1922.

CHROMIUM SULFATES (ous and ic).

SOLUBILITY IN WATER.

Salt.	Gms. per 100 Gms. H_2O.	Solid Phase.	Authority.
Chromous	12.35 (at 0°)	$CrSO_4.7H_2O$	(Moissan, 1882.)
Chromic	120 (at ?°)	$Cr_2(SO_4)_3.18H_2O$	(Etard, 1877.)

CHROMIUM ALUMS.

SOLUBILITY OF CHROMIUM ALUMS IN WATER AT 25°. (Locke, 1901.)

Alum.	Formula.	Per 100 cc. Water. Grams Anhydrous.	Grams Hydrated.	Gram Mols
Potassium Chromium Alum	$K_2Cr_2(SO_4)_4.24H_2O$	12.51	24.39	0.0441
Tellurium Chromium Alum	$Te_2Cr_2(SO_4)_4.24H_2O$	10.41	16.38	0.0212

SO

CHROMIUM Ammonium SULFATE (Alum) $(NH_4)_2Cr_2(SO_4)_4.24H_2O$.

100 cc. H_2O dissolve 10.78 gms. anhydrous or 21.21 gms. hydrated salt at 25°. (Locke, 1901.)

SOLUBILITY OF Chromium Ammonium Alum IN WATER.

(Koppel, 1906.)

It was shown that, due to the transition between the violet and green forms of the compound, the saturation point is reached very slowly, especially at the higher temperatures. From the determinations at 0° it was found that equilibrium is reached in 2½ hours. If this saturation time is taken for the other temperatures, the results are considered to show the solubility of the violet form alone. The final saturation represents the attainment of an equilibrium between the violet and green forms.

Results for the Violet Form. t°.	Time of Saturation, Hrs.	Gms. $(NH_4)Cr(SO_4)_2$ per 100 Gms. Sol.	Results for Final Equilibrium. t°.	Time of Saturation, Hrs.	Gms. $(NH_4)Cr(SO_4)_2$ per 100 Gms. Sol.
0	2.5	3.8	0	2.5	3.8
30	2.5	10.6	30	300	15.7–16
40	2.5	15.5	40	250	24.5–24.8

CAESIUM Cs_2

Fusion-point data for mixtures of Cs + K and Cs + Na are given by Goria, 1935.

CAESIUM Penta BORATE $Cs_2O.5B_2O_3.8H_2O$

SOLUBILITY OF CAESIUM PENTABORATE IN WATER.

(Rollet and Andres, 1930, 1931.)

BO

t°	Gms. $Cs_2O.5B_2O_3$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Cs_2O.5B_2O_3$ per 100 gms. sat. sol.	Solid Phase
-0.36 (Eutec.)	1.59	$Cs_2O.5B_2O_3.8H_2O$	80	13.8	$Cs_2O.5B_2O_3.8H_2O$
5	1.68	"	89.4	17.85	"
18.	2.33	"	93	19.5	"
30.	3.52	"	95	20.4	"
45.	5.57	"	99.1	22.3	"
60.	8.31	"	101.65	23.45	"
75	12.0	"	102. (b.pt.)		

CAESIUM BROMIDE CsBr

SOLUBILITY OF CAESIUM BROMIDE IN WATER.

Br

t°	Gms. CsBr per 100 gms. sat. sol.	Authority
18	51.84	Lannung, 1934.
25	55.23	Foote, 1907.
25	55.24	Meyer and Dunkel, 1931.

SOLUBILITY OF CAESIUM AND LEAD BROMIDES AND THEIR DOUBLE SALTS IN WATER AT 25°.

(Foote, 1907.)

Gms. per 100 Gms Sat. Sol.		Solid Phase.	Gms. per 100 Gms Sat. Sol.		Solid Phase.
CsBr.	PbBr₂.		CsBr.	PbBr₂.	
0.24	0.33	$PbBr_2+CsPb_2Br_5$	33.65	trace	$CsPbBr_3$
0.33	0.36	" "	36.7	"	" $+Cs_4PbBr_6$
12.83	trace	$CsPb_2Br_5$	46.4	"	Cs_4PbBr_6
17.24	"	"	51.15	"	"
17.68	"	" $+CsPbBr_3$	54.4	"	" $+CsBr$
18.58	"	$CsPbBr_3$	55.23	0	CsBr

100 gms. sat. sol. of Caesium Bromide in Liquid Ammonia contain 4.38 gms. CsBr at 0°. (Linhard and Stephan, 1933, 1934.)

SOLUBILITY OF CAESIUM BROMIDE IN VERY HIGHLY PURIFIED ACETONE.

(Lannung, 1932.)

t°	d of sat. solution	Gms. CsBr per 1000 gms. Acetone	Solid Phase
18	0.792	0.0403	CsBr
37	0.770	0.0406	"

CAESIUM Iodo Di **BROMIDE** $CsIBr_2$

100 gms. sat. sol. of Caesium Iodo di bromide in water contain 4.45 gm. $CsIB_2$ at 20°. (Wells, quoted by Cremer and Duncan, 1931.)

The solubility of Caesium Iodo di bromide in Carbon Tetrachloride is given by Cremen and Duncan, 1931, as 0.00014 normal(?) at 25°.

CAESIUM Mercuric **BROMIDE** $CsBr.2HgBr_2$.

100 grams saturated aqueous solution contain 0.807 gram $CsBr.2HgBr_2$ at 16°. (Wells, 1892.)

CAESIUM BROMATE $CsBrO_3$.

BrO

Solubility of Caesium Bhomate in Water.
(Mc Crosky and Buell, 1920; Buell and Mc Crosky, 1921.)

t°.	Gms $CsBrO_3$ per 100 gms H_2O	Solid Phase
25	3.66	$CsBrO_3$
30	4.53	"
35	5.39	"

CAESIUM METHIONATE $Cs[CH_2(SO_3)_2]$
CAESIUM Chlor **METHIONATE** $Cs[CHCl(SO_3)_2]$

100 gms. H_2O dissolve 21.4 gms. $Cs[CH_2(SO_3)_2]$ at 25°. (Backer, 1930.)
" " " " 51.2 " $Cs[CHCl(SO_3)_2]$ at 25 . " "

CAESIUM FORMATE $HCOOCs.H_2O$.

Solubility of Caesium Formate in Water. (Sidgwick and Gentle, 1922.)

t°	Gms HCOOCs per 100 gms sat sol.	Solid Phase.	t°.	Gms HCOOCs per 100 gms sat sol	Solid Phase
-0.77	4.00	Ice	42.7	88.67	$HCOOCs.H_2O$
1.72	8.11	"	44.6	90.49	"
3.44	14.29	"	45.0 m. pt.	-	"
-5.27	19.62	"	43.8	92.54	"
8.12	26.75	"	42.6	93.47	"
+1.0	77.07	$HCOOCs.H_2O$	41.0 tr. pt.	–	" +HCOOCs
21.0	81.69	"	95.4	95.27	HCOOCs
26.2	83.25	"	161 6	96.67	"
32.2	84.81	"	265.0 m. pt.	100.00	"
39.2	86.88	"			

CH

CAESIUM ACETATE CH_3COOCs.

Solubility of Caesium Acetate in Water.
(Sidgwick and Gentle, 1922.)

t°	Gms. CH_3COOCs per 100 gms. sat. sol.	Solid Phase.	t°	Gms CH_3COOCs per 100 gms sat sol	Solid Phase.
− 1.36	6.63	Ice	+ 21.5	91.06	CH_3COOC
− 5.32	19.38	"	61.1	91.98	"
− 7.92	25.26	"	88.6	93.09	"
−13.07	34.22	"	133.8	95.78	"
− 2.5	89.71	CH_3COOCs	194.0 m. pt.	100.00	"

CAESIUM Dihydroxy**TARTRATE** $Cs_2C_4H_4O_8.2H_2O$.

100 gms. H_2O dissolve 22.5 gms. $Cs_2C_4H_4O_8.2H_2O$ at 0°. (Fenton, 1898.)

CAESIUM PICRATE, CAESIUM Bi TARTRATE etc.

Solubility of Each in Water at 20°.

(Mosor and Ritschel, 1925.)

Compound.	Formula.	Gms. cmpd. per 1000 cc. sat. sol.
Caesium picrate	$C_6H_2(NO_2)_3OCs$	3.08
Caesium bitartrate	$Cs.HC_4H_4O_6$	71.13
Caesium silicomolybdate	-	0.4
Caesium phosphotungstate	-	0.04

CAESIUM BENZOATE C_6H_5COOCs.

Solubility of Caesium Benzoate in Water.

(Sidgwick and Ewbank, 1922.)

t°.	Gms. C_6H_5COOCs per 100 gms. sat. sol.	Solid Phase.
— 1.22	9.92	Ice
— 4.44	25.62	»
—10.81	43.08	»
+12.0	74.75	C_6H_5COOCs
53.5	77.34	»
124.0	81.51	»

Solubility of Caesium Ortho, Meta and Para Hydroxy Benzoates in Water. (Sidgwick and Ewbank, 1922.)

CH

Results for Caesium Ortho Hydroxy Benzoate.

t°.	Gms. $C_6H_4.OH.COOCs$ per 100 gms. sat. sol.	Solid Phase.
−1.83	16.08	Ice
−4.24	30.97	»
−8.08	47.71	»
−3.5	65.70	*o* 1.1
+4.5	68.24	»
20.5	70.59	»
33.0	80.07	»
41.5	83.35	*o* 1.$^1/_2$*
54.0	85.67	»
67.5	89.91	»
84.3	92.80	*o* 1.0
107.5	94.33	»

Results for Caesium Meta Hydroxy Benzoate.

t°.	Gms. $C_6H_4.OH.COOCs$ per 100 gms. sat. sol.	Solid Phase.
— 1.97	16.98	Ice
— 4.92	32.84	»
— 9.65	48.53	»
—18.50	63.15	»
+10.0	77.10	*m* 1.*x*
19.0	78.52	»
29.0	81.70	»
35.0	84.45	»
40.0	86.35	»
41.5	87.88	*m* 1.0*
73.0	89.88	»
126.5	93.42	»

Results for Caesium Para Hydroxy Benzoat

t°.	Gms. $C_6H_4.OH.COOCs$ per 100 gms. sat. sol.	Soli Pha
−1.56	14.34	Ic
−2.42	20.38	»
−4.27	29.57	»
+3.5	29.57	*p* 1
27.5	40.80	»
49.0	50.01	»
75.5	60.36	*p* 1
90.3	65.35	»
107.5	70.67	»
118.0	73.84	»
136.0	79.88	»

* Unstable.

o 1.1 = *o* $C_6H_4.OH.COOCs\,H_2O$; *o* 1.$^1/_2$ = *o* $C_6H_4.OH.COOCs.^1/_2H_2O$; *o* 1.0 = *o* $C_6H_4.OH.COOCs$;
m 1.*x* = *m* $C_6H_4.OH.COOCs\,xH_2O$; *m* 1.0 = *m* $C_6H_4.OH.COOCs$;
p 1.1 = *p* $C_6H_4.OH.COOCs\,H_2O$; *p* 1.0 = *p* $C_6H_4.OH.COOCs$

CAESIUM BENZENE SULFONATES

Solubility of Caesium Benzene Sulfonates in Water at 25°.

(Elgersma. 1929.)

Compound	Formula	Gms. compound per 100 gms. H_2O
Caesium o Nitro Benzene Sulfonate	$Cs[NO_2.C_6H_4SO_3]$	20.74
" m " " "	"	more than 37.00
" p " " "	"	5.46
" o,p Dinitro " "	$Cs[(NO_2)_2C_6H_3SO_3]$	2.50
" o Nitro p Chlor " "	$Cs[(NO_2)C_6H_3ClSO_3]$	6.98
" 2 " 5 " " "	"	2.25
" 3 " 6 " " "	"	1.51
" 2 " 4 Brom " "	$Co[(NO_2)C_6H_3BrSO_3]$	6.09

EQUILIBRIUM IN THE SYSTEM CAESIUM MANDELATE, MANDELIC ACID AND WATER AT 25°.

(Ross and Morrison, 1936; Ross, Morrison and Johnstone, 1937.)

Results for Racemic Mandelic Acid
(dl)$C_6H_5CH(OH)COOH$

Gms. per 100 gms. sat. sol. $C_8H_8O_3$	Gms. per 100 gms. sat. sol. $CsC_8H_7O_3$	Solid Phase	Gms. per 100 gms. sat. sol. $C_8H_8O_3$	Gms. per 100 gms. sat. sol. $CsC_8H_7O_3$	Solid Phase
16.95	0.0	$C_8H_8O_3$	50.8	25.6	$C_8H_8O_3$
17.3	0.4	"	51.3	27.2	"
18.4	1.4	"	52.5	30.7	"
20.1	2.8	"	52.5	32.2	1.1 salt
22.6	4.5	"	47.3	31.9	"
25.0	6.3	"	44.3	31.1	"
29.1	9.0	"	32.1	32.6	"
33.7	12.3	"	29.1	33.4	"
39.4	15.3	"	16.1	40.6	"
45.2	18.3	"	5.3	53.8	"
47.4	20.7	"	2.9	67.3	"
49.2	22.2	"	3.7	79.2	"

Results for Laevo Mandelic Acid
(l)$C_6H_5CHOHCOOH(-)$

Gms. per 100 gms. sat. sol. $C_8H_8O_3$	Gms. per 100 gms. sat. sol. $CsC_8H_7O_3$	Solid Phase
10.1	0.0	$C_8H_8O_3$
10.3	2.8	"
11.0	5.0	"
12.0	7.1	"
14.5	11.3	"
25.0	19.0	"
34.9	24.3	"
42.8	30.3	"
44.6	32.3	"
49.4	39.4	"
49.2	42.0	"

CH

1.1 salt = $C_8H_8O_3.C_8H_7O_3Cs$

* Owing to the viscosity of the concentrated solutions it was impossible to get additional points or obtain an acid 1.1 salt as solid phase.

CAESIUM CARBONATE Cs_2CO_3.

100 grams absolute alcohol dissolve 11.1 grams Cs_2CO_3 at 19°, and 20.1 grams at b. pt. (Bunsen.)

CO

CAESIUM BiCARBONATE $CsHCO_3$.

100 grams sat. solution in H_2O contain 67.8 grams $CsHCO_3$ at about 20°. (de Forcrand, 1909.)

CAESIUM OXALATE $Cs_2C_2O_4.H_2O$.

EQUILIBRIUM IN THE SYSTEM CAESIUM OXALATE, ZIRCONYL OXALATE AND WATER AT 19°.

(Boulanger, 1936.)

COO

Gms. per 100 gms. sat. sol. $(COOCs)_2$	Gms. per 100 gms. sat. sol. $(COO)_2ZrO$	Solid Phase	Gms. per 100 gms. sat. sol. $(COOCs)_2$	Gms. per 100 gms. sat. sol. $(COO)_2ZrO$	Solid Phase
33.98	0.0	$CsC_2O_4.H_2O$	15.0	1.80	2.1.1.4
32.0	trace	1.1.1.3(?)	14.57	2.22	"
25.1	0.6	"	14.5	2.4	"
22.0	0.82	"	12.17	2.19	(?)
19.83	0.97	"	10.0	1.8	"
19.05	1.02	"	7.58	1.3	"
17.02	1.29	2.1.1.4	5.0	1.02	"

1.1.1.3 = $(COOCs)_2.(COO)_2ZrO.(COOH)_2.3H_2O$; 2.1.1.4 = $2(COOCs)_2(COO)_2ZrO.(COOH)_2.9H_2O$.

SOLUBILITY OF MIXTURES OF CAESIUM OXALATE AND OXALIC ACID IN WATER AT 25°.

(Foote and Andrew, 1905.)

Varying amounts of the two substances were dissolved in hot water and the solutions allowed to cool in a thermostat held at 25°.

COO

Gms. per 100 Gms. Solution.		G. Mols. per 100 G. Mols. H_2O.		Solid Phase.
$H_2C_2O_4$.	$Cs_2C_2O_4$.	$H_2C_2O_4$.	$Cs_2C_2O_4$.	
10.20	...	2.274	...	$H_2C_2O_4.2H_2O$
10.29	0.61	2.314	0.035	$H_2C_2O_4.2H_2O+H_3Cs(C_2O_4)_2.2H_2O$
7.90	9.92	1.924	0.614	Double Salt.
4.11	25.12	1.162	1.81	$H_3Cs(C_2O_4)_2.2H_2O$
4.32	27.55	1.279	2.06	$H_3Cs(C_2O_4)_22H_2O+H_4Cs_2(C_2O_4)_3$
4.27	28.30	1.267	2.14	Double Salt.
4.40	35.90	1.476	3.07	$H_4Cs_2(C_2O_4)_3$
4.82	40.10	1.752	3.71	$H_4Cs_2(C_2O_4)_3+HCsC_2O_4$
4.45	42.32	1.672	4.05	Double Salt. $HCsC_2O_4$
3.05	48.80	1.268	5.16	
1.04	68.69	0.688	11.56	
0.91	71.24	0.648	13.06	$HCsC_2O_4+H_6Cs_8(C_2O_4)_7$
0.77	73.45	0.598	14.51	Double Salt.
0.75	74.04	0.596	14.96	$H_6Cs_8(C_2O_4)_7$
0.74	75.20	0.625	15.93	$H_6Cs_8(C_2O_4)_7+Cs_2C_2O_4.H_2O$
0.0	75.82	0.0	15.97	$Cs_2C_2O_4.H_2O$

CAESIUM Telluracid **OXALATE** $Cs_2[H_6TeO_6.C_2O_4]$.

100 gms. H_2O dissolve 6.42 gms. $Cs_2[H_6TeO_6.C_2O_4]$ at 0°, 12.39 gms. at 20°, 15.08 gms. at 30°, 19.78 gms. at 40° and 27.66 gms. at 50°.

(Rosenheim and Weinheber, 1910–11.)

CAESIUM CHLORIDE CsCl.

SOLUBILITY IN WATER.

(Berkeley — Trans. Roy. Soc. (Lond.) 203 A. 208, '04, see also Hinrichsen and Sachsel — Z. physik. Chem. 50, 99, '04–'05; at 25°, Foote.)

Cl

t°.	G. CsCl per 100 Gms. Solution.	G. CsCl per 100 Gms. Water.	G. Mol CsCl per Liter.	t°.	G. CsCl per 100 Gms. Solution.	G. CsCl per 100 Gms. Water.	G. Mol. CsCl per Liter.
0	61.7	161.4	6.74	60	69.7	229.7	8.28
10	63.6	174.7	7.11	70	70.6	239.5	8.46
20	65.1	186.5	7.38	80	71.4	250.0	8.64
30	66.4	197.3	7.63	90	72.2	260.1	8.80
40	67.5	208.0	7.86	100	73.0	270.5	8.96
50	68.6	218.5	8.07	119.4	74.4	290.0	9.22

More recent determinations gave the following results.

t°	Gms. CsCl per 100 gms. sat. sol.	Authority
18	65.23	(Lannung, 1934.)
25	65.53	(Meyer and Dunkel, 1931.)
25	66.1	(Benrath, 1927.)

CAESIUM Gold CHLORIDE $CsAuCl_4$.

SOLUBILITY IN WATER.

(Rosenbladt, 1886.)

t°.	Gms. $CsAuCl_4$ per 100 Gms. Solution.	t°.	Gms. $CsAuCl_4$ per 100 Gms. Solution.	t°.	Gms. $CsAuCl_4$ per 100 Gms. Solution.
10	0.5	40	3.2	80	16.3
20	0.8	50	5.4	90	21.7
30	1.7	60	8.2	100	27.5
		70	12.0		

SOLUBILITY OF MIXTURES OF CAESIUM CHLORIDE AND MERCURIC CHLORIDE IN WATER AT 25°. (Foote, 1903.)

Gms. per 100 Gms. Solution.		Solid Phase.
CsCl.	$HgCl_2$.	
65.61	0.0	CsCl
65.78	0.215	CsCl + Cs_3HgCl_5
62.36	0.32	Double Salt Cs_3HgCl_5 = 65.1% CsCl
57.01	0.64	
52.35	1.23	
51.08	1.44	Cs_3HgCl_5 + Cs_2HgCl_4
49.30	1.49	Double Salt Cs_2HgCl_4 = 55.4% CsCl
45.95	1.69	
45.23	1.73	Cs_2HgCl_4 + $CsHgCl_3$

Gms. per 100 Gms. Solution.		Solid Phase.
CsCl.	$HgCl_2$.	
38.63	1.32	Double Salt $CsHgCl_3$ = 38.3% CsCl
17.03	0.51	
1.53	0.42	
0.61	2.64	CsHg + $CsHg_2Cl_5$
0.49	2.91	Double Salt $CsHg_2Cl_5$ = 23.7% CsCl
0.40	3.78	
0.44	4.63	$CsHg_2Cl_5$ + $CsHg_5Cl_{11}$
0.41	4.68	Double Salt $CsHg_5Cl_{11}$ = 11.1% CsCl
0.25	5.65	
0.18	7.09	$CsHg_5Cl_{11}$ + $HgCl_2$
0.0	6.90	$HgCl_2$

C1

SOLUBILITY OF MIXTURES OF CAESIUM CHLORIDE AND MERCURIC CHLORIDE IN ACETONE AT 25°. (Foote, 1911.)

Gms. per 100 Gms. Solution.		Solid Phase.	Gms. per 100 Gms. Solution.		Solid Phase.
CsCl.	$HgCl_2$.		CsCl.	$HgCl_2$.	
0.032	0	CsCl	0.48	28.48	$CsCl.2HgCl_2$
0.11	0.02	Mixed salts	0.48	39.65	"
0.19	0.16	"	0.47	44.40	" + $CsCl.5HgCl_2$
0.25	0.17	"	0.32	49.83	$CsCl.5HgCl_2$
0.45	13.08	$CsCl.HgCl_2$	0.20	57.74	"
0.46	21.50	"	0.13	57.76	" + $HgCl_2$
0.56	27.2	" + $CsCl.2HgCl_2$	0.0	57.74	$HgCl_2$

CAESIUM Iridium CHLORIDES Cs_2IrCl_6, etc.

100 gms. H_2O dissolve 0.011 gm. caesium chloroiridate, Cs_2IrCl_6 at 19°. (Delepine, 1908.)
100 " " " 0.05 gm. caesium hexachloroiridite, $Cs_3IrCl_6.3H_2O$ at 19°.
100 " " " 0.83 " caesium aquopentachloroiridite, $Cs_2H_2OIrCl_5$ at 19°.

EQUILIBRIUM IN THE SYSTEM CAESIUM CHLORIDE, MAGNESIUM CHLORIDE AND WATER AT 25°.

(D'Ans and Busch, 1937.)

Gm. mols. per 1000 mols. H_2O		Solid Phase
CsCl	$MgCl_2$	
71.7	55.5	CsCl + $CsCl.MgCl_2.6H_2O$
39.6	64.8	$CsCl.MgCl_2.6H_2O$
3.3	88.0	"
1.0	104.8	" + $MgCl_2.6H_2O$

CAESIUM Platinum **CHLORIDE** Cs_2PtCl_6.

SOLUBILITY OF CAESIUM PLATINUM CHLORIDE IN WATER. (Archibald and Hallett, 1925.

t°.	Gms. Cs_2PtCl_6 per 100 gms. H_2O.
9	0.0047
10	0.0064
20	0.0086
30	0.0119
40	0.0158
50	0.0212
60	0.0290
70	0.0389
80	0.0525
90	0.0675
100	0.0915

The authors consider that the higher values for this compound reported by Bunsen, are due either to hydrolysis or the presence of potassium compounds in the salt.

100 gms. H_2O dissolve 0.135 gm. $CsPtCl_6$ at 20°. (Rosenheim and Weinheber, 1910–11.)

CAESIUM Rhenium **CHLORIDE** $CsReCl_6$

One liter Sat. solution of Caesium Rhenium Chloride in Aqueous 37% HCl contains 0.03 gm. $CsReCl_6$ at 0°

One liter Sat. solution of Caesium Rhenium Chloride in Aqueous 20% H_2SO_4 contains 0.3 gm. $CsReCl_6$ at 18°. (Noddak and Noddak, 1933.

Cl **CAESIUM** Thallium **CHLORIDE** $3CsCl.TlCl_3.2H_2O$.

100 parts H_2O dissolve 2.76 parts $3CsCl.TlCl_3.2H_2O$ at 17°, and 33.3 parts at 100°. (Godeffroy, 1886.)

EQUILIBRIUM IN THE SYSTEM CAESIUM CHLORIDE, THALLIUM TRICHLORIDE AND WATER AT 15°. (Malquori, 1926.)

Constant agitation in a thermostat was employed. The solid phases were identified by the « rest method » of Schreinemakers.

Gms. per 100 gms. sat. sol.			
$TlCl_3$.	CsCl.	H_2O.	Solid Phase.
65.170	-	34.830	$TlCl_3.4H_2O$
65.178	-	34.822	» +2.3
61.180	-	38.820	2.3
54.913	-	45.087	»
50.127	-	49.873	»
40.970	-	59.030	»
31.705	-	68.295	»
16.481	-	83.519	»
10.210	-	89.790	»
6.573	0.021	93.406	»
1.451	1.123	97.426	»
0.739	2.371	96.900	»
0.017	3.201	96.782	»
	3.272	96.728	»+2.2.2
	3.272	96.718	2.2.2
-	8.313	91.687	2.2.2
-	12.450	87.550	»
-	20.020	79.980	»
-	26.930	73.070	»
-	27.173	72.827	» +1.3.1
-	27.689	72.311	1.3.1
-	32.721	67.279	»
-	42.100	57.900	»
-	45.201	54.799	» +1.3
-	45.910	54.090	1.3
-	50.00	50.0	»
-	58.170	41.830	»
-	63.981	36.019	»
-	64.713	35.287	» +CsCl
-	64.750	35.250	CsCl

2.3 = $2TlCl_3.3CsCl$; 2.2.2 = $2TlCl_3.2CsCl.2H_2O$; 1.3.1 = $TlCl_3.3CsCl.H_2O$; 1.3 = $TlCl_3.3CsCl$.

CAESIUM Tellurium **CHLORIDE** $CsTeCl_6$.

SOLUBILITY IN AQUEOUS HYDROCHLORIC ACID. (Wheeler, 1893.)

100 parts HCl (Sp. Gr. 1.2) dissolve 0.05 part $CsTeCl_6$ at 22°.

100 parts HCl (Sp. Gr. 1.05) dissolve 0.78 part $CsTeCl_6$ at 22°.

CAESIUM CHLORIDE CsCl.

100 gms. sat. sol. of caesium chloride in selenium oxychloride ($SeOCl_2$) contain 3.83 gms. CsCl at 25°. (Wise, 1923.)

100 gms. sat. sol. of caesium chloride in liquid Ammonia contain 0.381 gm. CsCl at 0°. (Linhard and Stephan, 1933, 1934.)

1000 gms. pure acetone (CH_3COCH_3) dissolve 0.004 gm. CSCl at 18° and 0.0044 gm. at 37°. (Lannung, 1932.)

100 gms. sat. sol. of caesium chloride in acetone (CH_3COCH_3) contain 0.032 gm. CsCl at 25°. (Foote, 1912.)

Fusion-point data are given for the following mixtures of caesium chloride and other salts.

Mixture	Authority
Caesium Chloride + Cuprous Chloride	(Sandonnini and Scarpa, 1912; Sandonnini, 1914.)
" " + Thallium Chloride	(Sandonnini and Scarpa, 1912; Sandonnini, 1914.)
" " + Lithium Chloride	(Korreng, 1915; Richards and Meldrum, 1917.)
" " + " " + NaCl	(Richards and Meldrum, 1917.)
" " + Potassium Chloride	(Zemczuzny and Rambach, 1910.)
" " + Rubidium "	" " "
" " + Sodium "	" " "
" " + Caesium Sulfate	(Dombrovskava, 1933.)
" " + Potassium Sulfate	" "

C10

CAESIUM CHLORATE $CsClO_3$ CAESIUM PerCHLORATE $CsClO_4$.

SOLUBILITY OF EACH IN WATER.

(Calzolari, 1912; see also Carlson, 1910.)

Results for $CsClO_3$.				Results for $CsClO_4$.			
t°.	Gms. $CsClO_3$ per 100 Gms. H_2O.	t°.	Gms. $CsClO_3$ per 100 Gms. H_2O.	t°.	Gms. $CsClO_4$ per 100 Gms. H_2O.	t°.	Gms. $CsClO_4$ per 100 Gms. H_2O.
0	2.46	50	19.4	0	0.8	50	5.4
10	3.8	60	26.2	10	1.0	60	7.3
20	6.2	70	34.7	20	1.6	70	9.8
25	7.6	80	45.0	25	2.0 ($d=1.01$)	80	14.4 ($d=1.084$)
30	9.5	90	58.0	30	2.6	90	20.5
40	13.8	100	79.0	40	4.0	100	30.0

One liter sat. solution of caesium perchlorate in water contains 15.74 gms. $CsClO_4$ at 20°. (Moser and Ritschel, 1925.)

SOLUBILITY OF CAESIUM PERCHLORATE IN AQUEOUS ETHYL ALCOHOL.

(Flatt, 1923; Flatt and Jordan, 1930, 1933.)

Solvent	t°	Gm. mols. $CsClO_4$ per 1000 cc. solvent	Gms. $CsClO_4$ per 100 gms. solvent
Water	25	0.0848	1.974
42.5 Wt% C_2H_5OH	25	0.0350	0.879
67.9 Wt% C_2H_5OH	25	0.0136	0.365
50 Vol% C_2H_5OH	40	—	1.522
75 Vol% C_2H_5OH	40	—	0.635

SOLUBILITY OF CAESIUM PERCHLORATE IN SEVERAL SOLVENTS AT 25°.

(Willard and Smith, 1923.)

Solvent.	d of solvent.	d of sat. sol	Gms. $CsClO_4$ per 100 gms. sat. sol.
Water................	–	1.0165	1.93
Acetone.....	0.7859	0.7859	0.15
n Butyl alcohol........	0.8059	0.8059	0.006
iso Butyl alcohol......	0.7981	0.7981	0.007
Ethyl alcohol..........	0.7852	0.7852	0.011
Methyl alcohol........	0.7874	0.7878	0.093
n Propyl alcohol......	0.7993	0.7993	0.006

SOLUBILITY OF CAESIUM PERCHLORATE IN MIXTURES OF ETHYL ACETATE AND SEVERAL ALCOHOLS AT 25°. (Smith, 1925.)

Solvent.	Gms. $CsClO_4$ per 100 gms. sat. sol
10 vol. per cent of Methyl alcohol+90 vol. per cent Ethyl acetate..	0.0050
20 " " " +80 " " ..	0.0056
10 " Ethyl " +90 " " ..	0.0013
20 " " " +80 " " ..	0.0023
20 " 93 % " " +80 " " ..	0.0040
10 " *n* Butyl " +90 " " ..	0.0009
20 " " " +80 " " ..	0.0012

CrO **CAESIUM CHROMATES,** Cs_2CrO_4, $Cs_2Cr_2O_7$, etc.

SOLUBILITY IN WATER AT 30°.

(Schreinemakers and Meijeringh, 1908.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
Cs_2O.	CrO_3		Cs_2O	CrO_3.	
70.63	0.0	$CsOH.nH_2O$	0.169	21.21	$Cs_2Cr_3O_{10}$
69.22	0.119	" $+Cs_2CrO_4$	0.096	25.59	"
36.06	1.883	Cs_2CrO_4	1.89	36.19	"
31.00	7.523	"	2.79	41.68	"
31.68	9.652	"	3.29	44.23	"
35.80	13.08	"	±3.13	±44.45	" $+Cs_2Cr_4O_{13}$
31.05	10.79	$Cs_2Cr_2O_7$	2.96	44.66	$Cs_2Cr_4O_{13}$
24.05	8.98	"	3.40	46.03	"
3.04	2.16	"	3.94	56.77	"
1.61	4.57	" $+Cs_2Cr_3O_{10}$	4.35	62.70	" $+CrO_3$
1.18	7.95	$Cs_2Cr_3O_{10}$	2.33	62.50	CrO_3
0.586	15.05	"	0	62.28	"

F **CAESIUM FLUORIDE** $CsF.1\frac{1}{2}H_2O$.

100 gms. H_2O dissolve 366.5 gms. CsF at 18°, solid phase $CsF.1\frac{1}{2}H_2O$.
(de Forcrand, 1911.)

100 gms. sat. solution of Caesium Fluoride, $CsF.H_2O$(?) in Water contain 85.36 gms. CsF at 18 . (Lannung, 1934.)

SOLUBILITY OF CAESIUM FLUORIDE IN ACETONE.

(Lannung, 1932.)

t°	d of sat. sol.	Gm CsF per 1000 gms. CH_3COCH_3	Gm. mols. CsF per liter sat. sol.
18	0.792	0.0077	0.00004
37	0.770	0.0087	0.000044

CAESIUM Boro, Germano and Titano FLUORIDES

SOLUBILITY OF EACH IN WATER.

Compound	Formula	t°	Gms. Compound per 100 gms. H_2O	Authority
Caesium Boro Fluoride	$CsBF_4$	20	1.64	(deBoer and Van Liempt, 1927.)
" Germano "	$CsGeF_6$	0	0.84	(Muller, 1927.)
" " "	"	10	0.98	" "
" " "	"	25	1.89	" "
" " "	"	30	2.28	" "
" Titano "	Cs_2TiF_6	20-22	2.5	(Ginsberg, 1932.)

100 cc 98% Ethyl Alcohol, (C_2H_5OH), dissolve 0.002 gm. Cs_2TiF_6 at 20-22°. Ginsberg, 1932.

CAESIUM Phospho FLUORIDE $CsPF_6$

One liter sat. solution of Caesium Phospho Fluoride in Water contain 0.0302 gm. mols. $CsPF_6$ at 23°. (Lange and Müller, 1930.)

CAESIUM IODIDES CsI, CsI_3, etc.

SOLUBILITY IN WATER AT 25°.

(Foote and Chalker, 1908)

Gms. per 100 Gms. Sat. Solution.		Empirical Comp. of Residue	Present in Residue.
CsI.	I.		
7.72	1.18	$CsI_{3.29}$	CsI_3 and CsI_5
7.69	1.19	$CsI_{3.98}$	" "
2.40	1.23	$CsI_{5.76}$	CsI_5 and I
2.35	1.23	$CsI_{7.43}$	" "
2.39	1.25	$CsI_{19.3}$	" "

EQUILIBRIUM IN THE SYSTEM CAESIUM IODIDE, IODINE AND WATER AT 25°.

(Briggs and Greenawald, 1930.)

Particular attention was paid in the present experiments to securing equilibrium. The mixtures were given a preliminary heating to 95° and were also constantly rotated for many weeks. The attainment of equilibrium was especially difficult in the mixtures giving the higher of the two polyiodides as solid phase.

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
CsI	free I		CsI	free I		CsI	free I	
46.1	0.0	CsI	12.1	0.87	CsI_3	4.33	1.16	CsI_4
46.4	0.31	"	10.0	0.98	"	4.13	1.25	"
46.4	0.40	" + CsI_3	8.15	1.13	"	3.42	1.27	"
43.3	0.41	CsI_3	7.60	1.18	"	3.04	1.22	"
40.9	0.42	"	7.65	1.19	" + CsI_4	2.94	1.19	"
34.5	0.43	"	7.16	1.23	CsI_4	2.87	—	"
29.4	0.50	"	6.36	1.16	"	2.47	—	"
27.1	0.53	"	6.04	1.22	"	2.39	1.23	" + I
24.4	0.56	"	5.67	1.22	"	2.10	1.20	I
17.7	0.66	"	4.76	1.22	"	1.27	0.62	"
15.2	0.69	"	4.52	1.24	"	0.89	0.52	"

CAESIUM IODIDE CsI.

SOLUBILITY OF MIXTURES OF CAESIUM IODIDE AND IODINE IN WATER.

(Foote — Am. Ch. J. 29, 210, '03.)

t°.	Gms. per 100 Gms. Solution.		t°	Gms. per 100 Gms. Solution.		Solid Phase at both Temps.
	CsI.	I.		CsI.	I.	
−4	27.68	0.0	35.6	51.48	0.0	CsI
−4	27.52	0.09	35.6	51.66	0.71	CsI and CsI_3
−4	3.18	0.31	35.6	10.72	1.78	CsI_3 and CsI_5
−0.2	0.85	0.34	35.6	3.74	1.60	CsI_5 and I

t°.	Gms. per 100 Gms. Solution.		In Separated Heavy Solution (Gms. per 100 Gms. Solution.		Solid Phase.
	CsI.	I.	CsI.	I.	
52.2	16.75	4.52	...	...	CsI_3 and CsI_5
52.2	6.69	3.36	...	...	CsI_5 and I
52.2	6.72	3.32	22.94	73.72	CsI_5
52.2	6.65	3.45	22.80	74.63	I
73	26.98	15.07	...	...	CsI_3 and CsI_5
73	16.66	10.50	27.56	68.40	CsI_5
73	6.27	4.08	17.68	80.02	I

I

CAESIUM (Tri) IODIDE CsI_3.

100 cc. saturated aqueous caesium iodide (about 17 per cent CsI) solution contain 0.97 gram CsI_3 at 20°, density of solution = 1.154.

(Wells — Am. J. Sci. [3] 44, 221, '92.)

EQUILIBRIUM IN THE SYSTEM CAESIUM IODIDE AND SULFUR DIOXIDE.

(Foote and Fleischer, 1931.)

The system was studied by means of the vapor pressure temperature relations.

The following data were obtained for the two univarient systems:

$CsI.3SO_2$ + Solution - Vapor		$CsI.3SO_2$ + CsI - Vapor	
t°	Pressure Cm. Hg	t°	Pressure Cm. Hg
-21.60	42.7	-19.60	6.3
-18.45	43.8	-10.90	12.3
-16.30	53.9	- 5.25	18.4
-11.5	65.8	0.0	26.65
- 8.10	75.5	+ 7.5	43.8
- 4.25	87.1	12.40	60.3
- 0.0	102.5	20.25	98.2

The increasing solubility of the compound $CsI.3SO_2$ in liquid sulfur dioxide with rising temperature causes the vapor pressure curve of the saturated solution to diverge considerably from that of pure SO_2. At somewhat higher temperatures the curves of the two univarient systems probably intersect.

EQUILIBRIUM IN THE SYSTEM CAESIUM IODIDE, MERCURIC IODIDE AND WATER.

(Pernet, 1936, 1938.)

Results for the isotherms 0°, 12°, 34°, 54° and 78° are shown in the form of diagrams but numerical data are not given in the present papers. Five caesium iodo mercurates were identified. Three, namely, $2CsI.3HgI_2$, $2CsI.HgI_2$ and $3CsI.HgI_2$ exist at all the temperatures. Two, namely, $CsI.HgI_2$ exists from 0° to 12°, and $CsI.2HgI_2$, exists at temperatures above 54°.

100 gms. sat. solution of Caesium Iodide in **Liquid Ammonia** contain 60.28 gms. CsI at 0°. (Linhard and Stephan, 1933, 1934.)

SOLUBILITY OF CAESIUM IODIDE IN PURE ACETONE.

(Lannung, 1932.)

t°	d of sat. sol.	Gm CsI per 1000 gms. CH_3COCH_3	Gm. mol. CsI per liter sat. sol.
18	0.796	1.59	0.00486
37	0.771	1.39	0.00412

I

EQUILIBRIUM IN THE SYSTEM CAESIUM IODIDE, IODINE AND BENZENE.

(Foote, Bradley and Fleischer, 1933.)

Results at 6°		Results at 25°	
Gms. I per/ 100 gms. sat. sol.	Solid	Gms. I per 100 gms. sat. sol.	Solid Phase
0.023	$CsI + CsI_3$	0.047	$CsI + CsI_3$
0.55	CsI_3	0.77	CsI_3
1.20	"	1.34	"
1.30	" + CsI_4	2.35	" + CsI_4
2.00	CsI_4	3.89	CsI_4
3.41	"	5.27	"
3.80	" + T.C.	7.75	" + T.C.
4.55	T.C.	8.88	T.C.
6.25	"	12.19	"
6.00	"	13.96	" + I_2
8.59	" + I_2		

T.C. = Ternary compound of the probable composition $2CsI.9I_2.4C_6H_6$.

EQUILIBRIUM IN THE SYSTEM CAESIUM IODIDE, IODINE AND TOLUENE.

(Foote, Bradley and Fleischer, 1933.)

Results at 6°		Results at 25°	
Gms. I per 100 gms. sat. sol.	Solid Phase	Gms. I per 100 gms. sat. sol.	Solid Phase
0.024	$CsI + CsI_3$	0.053	$CsI + CsI_3$
0.54	CsI_3	0.77	CsI_3
1.08	"	1.72	"
1.53	" + CsI_4	2.54	" + CsI_4
4.35	CsI_4	3.09	CsI_4
6.74	"	9.90	"
10.41	" + I_2	14.66	"
		15.41	" + I_2

Since caesium iodide is insoluble in benzene and in toluene none was found in the above saturated solutions.

EQUILIBRIUM IN THE SYSTEM CAESIUM IODIDE AND IODINE.

(Briggs, 1930.)

t°	Mol. Percent CsI	Solid Phase	t°	Mol. Percent CsI	Solid Phase	t° (b.pt.)	Mol. Percent CsI
113	0.0	I	134	30.	CsI_4	183	0
108	5.0	"	149	32.5	CsI_3	188	10
100	9.0	"	171	36.5	"	197	20
88	13.0	"	175	37.5	"	212	30
71 (Eutec)	18.0	" + CsI_4	186	40.0	"	247	40
92	22.5	CsI_4	199	43.0	"	302	50
110	25.0	"	211	48.0	" + CsI	304	70
122	27.5	"	211	70.0	CsI_3	303	90
			303	49.4	CsI		

CAESIUM IODATE $CsIO_4$.

100 parts H_2O dissolve 2.6 parts $CsIO_3$ at 24°, and 2.5 parts $2CsIO_3.I_2O_5$ at 21°. (Wheeler, 1892; Barker, 1908.)

IO **CAESIUM** Per **IODATE** $CsIO_4$.

100 gms. H_2O dissolve 2.15 gms. $CsIO_4$ at 15°, $d_{\frac{15}{4}}$ sat. solution = 1.0166. (Barker, 1908.)

CAESIUM AZIDE CsN_3

100 gms. sat. solution of Caesium Azide in water contain 69.16 gms. CsN_3 at 0° and 75.45 gms. at 16°. (Curtius and Rissom, 1898)

CAESIUM NITRATE $CsNO_3$.

SOLUBILITY IN WATER.

(Berkeley — Trans. Roy. Soc. (Lond.) 203 A, 213, '04.)

t°.	Gms. $CsNO_3$ per 100 Gms. Solution.	Gms. $CsNO_3$ per 100 Gms. Water.	G. Mols. $CsNO_3$ per Liter.	t°.	Gms. $CsNO_3$ per 100 Gms. Solution.	Gms. $CsNO_3$ per 100 Gms. Water.	G. Mols $CsNO_3$ per Liter.
0	8.54	9.33	0.476	60	45.6	83.8	3.41
10	12.97	14.9	0.725	70	51.7	107.0	4.10
20	18.7	23.0	1.11	80	57.3	134.0	4.81
30	25.3	33.9	1.58	90	62.0	163.0	5.50
40	32.1	47.2	2.12	100	66.3	197.0	6.19
50	39.2	64.4	2.73	106.2	68.8	220.3	6.58

NO

THE ICE CURVES FOR MIXTURES OF CAESIUM NITRATE AND WATER, DETERMINED BY THE SYNTHETIC METHOD.

(Jones, 1908.)

Solubility curve.

t° of Crystallization	Gms. $CsNO_3$ per 100 Gms. H_2O.	Solid Phase.
−0.3	0.21	Ice
−0.4	1.28	"
−1.2	6.01	"
−1.3	8.0	"
−1.4 (Eutec.)	...	"

Supersolubility curve.

t° of Crystallization.	Gms. $CsNO_3$ per 100 Gms. H_2O.	Solid Phase.
−1.2	0.21	Ice
−2.5	1.28	"
−3.0	3.99	"
−3.2	6.01	"
−3.2	8	"

The eutectic is given as −1.254° and 8.51 gms. $CsNO_3$ per 100 gms. H_2O, by Washburn and MacInnes (1911).

EQUILIBRIUM IN THE SYSTEM CAESIUM NITRATE, LEAD NITRATE AND WATER AT 25°
(Malquori, 1928d.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$CsNO_3$	$Pb(NO_3)_2$		$CsNO_3$	$Pb(NO_3)_2$	
21.53	0.0	$CsNO_3$	14.09	38.13	$CsNO_3$
19.88	4.37	"	12.84	42.10	" + $Pb(NO_3)_2$
18.21	10.79	"	7.97	40.22	$Pb(NO_3)_2$
17.65	18.43	"	4.49	39.32	"
17.08	29.30	"	2.14	38.30	"
15.23	34.65	"	0.0	37.07	"

Fusion-point data are given for mixtures of $CsNO_3$ + $LiNo_3$ and $CsNO_3$ + $Pb(NO_3)_2$ by Puschin and Radoicic, 1937.

CAESIUM HYDROXIDE CsOH

OH

SOLUBILITY OF CAESIUM HYDROXIDE IN WATER.

t°	Gms. CsOH per 100 gms. sat. sol.	Authority
15	79.41	(de Forcrand; 1909a.)
30	75.18	(Schreinemakers and Meijeringh, 1908.)

CAESIUM PERMANGANATE $CsMnO_4$.

100 cc. sat. aqueous solution contain 0.097 gm. $CsMnO_4$ at 1°, 0.23 gm. at 19°, and 1.25 gms. at 59°. (Patterson — J. Am. Chem. Soc. 28, 1735, '06.)

CAESIUM SELENATE Cs_2SeO_4.

100 grams H_2O dissolve 245 grams Cs_2SeO_4 at 12°. (Tutton — J. Chem. Soc. 71, 850, '97.)

CAESIUM Per RHENATE $CsReO_4$

S

One liter sat. solution of Caesium Perrhenate in Water contain 7.8 gms. $CsReO_4$ at 19°. (Noddack and Noddack, 1931.)

CAESIUM SULFIDES Cs_2S, Cs_2S_5

Fusion-point data for mixtures of Cs_2S + Cs_2S_5 and for Cs_2S_5 + S are given by Biltz and Wilke-Dorfurt, 1906.)

CAESIUM Fluoro SULFONATE $CsFSO_3$

100 cc sat. solution of Caesium Fluoro sulfonate in water contain 2.23 gm $CsFSO_3$ at 0°. (Lange, 1927.)

CAESIUM SULPHATE Cs_2SO_4.

SOLUBILITY IN WATER.

(Berkeley — Trans. Roy. Soc. (Lond.) 203 A, 210, '04.)

t°.	Gms. Cs_2SO_4 per 100 Gms. Solution.	Gms. Cs_2SO_4 per 100 Gms. Water.	G. Mols. Cs_2SO_4 per Liter.
0	62.6	167.1	3.42
10	63.4	173.1	3.49
20	64.1	178.7	3.56
30	64.8	184.1	3.62
40	65.5	189.9	3.68
50	66.1	194.9	3.73
60	66.7	199.9	3.78
70	67.2	205.0	3.83
80	67.8	210.3	3.88
90	68.3	214.9	3.92
100	68.8	220.3	3.97
108.6	69.2	224.5	4.00

EQUILIBRIUM IN THE SYSTEM CAESIUM SULFATE, PRASEODYMIUM SULFATE AND WATER AT 25°.

(Restanio, 1934.)

SO

Gms. per 100 gms. sat. sol. Cs_2SO_4	Gms. per 100 gms. sat. sol. $Pr_2(SO_4)_3$	Solid Phase
41.62	—	—
20.15	—	1.1.8
10.06	—	"
7.21	—	"
1.92	0.47	"
0.45	3.70	"
0.40	6.10	1.1.8
0.35	7.00	"
0.31	8.16	—
0.33	8.21	—
0.15	8.19	—

1.1.8 = $Cs_2SO_4.Pr_2(SO_4)_3.8H_2O$.

CAESIUM ALUMS.

SOLUBILITY OF CAESIUM GALLIUM SELENATE ALUM AND OF CAESIUM GALLIUM SULFATE ALUM IN WATER AND OTHER SOLVENTS AT 25°.

(Dennis and Brigmann, 1918.)

Alum.	Formula.	Solvent.	Gms. Ga_2O_3 per 100 gms. sat. sol.	Gms. Alum per 100 cc. sat. sol.
Caesium gallium selenate alum..	$CsGa(SeO_4)_2.12H_2O$	Water	0.53	4.15
" " sulfate alum...	$CsGa(SO_4)_2.12H_2O$	"	0.23	1.51
" " " " ...	"	50% alcohol	0.00059	0.00387
" " " " ...	"	70% "	0.00054	0.00356
" " " " ...	"	Aq. mixture*	0.0035	0.0228

* Composed of 35 cc. H_2O, 50 cc. C_2H_5OH and 15 cc. conc. H_2SO_4.

Constant agitation is not mentioned. The analyses are reported in terms of gms. of Ga_2O_3 per 100 gms. of saturated solution and the corresponding gms. of alum are calculated to 100 cc. of sat. solution, but the density determinations required for this are not given.

CAESIUM ALUMS

SOLUBILITY OF CAESIUM CHROMIUM ALUM, CAESIUM IRON ALUM, CAESIUM INDIUM ALUM, AND OF CAESIUM VANADIUM ALUM IN WATER.

(Locke — Am. Ch. J. 27, 174, '01.)

Formula of Alum.	t°.	Gms. per 100 cc. H_2O.		Gram Mols. $CsM'''(SO_4)_2.12H_2O$ per 100 cc. H_2O
		Anhydrous Salt.	Hydrated Salt.	
$Cs_2Cr_2(SO_4)_4.24H_2O$	25	0.57	0.94	0.00151
"	30	0.96	1.52	0.0025
"	35	1.206	1.91	0.0032
"	40	1.53	2.43	0.00405
$Cs_2Fe_2(SO_4)_4.24H_2O$	25	1.71	2.72	0.0045
"	30	2.52	4.01	0.0066
"	35	3.75	6.01	0.0099
"	40	6.04	9.80	0.0156
$Cs_2In_2(SO_4)_4.24H_2O$	25	7.57	11.73	0.0172
$Cs_2V_2(SO_4)_2.24H_2O$	25	0.771	1.31	0.00204

SO

SOLUBILITY OF CAESIUM DOUBLE SULPHATES IN WATER AT 25°.

(Locke — Am. Ch. J. 27, 459, '01.)

Name.	Formula.	Gms. Anhydrous Salt per 100 Gms.		Gm. Mols. Salt per 100 Gms. H_2O.
		Solution.	Water.	
Caesium Cadmium Sulphate	$Cs_2Cd(SO_4)_2.6H_2O$	58.16	139.9	0.2455
Caesium Cobalt Sulphate	$Cs_2Co(SO_4)_2.6H_2O$	29.52	41.9	0.081
Caesium Copper Sulphate	$Cs_2Cu(SO_4)_2.6H_2O$	31.49	46.0	0.0882
Caesium Iron Sulphate	$Cs_2Fe(SO_4)_2.6H_2O$	50.29	101.1	0.1967
Caesium Magnesium Sulphate	$Cs_2Mg(SO_4)_2.6H_2O$	34.77	53.3	0.1106
Caesium Manganese Sulphate	$Cs_2Mn(SO_4)_2.6H_2O$	44.58	80.4	0.157
Caesium Nickel Sulphate	$Cs_2Ni(SO_4)_2.6H_2O$	20.37	25.6	0.0495
Caesium Zinc Sulphate	$Cs_2Zn(SO_4)_2.6H_2O$	27.87	38.6	0.0738

SOLUBILITY OF CAESIUM SODIUM SULFATES IN WATER AT 25°.

(Foote, 1911.)

Gms. per 100 Gms. Sat. Solution.		Per cent $CsSO_4$ in Residue.	Empirical Composition of Residue.
Cs_2SO_4.	Na_2SO_4.		
54.65	11.44	89.98	$1Na_2SO_4.3.53Cs_2SO_4$
54.58	11.63	78.22	$1Na_2SO_4.1.41Cs_2SO_4$
54.81	11.25	34.67	$4.8Na_2SO_4.1Cs_2SO_4$

The author's solubility method for determination of the formation and composition of double salts is described in the paper containing the above results.

Fusion-point data are given for mixtures of Cs_2SO_4 + KCl and Cs_2SO_4 + K_2SO_4 by Dombrovskaya, 1933.

CAESIUM DiSULFITE $Cs_2S_2O_5$

100 gms. liquid Sulfur Dioxide dissolve 0.047 gm $Cs_2S_2O_5$ at 0°. (Jander and Wickert, 1936.)

COPPER Cu

SOLUBILITY OF COPPER IN MILK.

(Quam, 1929.)

Highly polished 4 x 7.5 cm strips of Copper were immersed in 50 cc portions of raw milk and rocked 46 times per minute for 30 minutes. The loss in weight of the copper strips was determined by difference and the results expressed as milligrams Cu dissolved per sq. decimeter of surface. The dissolved copper was also determined by analysis of the milk after the period of contact with the metal.

t°	Mgs. Cu dissolved per sq. decimeter	t°	Mgs. Cu dissolved per sq. decimeter	t°	Mgs. Cu dissolved per sq. decimeter
30	0.258	60	1.118	85	1.892
40	0.516	65	1.333	90	1.961
45	0.671	70	1.462	95	1.788
50	0.860	80	1.806	100	1.376

SOLUBILITY OF COPPER IN MERCURY.

(Irvin and Russell, 1932.)

Copper amalgam was prepared by three methods and the samples passed through sintered glass filters until a thick layer of paste was formed. The filtrate was then passed twice through its paste and analyzed. When chamois leather was used instead of sintered glass irregular and higher results were obtained. The average of a large number of determinations was 0.0020 gm. Cu per 100 gms. Hg at 20°.

Previous determinations by Tammann, Kollmann and Hinnuber, 1927, made by the electrometric method, gave 0.0032 gm. Cu per 100 gms. Hg at 18°.

Data for the distribution of Copper between, Zinc and Lead, Zinc and Bismuth, Aluminium and Lead and Aluminium and Bismuth are given by Tammann and Schaftmeister, 1924.

Br

COPPER BROMIDE (ic) $CuBr_2$

SOLUBILITY OF CUPRIC BROMIDE IN WATER.

(Carter and Megson, 1928.)

t°	Gms. per 100 gms. sat. sol.	Solid Phase	t°	Gms. per 100 gms. sat. sol.	Solid Phase
0.0	51.8	$CuBr_2.4H_2O$	20	55.9	$CuBr_2$
5.75	52.8	"	25	55.8	"
9.9	53.7	"	30.1	56.1	"
15.0	55.0	"	34.8	56.0	"
18.0(tr.pt.)	55.9	" + $CuBr_2$	50.0	56.8	"
0.0	55.7	$CuBr_2$ (Metastable)			

Below the transition point the solid phase consists of green needles and above of black rhomboids. The d_4^{25} of the sat. solution at 25° is 1.84.

EQUILIBRIUM IN THE SYSTEM CUPRIC BROMIDE, HYDROBROMIC ACID AND WATER AT 25°.

(Carter and Megson, 1928.)

$d\frac{25}{4}$ of sat. sol.	Gms. per 100 gms. sat. sol.		$d\frac{25}{4}$ of sat. sol.	Gms. per 100 gms. sat. sol.		$d\frac{25}{4}$ of sat. sol.	Gms. per 100 gms. sat. sol.	
	$CuBr_2$	HBr		$CuBr_2$	HBr		$CuBr_2$	HBr
1.84	55.8	0.0	1.63	26.9	26.0	—	18.5	43.6
1.82	52.3	2.9	1.64	25.9	26.9	1.79	15.8	48.0
1.78	48.3	6.3	1.65	23.1	31.9	—	15.1	48.8
1.73	43.2	10.6	1.68	22.2	34.6	—	11.8	53.5
1.69	37.6	15.4	1.72	20.4	39.1	—	10.8	54.7
1.65	32.9	19.4	1.74	19.2	42.1	1.83	7.7	59.3

The solid phase is the anhydrous $CuBr_2$ (black rhomboids) throughout. Data are also given for equilibrium at 0° and for the metastable portion of the curve at 25°.

COPPER BROMIDE (ous) Cu_2Br_2.

Br

SOLUBILITY OF CUPROUS BROMIDE IN AQUEOUS SOLUTIONS OF POTASSIUM BROMIDE AT 18°-20°.

(Bodländer and Storbeck, 1902.)

Millimols per Liter.					Grams per Liter.			
KBr.	Total Cu.	Total Br.	Cu (ic).	Cu (ous).	KBr.	Total Cu.	Cu (ic).	Cu (ous).
0	0.3157	0.4320	0.2096	0.1061	0	0.0201	0.0133	0.0067
25	0.119	...	0.012	0.107	2.98	0.0076	0.0007	0.0068
40	0.200	...	0.013	0.187	4.76	0.0127	0.0007	0.0119
60	0.310	...	0.025	0.285	7.15	0.0197	0.0015	0.0181
80	0.423	...	0.012	0.411	9.53	0.0266	0.0007	0.0261
100	0.584	...	...	0.584	11.91	0.0371	...	0.0371
120	0.693	...	...	0.693	14.29	0.0441	...	0.0441
500	8.719	...	...	8.719	59.55	0.5540	...	0.5540

100 gms. acetonitrile dissolve 3.86 gms. Cu_2Br_2 at 18°. (Naumann and Schier, 1914.)

Freezing-point lowering data for mixture of CuBr + KBr are given by de Cesaris, 1911.

COPPER BROMIDE (ic) $CuBr_2$.

100 gms. acetonitrile dissolve 24.43 gms. $CuBr_2$ at 18°. (Naumann and Schier, 1914.)

100 gms. 95% formic acid dissolve 0.16 gm. $CuBr_2$ at 21°. (Aschan, 1913.)

COPPER METHIONATE $CuCH_2O_6S_2$

100 gms. Water dissolve 76.8 gms. $CuCH_2O_6S_2$ at 25°. (Backer and Terpstra, 1929.)

COPPER FORMATE $Cu(CH_2O)_2$

CH

SOLUBILITY OF CUPRIC FORMATE IN FORMIC ACID.

(Davidson and Holm, 1931.)

t°	25°	35°	42°	49°	52°
Mols. $Cu(CH_2O)_2$ per 100 mols. $Cu(CH_2O)_2$ + HCOOH	0.004	0.0045	0.0048	0.0065	0.0075

The determinations were made by the freezing-point method. The bright blue solid phase could not be obtainned in sufficient quantity for analysis.

SOLUBILITY OF CUPRIC FORMATE IN FORMIC ACID SOLUTIONS OF AMMONIUM FORMATE.

(Davidson and Holm, 1931.)

t°	Mol. Ratio NH_4CHO_2 in Solvent	Mols. $Cu(CHO_2)_2$ per 100 mols. $Cu(CHO_2)_2$ + NH_4CHO_2 + HCOOH	t°	Mol. Ratio NH_4CHO_2 in Solvent	Mols. $Cu(CHO_2)_2$ per 100 mols. $Cu(CHO_2)_2$ + NH_4CHO_2 + HCOOH
33.5	0.10	0.055*	68.5	0.2975	1.286
36.5	"	0.060*	74.0	"	1.365
39.0	"	0.076*	29.0	0.3354	1.179
41.0	"	0.083*	31.0	"	1.308
44.0	"	0.098*	33.0	"	1.501
65.0	"	0.076	38.5	"	1.680
71.0	"	0.083	43.0	"	1.950
77.0	"	0.098	44.0	"	2.004
60.0	0.1973	0.319	37.0	0.4375	1.990
70.5	"	0.399	43.0	"	2.470
77.2	"	0.405	48.5	"	2.816
51.5	0.2975	1.016	51.5	"	3.131

CH

* Unstable modification

At NH_4CHO_2 concentrations below 0.3 mol. ratio the bright blue solid phase could not be obtained in sufficient quantity for analysis. At higher NH_4CHO_2 concentration the solid phase was pale blue $2Cu(CHO_2)_2 \cdot 3HCOOH$.

COPPER ACETATE $Cu(CH_3COO)_2.H_2O$

SOLUBILITY OF COPPER ACETATE IN AQUEOUS SOLUTIONS OF ACETIC ACID AT 25°.

(Sandved, 1927.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$Cu(C_2H_3O_2)_2$	$HC_2H_3O_2$		$Cu(C_2H_3O_2)_2$	$HC_2H_3O_2$		$Cu(C_2H_3O_2)_2$	$HC_2H_3O_2$	
6.79	0.0	Cu1	1.18	63.67	CuI	0.20	94.94	1.1.1
4.73	6.18	"	0.89	70.81	"	0.21	95.26	"
4.27	11.14	"	0.79	74.06	"+1.1.1	0.17	95.50	"+1.1
4.16	13.65	"	0.77	74.42	1.1.1	0.23	95.66	1.1
3.49	22.35	"	0.69	75.74	"	0.23	96.37	"
3.12	28.43	"	0.48	81.60	"	0.31	97.20	"
2.68	35.53	"	0.25	88.46	"	0.71	98.77	"
2.10	46.08	"	0.22	92.17	"	0.71	98.91	"
1.70	53.35	"	0.21	93.33	"			

Cu1 = $Cu(C_2H_3O_2)_2.H_2O$; 1.1.1 = $Cu(C_2H_3O_2)_2.HC_2H_3O_2.H_2O$; 1.1 = $Cu(C_2H_3O_2)_2.HC_2H_3O_2$.

COPPER ACETATE $Cu(CH_3COO)_2.H_2O$.

SOLUBILITY OF COPPER ACETATE IN AQUEOUS SOLUTIONS OF POTASSIUM ACETATE AT 25°. (Buttgenbach, 1925.)

The original determinations were evidently published in the author's dissertation (Aachen, 1925). Since this was not available the following approximate values were read from the small scale diagram given in the condensed account of the work published in the Z. anorg. allgem. chem.

d_{25} of sat. sol.	Gms. per 100 cc. sat. sol.		Solid Phase.	d_{25} of sat. sol.	Gms. per 100 cc. sat. sol.		Solid Phase.
	Cu.	CH_3COOK.			Cu.	CH_3COOK,	
1.05	2.4	0.0	$Cu(CH_3COO)_2.H_2O$	1.27	2.0	52.0	1.1.1
1.06	1.4	7.0	»	1.31	1.65	64 0	»
1.10	1.3	12.0	»	1.33	1.8	72.0	»
1.12	1.4	17.0	»	1 34	1.95	74.0	» +1.3
1.14	1.6	22.0	»	1.36	1.4	84.0	1.3
1.16	2.0	28.5	»	1.38	1.7	100.0	»
1.19	2.4	34.0	»	–	0.15	112.0	1.3 + $CH_3COOK.1\frac{1}{2}H_2O$
1.23	3.0	41.0	» +1.1.1	–	0.00	104.0	$CH_3COOK.1\frac{1}{2}H_2O$
1.25	2.4	46.0	1.1.1				

1.1.1 = $Cu(CH_3COO)_2.CH_3COOK.H_2O$; 1.3 = $Cu(CH_3COO)_2.3CH_3COOK$.

A portion of the 40° curve near the tr. pt. 1.1.1 + 1.3 is also given.

SOLUBILITY OF COPPER ACETATE IN ACETIC ACID SOLUTIONS OF POTASSIUM ACETATE, DETERMINED BY THE SYNTHETIC METHOD.

(Davidson and Griswold, 1936.)

t°	Mol. Fraction $KC_2H_3O_2$ in Solvent	Mols. $Cu(C_2H_3O_2)_2$ per 100 Mols. $Cu(C_2H_3O_2)_2$ + $KC_2H_3O_2$ + $HC_2H_3O_2$	Solid Phase	t°	Mol. Fraction $KC_2H_3O_2$ in Solvent	Mols. $Cu(C_2H_3O_2)_2$ per 100 Mols. $Cu(C_2H_3O_2)_2$ + $KC_2H_3O_2$ + $HC_2H_3O_2$	Solid Phase
31.8	0.0146	0.350	1.1	48.5	0.0657	0.745	2.1.2
38.3	"	0.476	"	60.5	"	1.100	"
42.3	"	0.557	"	26.0	0.0738	0.373	"
45.3	"	0.632	"	35.5	"	0.497	"
48.3	"	0.723	"	45.8	"	0.676	"
31.3	0.0254	0.392	"	49.0	"	0.746	"
34.0	"	0.435	"	52.0	"	0.814	"
42.0	"	0.590	"	27.1	0.107	0.409	"
48.0	"	0.752	"	38.3	"	0.557	"
51.0	"	0.843	"	44.6	"	0.654	"
32.0	0.0486	0.530	2.1.2	52.3	"	0.817	"
36.8	"	0.623	"	56.8	"	0.927	"
41.0	"	0.711	"	29.3	0.116	0.454	"
44.0	"	0.800	"	36.8	"	0.549	"
48.0	"	0.916	"	45.7	"	0.700	"
29.8	0.0590	0.440	"	51.8	"	0.832	"
35.7	"	0.520	"	62.0	"	1.100	"
44.2	"	0.700	"	43.6	0.144	0.800	"
48.5	"	0.804	"	49.1	"	0.923	"
58.5	"	1.100	"	51.7	"	0.980	"
27.0	0.0657	0.378	"	57.3	"	1.110	"
35.5	"	0.495	"	61.3	"	1.240	"
41.5	"	0.597	"				

1.1 = $Cu(C_2H_3O_2)_2.HC_2H_3O_2$; 2.1.2 = $2Cu(C_2H_3O_2)_2.KC_2H_3O_2.2HC_2H_3O_2$.

SOLUBILITY OF COPPER ACETATE IN PURE ACETIC ACID, DETERMINED BY THE FREEZING-POINT METHOD.

(Davidson and Griswold, 1931.)

t°	Mols. $Cu(C_2H_3O_2)_2$ per 100 mols. $Cu(C_2H_3O_2)_2$ + $HC_2H_3O_2$	Solid Phase	t°	Mols. $Cu(C_2H_3O_2)_2$ per 100 mols. $Cu(C_2H_3O_2)_2$ $HC_2H_3O_2$	Solid Phase
16.65	0.0	Ac.	41.5	0.408	1.1
16.63	0.0307	"	45.8	0.487	"
16.50	0.0471	"	48.7	0.584	"
16.43	0.0831	"	56.0	0.768	"
16.57	0.0994	"	55.7	0.773	"
25.3	0.169	1.1	61.0	0.976	"
30.1	0.236	"	91.3	0.844	"
32.1	0.266	"	95.5	0.912	"
35.0	0.305	"	99.0	0.976	"

SOLUBILITY OF COPPER ACETATE IN ACETIC ACID SOLUTIONS OF AMMONIUM ACETATE, DETERMINED BY THE SYNTHETIC METHOD.

(Davidson and Griswold, 1931.)

CH

t°	Mol. Percent $NH_4C_2H_3O_2$ in Solvent	Mols. $Cu(C_2H_3O_2)_2$ per 100 Mols. $Cu(C_2H_3O_2)_2$ + $NH_4C_2H_3O_2$ + $HC_2H_3O_2$	Solid Phase	t°	Mol. Percent $NH_4C_2H_3O_2$ in Solvent	Mols. $Cu(C_2H_3O_2)_2$ per 100 Mols. $Cu(C_2H_3O_2)_2$ + $NH_4C_2H_3O_2$ + $HC_2H_3O_2$	Solid Phase
33.8	7.9	0.624	1.1	31.5	20.7	0.796	1.4.4
37.3	"	0.693	"	32.5	"	1.188	"
40.7	"	0.800	"	33.5	"	1.584	"
45.2	"	0.929	"	37.0	"	1.708	1.1
32.5	11.6	0.816	"	40.7	"	1.766	"
38.5	"	1.026	"	41.8	"	1.800	"
42.7	"	1.179	"	31.0	22.1	0.777	1.4.4
28.0	15.1	1.005	"	34.0	"	1.125	"
31.8	"	1.072	"	34.0	"	1.399	"
36.8	"	1.273	"	48.0	23.7	0.448	"
41.2	"	1.488	"	50.5	"	0.532	"
42.7	"	1.746	"	54.0	"	0.765	"

1.1 = $Cu(C_2H_3O_2)_2.HC_2H_3O_2$; 1.4.4 = $Cu(C_2H_3O_2)_2.4NH_4C_2H_3O_2.4HC_2H_3O_2$

100 gms. Acetone (CH_3COCH_3) dissolve 0.28 gm. $Cu(C_2H_3O_2)_2$ at 15°. (Henstock, 1934.)

100 gms. Methyl Alcohol (CH_3OH) dissolve 0.48 gm $Cu(C_2H_3O_2)_2$ at 15° and 0.48 gm. at 66° (b.pt.). (Henstock, 1934.)

100 gms. glycerol (d_{15} = 1.256 = 96%) dissolve 10 gms. copper acetate at 15°-16°. (Ossendowski, 1907.)

SOLUBILITY OF ANHYDROUS COPPER ACETATE IN PYRIDINE.

(Mathews and Benger, 1914.)

t°.	Gms. $Cu(C_2H_3O_2)_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $Cu(C_2H_3O_2)_2$ per 100 Gms. Sat. Sol.	Solid Phase.
−11.6	0.37	$Cu(C_2H_3O_2)_2.4C_5H_5N$	45.2	4.17	$Cu(C_2H_3O_2)_2.4C_5H_5N$
+ 2	0.6	"	34.8	3.75	$Cu(C_2H_3O_2)_2.C_5H_5N$
13	1.03	"	55.7	4.13	"
26.45	1.61	"	64.3	4.48	"
37.4	2.83	"	76.2	4.83	"
41.9	3.12	"	83.3	5.40	"
43.2	3.39	"	95.4	6.31	"

Transition point = 44.7°.

COPPER TARTRATE $CuC_4O_6H_4.3H_2O$.

SOLUBILITY IN WATER.

(Cantoni and Zachoder, 1905.)

t°.	Gms. $CuC_4O_6H_4.3H_2O$ per 100 cc. Solution.	t°.	Gms. $CuC_4O_6H_4.3H_2O$ per 100 cc. Solution.	t°.	Gms. $CuC_4O_6H_4.3H_2O$ per 100 cc. Solution.
15	0.0197	40	0.1420	65	0.1767
20	0.0420	45	0.1708	70	0.1640
25	0.0690	50	0.1920	75	0.1566
30	0.0890	55	0.2124	80	0.1440
35	0.1205	60	0.1970	85	0.1370

100 cc. of aqueous saturated solution of copper tartrate contain 2.3×10^{-4} gm. mols. or 0.061 gms. $Cu\,C_4\,O_6\,H_4.3\,H_2\,O$ at 18°. (Kolthoff, 1926.)

COPPER FUMARATE $C_4H_2O_4.Cu.2H_2O$.

100 gms. H_2O dissolve 0.02 gm. $C_4H_2O_4.Cu$ at 30°. (Weiss and Downs, 1923.)

COPPER MALEATE $C_4H_2O_4Cu.H_2O$.

100 gms. H_2O dissolve 0.12 gm. $C_4H_2O_4Cu$ at 30°. (Weiss and Downs, 1923.)

COPPER Potassium CITRATE $CuK_4[(COOCH_2)_2C(OH)COO]_2$.

CH

100 cc. sat. solution in H_2O contain 43.3 gms. of the salt at 10°. (Pickering, 1915.)

COPPER Nitroso phenyl HYDROXYLAMINE. (Cupferronate) $Cu[C_6H_5N(NO)O]_2$

100 gms H_2O dissolve 1.1.10 ^{5} gms. of the compound at 18°. (Pinkus and Martin, 1927.)

COPPER BENZOATES $(C_6H_5COO)_2Cu.4H_2O$, etc.

SOLUBILITY OF COPPER BENZOATES IN WATER AT 20°.

(Ephraim and Pfister, 1925.)

Compound.	Formula.	Gms. anhydrous cmpd. per 100 cc. sat. sol.
Copper benzoate..............	$(C_6H_5.COO)_2Cu.4H_2O$	0.100
» -4-Chloro benzoate....	$(C_6H_4Cl\cdot COO)_2Cu.2H_2O$	0.192
» -4-Nitro »	$(C_6H_4NO_2.COO)_2Cu.H_2O$	0.161
» -4-Oxy »	$(C_6H_4OH.COO)_2Cu.7H_2O$	0.242
» cinnamate............	$C_{18}H_{14}O_4.Cu$	0.0304

100 gms. Acetone (CH_3COCH_3) dissolve 2.03 gm. $Cu(C_6H_5COO)_2$ at 15°. (Henstock, 1934.)

100 gms. Methyl Alcohol (CH_3OH) dissolve 0.49 gm. $Cu(C_6H_5COO)_2$ at 15° and 1.97 gm. at 66° (b.pt.). (Henstock, 1934.)

COPPER Benzene and Naphtalene SULFONATES.

SOLUBILITY OF EACH SEPARATELY IN WATER. (Ephraim and Seger, 1925.)

Results for Copper Benzene Sulfonate.

t°.	Gms. $Cu(C_6H_5SO_3)_2$ per 100 cc. sat. sol.	Solid Phase.
18.....	32.33	$Cu(C_6H_5SO_3)_2.6H_2O$
34.....	39.26	»
49.5...	49.70	»
50.0...	48.89	$Cu(C_6H_5SO_3)_2.4H_2O$
64.5...	55.92	»
80.5 ..	66.24	»

Results for Copper Naphtalene-2-Sulfonate.

t°.	Gms. $Cu(C_{10}H_7SO_3)_2$ per 100 cc. sat. sol.	Solid Phase.
20.....	1.07	$Cu(C_{10}H_7SO_3)_2.6H_2O$
32.....	1.49	»
45.....	2.26	»
59.....	3.80	»
74.....	6.54	»
82.....	9.42	»

SOLUBILITY OF SEVERAL COPPER SULFONATES IN WATER.

Compound.	Formula.	t°.	Gms. anhydrous cmpd. per 100 cc. sat. sol.
Copper Anthracene -1-sulfonate	$Cu(C_{14}H_9SO_3)_2.6H_2O$	20	0.0806 (1)
» » -2- »	$Cu(C_{14}H_9SO_3)_2$ –	20	0.0083 (1)
» Naphthalene-1- »	$Cu(C_{10}H_7SO_3)_2.6H_2O$	17	4.647 (2)
» » -6-oxy-2- »	$Cu(C_{10}H_7SO_3)_2.7H_2O$	20	1.249 (1)
» » -5-chlor-1- »	$Cu(C_{10}H_6SO_3Cl)_2.4H_2O$	20	1.088 (1)
» -10-Chlorphenanthrene-3 or 6- »	$Cu(C_{14}H_8ClSO_3)_2.4H_2O$	20	0.010 (3)

(1) Ephraim and Pfister, 1925*a*. (2) Ephraim and Seger, 1925. (3) Sandquist. 1917.

100 gms. H_2O dissolve 0.25 gm. copper 2-phenanthrene monosulfonate at 20°.
" " " 0.09 " " 3- " " "
" " " 0.26 " " 10- " " "

(Sandquist, 1913.)

COPPER Diazoamidobenzene (ous) $Cu(C_6H_5N = N - NC_6H_5)$

One liter Methyl alcohol dissolve less than 0.001 gm. $Cu(C_6H_5N = N-NC_6H_5)$ at 25°.

One liter Ethyl alcohol dissolve less than 0.0022 gm. $Cu(C_6H_5N = N-NC_6H_5)$ at 25°.

One liter n Propyl alcohol dissolve less than 0.0084 gm. $Cu(C_6H_5N = N-NC_6H_5)$ at 25°. (Watt and Fernelius, 1935.)

COPPER HELIANTHATE $(C_{14}H_{14}N_3SO_3)_2Cu.4H_2O$.

1000 cc. H_2O dissolve 0.122 gm. of the hydrated salt at 20-25°.

(Stark and Dehn, 1918.)

CN **COPPER CYANIDE** (ous) $Cu_2(CN)_2$.

SOLUBILITY OF POTASSIUM CYANIDE IN AQUEOUS SOLUTIONS OF CUPROUS CYANIDE AT 25° AND VICE VERSA.

(Bassett and Corbet, 1924.)

NOTE. — Difficulty was experience in preparing KCN free from KOH. I was necessary to prepare the saturated solutions from double salts which coul be obtained free of KOH. Constant rotation in wax bottles was employed. T eliminate errors due to oxidation, an atmosphere of coal gas, which had bee previously washed by passing through solutions of lead acetate and sodium hydroxid was maintained in the bottles. Both the liquid and solid phases were analyzed

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
KCN.	CuCN	Solid Phase.	KCN.	CuCN.	Solid Phase
41.7	0.00	KCN	22.32	14.71	$KCu(CN)_2$
40.53	2.16	»	19.95	13.78	»
40.31	4.20	»	12.10	8.84	»
41.70	5.84	$K_3Cu(CN)_4$	9.97	7.52	$KCu_2(CN)_3.H_2$(
35.96	10.86	»	6.05	3.93	»
33.86	15.30	»	6.03	3 88	»
41.94	6.13	$K_3Cu(CN)_4.H_2O$	4.21	1.87	»
36.24	12.92	»	3.27	1.68	»
34.82	18.47	»	1.34	0.60	»
35.28	22.52	»	0.42	trace	» + CuC
34.77	22.59	$KCu(CN)_2$	trace	trace	CuCN

Freezing-point data for $Cu_2(CN)_2$ + KCN and $Cu_2(CN)_2$ + NaCN are given by Truthe (1912).

COPPER NITRO PRUSSIATE $CuFe(CN)_5NO$

One liter sat. solution of Copper Nitroprussiate in Water contains 6.0×10^{-5} gm. mol. $CuFe(CN)_5NO$ at 20°. (Tomicek and Kubik, 1937.)

COPPER THIOCYANATE (ic) $Cu(SCN)_2$.

CNS

SOLUBILITY IN AQUEOUS AMMONIA SOLUTIONS AT 25° AND AT 40°.

(Horn, 1907.)

	Results at 25°.			Results at 40°.		
d_{25} Sat. Sol.	Gms. per 100 Gms. Sat. Sol. NH_3.	Gms. per 100 Gms. Sat. Sol. $Cu(SCN)_2$.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. NH_3.	Gms. per 100 Gms. Sat. Sol. $Cu(SCN)_2$.	Solid Phase.
1.0082	0.79	2.45	$Cu(SCN)_2.2NH_3$	0.94	2.81	$Cu(SCN)_2.2NH_3$
1.0166	1.98	4.08	"	1.77	4.18	"
1.0213	2.50	5.11	"	2.57	6.55	"
1.0171	4.26	5.96	$Cu(SCN)_2.4NH_3$	3.52	8.76	"
1.0151	5.35	6.22	"	4.35	11.78	$Cu(SCN)_2.4NH_3$
1.0134	6.39	6.59	"	5.50	12.07	"
1.0070	9.93	7.98	"	7.58	12.99	"
0.9987	16.55	11.24	"	13.98	16.58	"
0.9985	21.47	15.22	"	18.02	19.76	"

COPPER CARBONATE $CuCO_3$.

100 gms. of a sat. solution of copper carbonate in water at 18° and in contact with CO_2 at a pressure of 1 atmosphere, contain 0.03 gm. $CuCO_3$. At a pressure of 56 atmospheres of CO_2 the sat. solution contains 0.041 gm. $CuCO_3$. (Haehnel, 1924.)

COPPER CARBONATE Basic.

CO

SOLUBILITY IN AQUEOUS CO_2 SOLUTIONS AT 30°.

(Free, 1908.)

Aq. 0.5 *n* Na_2CO_3 and 0.5 *n* $CuSO_4$ were mixed and the precipitate washed and suspended in H_2O containing CO_2 at a pressure slightly above atmospheric, for 3 days. The filtered precipitate was kept in water ready for use. In the fresh condition or dried, the molecular ratio of the constituents was found to be 1CuO: 0.515 CO_2: 0.61 H_2O. For the solubility determinations, about 2 gms. of the precipitate were suspended in 600 cc. of H_2O and CO_2 passed in to the desired concentration. The mixture was shaken frequently for 3 days. The total CO_2 in the sat. solution was determined and the free CO_2 calc. by difference, assuming that the amount combined to the Cu was in the molecular ratio 2CuO:1CO_2.

Parts per Million.		Parts per Million.	
Free CO_2.	Metallic Cu.	Free CO_2.	Metallic Cu.
0 = pure H_2O	1.5	859	28
157	8.3	961	31
277	13.7	1158	33.7
348	17	1224	34.8
743	25.7	1268–1549	35.3–39.7*

* Saturated with CO_2 at 1 + atmosphere.

Results practically identical with the above were obtained for a NaCl solution containing 100 parts per million. Data for other concentrations of NaCl and for other salts are also given. Salts with a common ion depress the solubility. Those with no common ion increase it slightly. A recalculation of the results of Free is given by Seyler (1908).

SOLUBILITY OF MIXTURES OF COPPER CARBONATE AND POTASSIUM CARBONATE IN WATER AT 25°.

(Wood and Jones, 1907–08.)

100 gms. H_2O dissolve 3.15 gms. $CuCO_3$ + 105 gms. K_2CO_3 at 25° when the solid phase in contact with the solution is $CuCO_3.K_2CO_3 + K_2CO_3$.

Additional points on the curves were determined but the analytical data are not given. The following approximate values were read from the curve for the double salt, $CuCO_3.K_2CO_3$:

Gms per 100 Gms. H_2O.		Solid Phase.
K_2CO_3.	$CuCO_3$.	
105	3.15	$K_2CO_3 + CuCO_3.K_2CO_3$
100	3.20	$CuCO_3.K_2CO_3$
90	3.40	"
85	3.60	"

The triple point for double salt + $CuCO_3$ could not be determined since $CuCO_3$ is not capable of existing alone and decomposes into CO_2 + $Cu(OH)_2$.

CO **COPPER** Sodium **CARBONATE** $CuNa_2(CO_3)_2.3H_2O$.

SOLUBILITY OF MIXTURES OF COPPER SODIUM CARBONATE AND SODIUM BICARBONATE IN WATER AT 18°. (Appleby and Lane, 1918.)

Gms. per liter of sat. solution.			Solid Phase.
Na_2CO_3.	$NaHCO_3$.	Cu.	
9.27	87.79	–	$CuNa_2(CO_3)_2.3H_2O$
11.08	86.45	0.0509	" + $NaHCO_3$
13.44	85.27	0.0542	" "
96.68	65.31	0.1061	" "
168.75	53.60	0.1553	" "
185.02	53.77	–	" " + $Na_2CO_3.10H_2O$
197.08	18.94	0.257	" + $Na_2CO_3.10H_2O$

No evidence of the presence of trona ($Na_2CO_3.NaHCO_3.2H_2O$) at 18° was obtained.

COO **COPPER OXALATE** (ic) $CuC_2O_4.\frac{1}{2}H_2O$.

One liter H_2O dissolves 0.02364 gm. CuC_2O_4 at 25°, determined by the conductivity method. (Schafer 1905.)

SOLUBILITY OF COPPER OXALATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 18°.

(Britton and Jarrett, 1936.)

Gm. Mols. per 1000cc sat. solution		Solid Phase	Gm. Mols. per 1000cc sat. solution		Solid Phase
H_2SO_4	CuC_2O_4		H_2SO_4	CuC_2O_4	
0.0	0.00015	CuC_2O_4	0.50	0.00336	CuC_2O_4
0.05	0.00039	"	1.00	0.00658	"
0.125	0.00089	"	1.50	0.00969	"
0.25	0.00180	"	1.875	0.01240	"

EQUILIBRIUM IN THE SYSTEM COPPER OXALATE, SODIUM OXALATE AND WATER AT 18°

(Britton and Jarrett, 1932.)

Gm. Mols. per 1000 cc sat. sol. $Na_2C_2O_4$	Gm. Mols. per 1000 cc sat. sol. CuC_2O_4	Solid Phase	Gm. Mols. per 1000 cc sat. sol. $Na_2C_2O_4$	Gm. Mols. per 1000 cc sat. sol. CuC_2O_4	Solid Phase	Gm. Mols. per 1000 cc sat. sol. $Na_2C_2O_4$	Gm. Mols. per 1000 cc sat. sol. CuC_2O_4	Solid Phase
0.0	0.00015	CuC_2O_4	0.0758	0.0322	CuC_2O_4+1.1.2	0.1670	0.0119	1.1.2
0.010	0.00490	"	0.0800	0.0328	1.1.2	0.2001	0.00925	" + $Na_2C_2O_4$
0.020	0.0093	"	0.0823	0.0268	"	0.2335	0.0080	$Na_2C_2O_4$
0.040	0.0171	"	0.0919	0.0230	"	0.2370	0.0060	"
0.050	0.0207	"	0.1240	0.0164	"	0.2375	0.0072	"
0.060	0.0247	"	0.1623	0.0124	"	0.240	0.000	"

COO

1.1.2 = $CuC_2O_4.Na_2C_4O.2H_2O$

COPPER (ic) CHLORIDE $CuCl_2.2H_2O$

SOLUBILITY OF COPPER CHLORIDE IN WATER.

(Boye, 1933.)

t°	Gms. per 100 gms. sat. sol.	Solid Phase	t°	Gms. per 100 gms. sat. sol.	Solid Phase
- 2.9	7.8	Ice	25.7	43.6	$CuCl_2.3H_2O$ x $CuCl.2H_2O$
- 4.5	11.3	"	28.5	43.6	$CuCl_2.2H_2O$
-10.0	17.5	"	31.0	43.6	"
-18.1	25.4	"	35.8	43.9	"
-31.4	34.1	"	39.9	44.7	"
-37.5	37.5	"	42.2	45.2	" + $CuCl_2.H_2O$
-43.4 (Eutec)	39.9	" + $CuCl_2.4H_2O$	45.3	45.0	$CuCl_2.H_2O$
-29.9	39.4	$CuCl_2.4H_2O$	50.0	45.0	"
-26.8	39.4	"	61.2	46.7	"
0.0	40.7	"	68.3	47.8	"
+10.0	41.5	"	75.1	48.7	"
15.0	42.1	" + $CuCl_2.3H_2O$	82.0	49.8	"
19.0	42.1	$CuCl_2.3H_2O$	89.9	50.9	"
21.6	42.3	"	96.1	52.0	"
23.0	42.6	"	101.8	52.8	"
24.9	43.3	$CuCl_2.3H_2O$	116.8 b.pt.	55.0	"

Cl

The existence of the tetra, tri and mono hydrate of cupric chloride is questioned by Benrath, 1934a, who considers that only the dihydrate is stable between 0° and 100°. It is pointed out that the ½-1 hour allowed by Boye for attainment of equilibrium is insufficient. Although a higher hydrate may be obtained by cooling a super saturated solution to 0° this is transformed competely to dihydrate after several days. Chretien and Weil, 1935, also found only the dihydrate between 0 & 112°.

Density of solution saturated at 0° = 1.511, at 17.5° = 1.579.

100 gms. sat. solution in water contain 43.95 gms. $CuCl_2$ at 30°, solid phase, $CuCl_2.2H_2O$. (Schreinemakers, 1910.)

100 gms. sat. sol. in water contain 43.60 gms. $CuCl_2$ at 25°, 47.24 gms. at 54°, 50.40 gms. at 75°, 54.60 gms. at 100° and 56.66 gms. at 112°. (Chretien and Weil, 1935.)

COPPER CHLORIDE (ous) CuCl.

SOLUBILITY OF CUPROUS CHLORIDE IN AQUEOUS SOLUTIONS OF CUPRIC CHLORIDE AT 19°.

(Fedotieff, 1928.)

Gms. per liter sat. solution $CuCl_2$	Gms. per liter sat. solution CuCl	Solid Phase	Gms. per liter sat. solution $CuCl_2$	Gms. per liter sat. solution CuCl	Solid Phase
134.5	15.8	CuCl	536.5	78.7	CuCl
260.0	40.7	"	661.9	87.4	" + $CuCl_2.2H_2O$
435.7	63.8	"			

SOLUBILITY OF CUPROUS CHLORIDE IN AQUEOUS SOLUTIONS OF CUPRIC SULFATE AT ABOUT 20°.

(Bodländer and Storbeck, 1902.)

Millimols per Liter.					Grams per Liter.				
$CuSO_4$.	Total Cu.	Total Cl.	Cu (ic).	Cu (ous).	$CuSO_4$.	Total Cu.	Total Cl.	Cu (ic).	Cu (ous).
0	2.880	5.312	2.258	0.622	0	0.183	0.188	0.143	0.040
0.987	3.602	4.908	3.145	0.457	0.158	0.229	0.174	0.200	0.029
1.975	4.553	4.687	4.131	0.422	0.315	0.290	0.166	0.263	0.027
2.962	5.193	4.256	4.625	0.509	0.473	0.330	0.151	0.292	0.032
4.937	7.276	4.329	6.546	0.730	0.788	0.463	0.154	0.416	0.046

Cl

SOLUBILITY OF CUPROUS CHLORIDE IN AQUEOUS SOLUTIONS OF FERROUS CHLORIDE AT 21.5° AND VICE VERSA.

(Kremann and Noss, 1912.)

In order to ascertain the composition of the solid phase, the experiment was made by mixing together weighed amounts of H_2O, CuCl and $FeCl_2$ and agitating in a thermostat at constant temperature. A weighed portion of the clear saturated solution in each case was analyzed and the composition of the solid phase calculated by difference.

Gms. per 100 Gms. H_2O. $FeCl_2$.	Gms. per 100 Gms. H_2O. CuCl.	Solid Phase.	Gms. per 100 Gms. H_2O. $FeCl_2$.	Gms. per 100 Gms. H_2O. CuCl.	Solid Phase.
0	1.53	CuCl	43.75	12.42	CuCl
6.02	1.33	"	54	17.04	"
11.62	1.80	"	66.40	21.6	"
16.30	3.11	"	73.20	23.20	" + $FeCl_2.4H_2O$
26.30	7.12	"	71.90	21.65	$FeCl_2.4H_2O$
29.35	8.06	"	69.30	11.9	"
33.12	9.56	"	65.10	0	"

100 gms. H_2O dissolve 1.52 gms. CuCl at 25°. (Noss, 1912.)

SOLUBILITY OF CUPROUS CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID CONTAINING $CuCl_2$ AT 25°.

(Poma, 1909, 1910.)

Results for 1 *n* HCl.			Results for 2 *n* HCl.			Results for 4 *n* HCl.		
Mols. per Liter.			Mols. per Liter.			Mols. per Liter.		
$CuCl_2$ Added.	$CuCl_2$+CuCl.	Solid Phase.	$CuCl_2$ Added.	$CuCl_2$+CuCl.	Solid Phase.	$CuCl_2$ Added.	$CuCl_2$+CuCl.	Solid Phase.
0	0.0862	CuCl	0	0.2365	CuCl	0	0.7704	CuCl
0.1	0.2017	"	0.094	0.3528	"	0.095	0.9044	"
0.2	0.3256	"	0.188	0.4766	"	0.189	1.0370	"
0.4	0.5707	"	0.235	0.5385	"	0.379	1.3040	"
0.5	0.6924	"	0.282	0.6038	"	0.473	1.4380	"

SOLUBILITY OF CUPROUS CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID.

(Engel — *Ibid* [6] 17, 372, '89; Compt. rend. 121, 529, '95.)

Milligram Mols. per 10 cc. Sol.		Sp. Gr. of Solutions.	Gms. per 100 cc. Sol.		Gms. per 100 Gms. Sol.	
$\frac{1}{2}Cu_2Cl_2$.	HCl.		Cu_2Cl_2.	HCl.	Cu_2Cl_2.	HCl.
Results at 0°.						
0.475	8.975	1.05	0.471	0.327	0 448	0.312
1.5	17.5	1.049	1.486	0.638	1.418	0.608
2.9	26.0	1.065	2.872	0.948	2.697	0.932
4.5	34.5	1.080	4.457	1.257	4.127	1.164
8.25	47.8	1.135	8.172	1.743	7.199	1.535
15.5	68.5	1.261	15.7	2.497	12.46	1.980
33.0	104.0	1.345	32.68	3.827	24.30	2.845
Results at 15°-16°.						
7.4	54.4	1.19	7.33	1.983	6.159	1.666
10.8	68.9	1.27	10.69	2.511	8.422	1.977
12.8	75.0	1.29	12.68	2.734	9.826	2.119
16 0	92.0	1.38	15.84	3.346	11.48	2.424

SOLUBILITY OF CUPROUS CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 19°.

(Fedotieff, 1928.)

Gms. per liter sat. sol.	
CuCl	HCl
11.1	49.6
74.0	141.2
121.9	182.9
187.4	229.8
217.7	256.0

COPPER CHLORIDE (ic) $CuCl_2.2H_2O$.

EQUILIBRIUM IN THE SYSTEM COPPER OXIDE, HYDROCHLORIC ACID AND WATER AT 25°. (Britton, 1925.)

The saturated solutions were prepared from moist hydrated copper oxide, moist basic cupric chloride, hydrochloric acid and cupric chloride solution. Equilibrium was attained in about a week, but final analyses of the solutions and air dried solid phases were made only after three months. The terms in which the results are expressed are not clearly defined.

Liquid phases.		Solid Phase.
% CuO.	% HCl.	
0.0	0.0	$4CuO.2HCl.3H_2O$+CuO (hydrate)
0.16	0.15	$4CuO.2HCl.3H_2O$
3.90	3.57	»
8.35	7.66	»
15.22	13.96	$4CuO.2HCl.3H_2O$
18.52	17.03	»
21.24	19.49	»
25.59	23.51	» + $CuCl_2.2H_2O$

SOLUBILITY OF CUPRIC CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID.

(Foote, 1923.)

Results at 0°. Gms. per 100 gms. sat. sol. $CuCl_2$.	HCl.	Solid Phase.	Results at 25°. Gms. per 100 gms. sat. sol. $CuCl_2$.	HCl.	Solid Phase.
40.92	0.0	$CuCl_2.2H_2O$	43.32	0.0	$CuCl_2.2H_2O$
34.82	3.72	»	32.85	6.52	»
23.82	10.35	»	23.74	12.95	»
15.64	16.71	»	18.34	18.08	»
12.12	21.82	»	17.01	22.26	»
13.86	29.02	»	18.20	25.07	»
17.42	31..6	» + $HCl.CuCl_23H_2O$	22.65	27.76	»
15.66	32.66	$HCl.CuCl_2.3H_2O$	24.07	28.05	»
12.29	36.82	»	25.65	28.49	»
11.85	37.19	»			

SOLUBILITY OF CUPRIC CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 0°.

(Engel — Ann. chim. phys. [6] 17, 351, '89.)

Cl

Milligram Mols. per 10 cc. Sol. ½$CuCl_2$.	HCl.	Sp Gr. of Solutions.	Gms. per 100 cc. Sol. $CuCl_2$.	HCl.	Gms. per 100 Gms. Sol. $CuCl_2$.	HCl.
91.75	0	1.49	61.70	0.0	41.41	0.0
86.8	4.5	1.475	58.37	1.64	39.58	1.11
83.2	7.8	1.458	55 95	2.84	38.37	1.95
79.35	10.5	1.435	53 37	3.83	37.19	2.67
68.4	20.25	1.389	46.01	7.38	33.11	5.31
50.0	37.5	1.319	33.62	13.67	25.50	10.37
22.8	70.25	1.231	15 33	25.61	12.46	20 80
23.5	102.5	1.288	15.81	37.36	12.27	29 00
26.7	128.0	1.323	17 96	46.66	13.57	35.26
			29 0	Sat. HCl		

SOLUBILITY OF CUPRIC CHLORIDE IN AQUEOUS SOLUTIONS OF MERCURIC CHLORIDE AT 35° AND VICE VERSA.

(Schreinemakers and Thonus, 1912.)

Gms. per 100 Gms. Sat. Sol. $HgCl_2$.	$CuCl_2$.	Solid Phase.	Gms per 100 Gms. Sat. Sol. $HgCl_2$.	$CuCl_2$.	Solid Phase.
0	44.47	$CuCl_2.2H_2O$	52.54	18.46	$HgCl_2$
21.03	33.5	"	52.81	18.06	"
37.30	26.07	"	51.03	14.73	"
44.47	23.31	"	49.50	5.94	"
50.47	21.50	" + $HgCl_2$	23.87	2.64	"
52.44	19.40	$HgCl_2$	8.51	0	"

The following additional determinations of the solubility of cupric chloride in aqueous mercuric chloride solutions are given by Bassett, Barton, Foster and Pateman, 1933.

Results at 25°

Gms. per 100 gms. sat. sol.		Solid Phase
$HgCl_2$	$CuCl_2$	
0.0	43.32	$CuCl_2.2H_2O$
48.75	22.53	"
51.68	21.46	" + $HgCl_2$
51.50	21.35	$HgCl_2$
51.57	20.95	"
51.83	20.64	"
52.89	18.86	"
51.47	14.86	"
6.90	0.0	"

Results at 35°

Gms. per 100 gms. sat. sol.		Solid Phase
$HgCl_2$	$CuCl_2$	
0.0	44.47	$CuCl_2.2H_2O$
49.71	22.50	"
52.13	21.69	" + $HgCl_2$
52.35	21.09	$HgCl_2$
52.60	20.27	"
53.28	18.70	"
52.30	14.51	"
8.51	0.0	"

SOLUBILITY OF CUPROUS CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT ABOUT 20°.

(Bodländer and Storbeck, 1902.)

Cl

Millimols per Liter.					Grams per Liter.				
KCl.	Total Cu.	Total Cl.	Cu (ic).	Cu (ous).	KCl.	Total Cu.	Total Cl.	Cu (ic).	Cu (ous).
0	2.851	5.416	2.222	0.629	0	0.181	0.193	0.141	0.040
2.5	1.955	6.015	1.421	0.534	0.186	0.124	0.213	0.090	0.034
5	1.522	7.525	1.008	0.514	0.373	0.097	0.267	0.069	0 033
10	1.236	11.735	0.475	0.761	0.746	0 079	0.416	0.030	0.048
20	1.446	21.356	0.324	1.122	1 492	0.092	0.759	0.021	0 071
50	2.411	not det.	0.1088	2.302	3.730	0.153	not det.	0.007	0.146
100	4.702	"	0	4.702	7 460	0.299	"	0	0.299
200	9.485	"	0	9.485	14 920	0.603	"	0	0.603
1000	97	"	0	97	74 60	6.170	"	0	6.170
2000	384	"	0	384	149.2	24.42	"	0	24.420

The results in the 3d, 7th, 8th and last line of this table are at 16°.

SOLUBILITY OF CUPROUS CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT 25° AND VICE VERSA. (Valeton and Frömel, 1924.)

Mols. per 100 mols. of mixture			Mols. per 100 mols. of mixture			Mols. per 100 mols. of mixture		
CuCl.	KCl.	Solid Phase.	CuCl.	KCl.	Solid Phase.	CuCl.	KCl.	Solid Phase
0.27	0.09	CuCl	1.75	1.15	1.1.1	0.90	1.15	1.2
0.68	0.18	»	1.66	1.20	»	0.80	1.05	»
0.96	0.25	»	1.65	1.24	»	0.52	0.85	»
1.91	0.54	»	1.55	1.25	»	0.40	0.80	»
2.10	0.62	»	1.44	1.45	»	0.30	0.75	»
2.05	0.90	»+1.1.1	1.32	1.62	»+1.2	0.25	0.75	»+KCl
1.97	0.95	1.1.1	1.25	1.55	1.2	0.25	0.85	KCl
1.90	1.00	»	1.25	1.50	»	0.23	0.90	»
1.85	1.05	»	1.10	1.35	»	0.20	1.49	»
1.80	1.10	»	1.00	1.22	»	0.00	8.0	»

1.1.1 = $CuCl.KCl.H_2O$ 1.2 = $CuCl.2KCl$.

Fusion point data for mixtures of CuCl and HgCl are given by Janecke, 1923.

SOLUBILITY OF CUPROUS CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT 22° AND VICE VERSA.

(Brönsted, 1912.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
KCl.	CuCl.		KCl.	CuCl.		KCl.	CuCl.	
3.87	0.115	CuCl	21.64	13.32	CuCl	24.04	4.53	CuCl.2KCl
6.56	0.405	"	23.84	17.23	"	25.03	3.14	"
8.24	0.861	"	25.24	21.47	"	26.28	2.20	"
11.33	2.19	"	23.87	15.48	CuCl.2KCl	27.06	1.60	"
15.30	4.80	"	23.57	13.99	"	26.68	1.21	KCl
17.47	7.19	"	23.50	11.39	"	26.32	0.58	"
20.31	10.21	"	23.49	7.35	"	25.68	0	"

Cl **COPPER CHLORIDE** (ic) $CuCl_2.2H_2O$

SOLUBILITY OF COPPER CHLORIDE AND POTASSIUM CHLORIDE DOUBLE SALTS AND MIXTURES IN WATER.

(Meyerhoffer — Z. physik. Chem. 5, 102, '90.)

t°.	Cl per 1 Gram Solution.		Mols. per 100 Mols. H_2O.		Solid Phase.
	Present as $CuCl_2$.	Present as KCl.	$CuCl_2$.	KCl.	
39.4	0.120	0.107	5.56	9.93	$CuCl_2.2KCl.2H_2O$ + KCl
49.9	0.129	0.115	6.39	11.4	"
60.4	0.142	0.125	7.71	13.6	"
79.1	0.168	0.142	11.1	18.8	"
90.5	0.188	0.154	14.9	24.4	"
93.7	0.194	0.156	16.2	26.0	$CuCl_2.KCl$ + KCl
98.8	0.197	0.162	17.5	28.7	"
0	0.214	0.021	9.84	1.94	$CuCl_2.2KCl.2H_2O$ + $CuCl_2.2H_2O$
39.6	0.232	0.049	12.9	5.44	"
50.1	0.233	0.059	13.7	6.90	"
52.9	0.241	0.062	14.8	7.63	"
60.2	0.246	0.066	15.8	8.49	$CuCl_2.KCl$ + $CuCl_2.2H_2O$
72.6	0.255	0.063	16.8	8.35	"
64.2	...	...	14.9	11.6	$CuCl_2.2KCl.2H_2O$ + $CuCl_2.KCl$
72.5	...	....	14.8	15.0	$CuCl_2.KCl$

COPPER CHLORIDE (ic) $CuCl_2.2H_2O$

EQUILIBRIUM IN THE SYSTEM CUPRIC CHLORIDE, POTASSIUM CHLORIDE AND WATER AT VARIOUS TEMPERATURES.

(Chretien and Weil, 1935.)

t°	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
		KCl	$CuCl_2$	
-65.0	—	0.20	39.9	Ice + 1.1.2 + $CuCl_2.2H_2O$
-63.2	—	0.70	36.5	Ice + 1.1.2 + 1.2.2
-30.0	—	0.93	39.74	1.1.2 + $CuCl_2.2H_2O$
"	—	1.67	36.51	1.1.2 + 1.2.2
-21.0	—	8.0	21.40	Ice + KCl + 1.1.2
-18	—	9.04	21.10	Ice + KCl
0	—	3.35	40.97	1.1.2 + $CuCl_2.2H_2O$
"	1.537	3.68	40.17	1.1.2
"	1.509	4.88	38.23	1.1.2 + 1.2.2
"	1.478	5.19	35.98	1.2.2
"	—	8.32	28.48	"
"	1.340	13.22	21.07	"
"	1.338	13.92	20.15	" + KCl
"	1.251	15.26	13.11	KCl
"	—	18.26	6.14	"
"	—	21.85	0.0	"
20	1.578	5.90	42.45	1.1.2 + $CuCl_2.2H_2O$
"	—	7.70	39.88	1.1.2 + 1.2.2
"	1.370	17.98	21.06	1.2.2 + KCl
25	—	0.0	43.60	$CuCl_2.2H_2O$
"	1.558	2.94	43.45	"
"	1.581	5.49	43.25	"
"	1.593	6.27	43.16	"
"	1.594	6.46	43.15	" + 1.1.2
"	1.589	6.75	42.76	1.1.2
"	1.583	7.50	41.59	"
"	1.573	7.94	41.27	"
"	1.567	8.37	40.43	" + 1.2.2
"	1.541	9.23	38.40	1.2.2
"	1.475	11.37	33.10	"
"	—	14.84	27.90	"
"	—	17.77	23.24	"
"	1.350	19.03	21.30	" + KCl
"	1.127	21.80	11.21	KCl
"	1.190	24.01	5.47	"
"	—	26.40	0.0	"
35	—	8.15	44.10	1.2.2 + $CuCl_2.2H_2O$
"	—	10.33	41.57	1.2.2 + 1.1.2
"	—	21.06	22.56	1.2.2 + KCl
50	—	11.55	45.67	1.2.2 + $CuCl_2.2H_2O$
"	—	14.00	42.92	1.2.2 + 1.1.2
"	—	25.36	26.97	1.2.2 + KCl
54	—	—	47.24	$CuCl_2.2H_2O$
54.4	—	12.4	46.3	" + 1.1.2
56.0	—	13.55	45.73	M.C + 1.1.2

Cl

1.1 = $CuCl_2.KCl$; 1.1.2 = $CuCl_2.KCl.2H_2O$; 1.2.2 = $CuCl_2.2KCl.2H_2O$;
M.C. = Mixed Crystals.

COPPER CHLORIDE (ic) $CuCl_2.2H_2O$

EQUILIBRIUM IN THE SYSTEM CUPRIC CHLORIDE, POTASSIUM CHLORIDE AND WATER AT VARIOUS TEMPERATURES. (Continued)

(Chretien and Weil, 1935.)

t°	d. of sat. sol.	Gms. per 100 gms. sat. sol. KCl	Gms. per 100 gms. sat. sol. $CuCl_2$	Solid Phase
58	—	12.36	46.61	$CuCl\ .2H_2O$
"	—	12.82	46.85	" + M.C.
"	—	14.36	45.64	M. C.
"	—	14.94	45.00	" + 1.1.2
"	—	15.47	44.40	1.1.2
58.4	—	15.6	44.4	" + M.C. + 1.1
59.0	—	12.95	46.81	M. C.
"	—	14.42	45.46	"
"	—	14.85	45.20	" + 1.1
"	—	15.50	44.53	1.1
59.2	—	16.0	44.2	" + 1.1.2 + 1.2.2
60.0	—	13.9	47.1	" + M.C. + $CuCl_2.2H_2O$
"	—	16.18	44.14	1.2.2 + 1.1
61.0	—	12.93	47.13	1.1 + $CuCl_2.2H_2O$
75.0	—	0.0	50.40	$CuCl_2.2H_2O$
"	1.711	5.74	49.88	"
"	1.787	12.45	49.30	" + 1.1
"	1.781	15.35	46.70	1.1
"	—	18.44	44.11	"
"	1.761	20.27	42.73	"
"	1.756	21.95	41.42	" + 1.2.2
"	1.716	25.16	35.75	1.2.2
"	1.629	28.33	31.56	" + KCl
"	1.499	28.13	23.74	KCl
"	1.360	29.79	12.63	"
"	—	33.20	0.0	"
88	—	29.74	38.03	1.1 + 1.2.2
"	—	30.32	36.22	1.2.2 + KCl
93.2	—	31.2	37.5	" + " + 1.1
100	—	0.0	54.6	$CuCl_2.2H_2O$
"	1.690	5.53	53.69	"
"	1.853	11.53	53.26	" + 1.1
"	1.815	13.14	51.30	1.1
"	1.771	25.42	41.80	"
"	1.783	31.69	38.21	"
"	1.700	33.29	37.51	" + KCl
"	1.651	32.20	31.11	KCl
"	—	35.70	0.0	"
108.6 (b.pt.)	—	36.80	0.0	"
112	—	0.0	56.66	$CuCl_2.2H_2O$
115.8 (b.pt.)	—	0.0	57.90	"
116	—	35.21	38.17	1.1 + KCl
"	—	10.10	56.02	" + $CuCl_2.2H_2O$
119.9	—	35.50	38.40	" + KCl
121.5 (b.pt.)	—	9.90	58.15	" + $CuCl_2.2H_2O$

1.1 = $CuCl_2.KCl$; 1.1.2 = $CuCl_2.KCl.2H_2O$; 1.2.2 = $CuCl_2.2KCl.2H_2O$; M. C. = Mixed Crystals.

SOLUBILITY OF CUPRIC CHLORIDE IN AQUEOUS SOLUTIONS OF LITHIUM CHLORIDE AT 30° AND VICE VERSA. (Schreinemakers, and Noorduyn, 1918.)

Gms. per 100 gms. sat. sol. $CuCl_2$.	Gms. per 100 gms. sat. sol. LiCl.	Solid Phase.
43.4	0.0	$CuCl_2.2H_2O$
40.2	2.5	»
39.5	2.9	»
35.5	5.7	»
34.9	6.2	»
27.9	11.8	»
24.2	13.8	»
22.7	16.3	»
20.7	19.0	»
19.6	26.2	$CuCl_2.2H_2O$ + 1.1.2
16.2	28.6	1.1.2
13.6	29.7	»
7.3	36.3	»
4.4	40.3	»
2.7	42.8	»
1.8	45.4	» + $LiCl.H_2O$
1.7	45.5	$LiCl.H_2O$
0.0	46.3	»

1.1.2 = $CuCl_2.LiCl.2H_2O$.

EQUILIBRIUM IN THE SYSTEM CUPRIC CHLORIDE, LITHIUM CHLORIDE AND WATER AT VARIOUS TEMPERATURES.

(Benrath, 1932a.)

Cl

t°	Gms. per 100 gms. sat. sol. $CuCl_2$	Gms. per 100 gms. sat. sol. LiCl	Solid Phase
0	40.85	0.0	$CuCl_2.2H_2O$
"	32.33	5.78	"
"	18.97	15.69	"
"	11.22	29.55	" + 1.1.2
"	9.14	31.10	1.1.2
"	3.92	36.03	"
"	2.08	38.77	" + $LiCl.2H_2O$
"	0.0	40.51	$LiCl.2H_2O$
16	15.46	27.84	$CuCl_2.2H_2O$ + 1.1.2
"	1.42	43.45	$LiCl.2H_2O$ + 1.1.2
19	42.67	0.0	$CuCl_2.2H_2O$
"	33.46	6.44	"
"	21.32	16.08	"
"	18.78	18.59	"
"	16.06	27.58	" + 1.1.2
"	11.29	31.15	1.1.2
"	1.39	44.22	" + $LiCl.2H_2O$
"	0.90	44.55	$LiCl.2H_2O$
40	22.69	25.03	$CuCl_2.2H_2O$ + 1.1.2
"	2.41	45.70	$LiCl.2H_2O$+1.1.2
50	46.05	0.0	$CuCl_2.2H_2O$
"	37.39	6.65	"
"	26.97	16.69	"
"	25.17	21.49	"
"	25.54	24.20	" + 1.1.2
50	25.65	24.80	1.1.2
"	8.98	37.43	"
"	6.68	40.21	"
"	3.22	46.01	"
"	3.06	46.51	" + $LiCl.H_2O$
"	1.09	47.50	$LiCl.H_2O$
"	0.0	48.18	"
75	33.13	21.67	$CuCl_2.2H_2O$ + 1.1.2
"	5.39	43.81	$LiCl.H_2O$ + 1.1.2
99	53.66	0.0	$CuCl_2.2H_2O$
"	47.88	5.04	"
"	40.62	12.60	"
"	39.59	14.51	"
"	40.31	16.16	"
"	42.03	18.30	" + 1.1.2
"	31.13	25.82	1.1.2
"	27.78	27.80	"
"	12.23	45.38	"
"	10.61	46.91	"
"	9.18	49.77	" + LiCl
"	8.78	50.06	LiCl
"	7.69	50.68	"
"	0.0	55.84	"

1.1.2 = $CuCl_2.LiCl.2H_2O$

THE SYSTEM AMMONIUM CHLORIDE + CUPRIC CHLORIDE + WATER.

(Rivett and Clendinnen, 1923.)

Results at 0°.2 ± 0°.1.

$d_{\frac{25}{4}}$ of sat. sol.	Gms. per 100 gms. sat. sol. NH₄Cl.	Gms. per 100 gms. sat. sol. CuCl₂.	Gms. per 100 gms. undissolved residue. NH₄Cl.	Gms. per 100 gms. undissolved residue. CuCl₂.
1.078	22.59	0.91	82.4	2.29
1.084	22.28	1.62	41.8	38.6
1.117	13.69	7.57	34.8	42.2
1.178	7.49	15.09	34.9	44.6
1.273	2.95	24.46	32.1	44.6
1.392	1.19	33.86	26.8	45.3
1.495	0.76	41.7	1.70	48.9
1.498	0.75	40.8	0.49	52.1

Results at 25° ± 0°.1.

$d_{\frac{25}{4}}$ of sat. sol.	Gms. per 100 gms. sat. sol. NH₄Cl.	Gms. per 100 gms. sat. sol. CuCl₂.	Gms. per 100 gms. undissolved residue. NH₄Cl.	Gms. per 100 gms. undissolved residue. CuCl₂.
1.086	28.02	0.995	73.3	1.51
1.092	27.69	1.78	45.6	24.9
1.093	26.86	2.05	36.1	38.1
1.114	19.59	6.41	34.9	40.0
1.145	15.26	19.96	34.0	40.8
1.191	10.94	16.35	28.9	37.2
1.263	6.53	23.76	27.5	40.2
1.378	3.16	33.2	27.6	44.7
1.524	1.82	43.3	8.08	53.2
–	1.79	43.3	13.64	51.5
1.523	1.44	43.2	0.88	57.2

These results show that the supposed compound $2\,NH_4\,Cl.Cu\,Cl_2.2\,H_2\,O$ exists only in a very narrow region of the mixed crystals.

Cl

COPPER CHLORIDE, AMMONIUM CHLORIDE MIXTURES IN AQUEOUS SOLUTION AT 30°.

(Meerburg — Z. anorg. Chem. 45, 3, '05.)

Grams per 100 Gms. Sat. Solution. CuCl₂.	Grams per 100 Gms. Sat. Solution. NH₄Cl.	Grams per 100 Gms. Solid Phase. CuCl₂.	Grams per 100 Gms. Solid Phase. NH₄Cl.	Solid Phase.
0	29.5	...	...	NH_4Cl
1.9	28.6	6.0	48.2	$NH_4Cl + CuCl_2.2NH_4Cl.2H_2O$
3.6	25.9	37.0	34.9	$CuCl_2.2NH_4Cl.2H_2O$
10.5	16.5	21.7	23.1	"
19.9	9.4	28.5	18.4	"
29.4	4.9	35.1	15.3	"
41.4	2.1	43.1	13.3	"
43.2	2.0	51.9	6.6	$CuCl_2.2NH_4Cl.2H_2O + CuCl_2.2H_2O$
43.9	0	...		$CuCl_2.2H_2O$

Additional determinations for the ammonia end of this system at 25° are given by Foote, 1912.

COPPER AMMONIUM CHLORIDE $CuCl_2.2NH_4Cl.2H_2O$.

SOLUBILITY IN WATER.

(Meerburg, 1905.)

t°.	Gms. CuCl₂.2NH₄Cl per 100 Gms. Solution.	Solid Phase.	t°.	Gms. CuCl₂.2NH₄Cl per 100 Gms. Solution.	Solid Phase.
−10.5	3.87	Ice	30	27.70	$CuCl_2.2NH_4Cl.2H_2O$
−10.8	20.12		40	30.47	"
−11	20.3	$Ice + CuCl_2.2NH_4Cl.2H_2O$	50	33.24	"
−10	20.46	$CuCl_2.2NH_4Cl.2H_2O$	60	36.13	"
0	22.02	"	70	39.35	"
12	24.26	"	80	43.36	"
20	25.95	"			

SOLUBILITY OF CUPROUS CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AT 26.5° AND VICE VERSA.

(Kremann and Noss, 1912.)

Gms. per 100 Gms. H_2O. NaCl.	Gms. per 100 Gms. H_2O. CuCl.	Solid Phase.	Gms. per 100 Gms. H_2O. NaCl.	Gms. per 100 Gms. H_2O. CuCl.	Solid Phase.
0	1.55	CuCl	44.14	57.21	CuCl
10.8	3.15	"	55.10	44.10	NaCl
20.7	7.30	"	56.80	41.70	"
27	40.60	"	50.90	18.70	"
36.48	49.10	"			

SOLUBILITY OF COPPER CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE.

(Hunt, 1870.)

t°.	Gms. $CuCl_2$ per 100 cc. Solution of: Sat. NaCl.	15% NaCl.	5% NaCl.
11	8.9	3.6	...
40	11.9	6	1.1
90	16.9	10.3	2.6

Cl

SOLUBILITY OF CUPRIC CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AT 19° AND VICE VERSA.

(Fedotieff, 1098.)

Gms. per 1000 cc sat. solution NaCl	Gms. per 1000 cc sat. solution $CuCl_2$	Solid Phase	Gms. per 1000 cc sat. solution NaCl	Gms. per 1000 cc sat. solution $CuCl_2$	Solid Phase
9.3	1.2	$CuCl_2.2H_2O$	243.2	129.0	$CuCl_2.2H_2O$
47.2	5.4	"	369.8	298.3	" + NaCl
80.2	12.3	"	361.5	245.8	NaCl
123.1	29.2	"	329.0	50.4	"
170.7	54.4	"	317.0	0.0	"

The solutions were saturated in an atmosphere of carbon dioxide The sodium chloride solutions were acidified with several drops of hydrochloric acid.

SOLUBILITY OF CUPRIC CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AT 30° AND VICE VERSA.

(Schreinemakers and de Baat, 1908–09.)

Gms. per 100 Gms. Sat. Sol. NaCl.	Gms. per 100 Gms. Sat. Sol. $CuCl_2$.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. NaCl.	Gms. per 100 Gms. Sat. Sol. $CuCl_2$.	Solid Phase.
0	43.95	$CuCl_2.2H_2O$	12.25	32.40	NaCl
3.10	41.14	"	13.54	28.64	"
4.28	41.06	"	15.40	23.72	"
6.41	39.40	"	18.44	16.98	"
10.25	36.86	" +NaCl	20.61	11.03	"
12.02	32.38	NaCl	26.47	0	"

SOLUBILITY OF CUPRIC CHLORIDE IN ANHYDROUS ACETIC ACID DETERMINED BY THE SYNTHETIC METHOD.

(Davidson and Chappell, 1938.)

t^o	Gm. Mol. $CuCl_2$ per 100 gm. mol. $CuCl_2$ + CH_3COOH	Solid Phase
30	0.0070	$CuCl_2$
35	0.0081	"
50	0.0150	"
62	0.0163	"
75	0.0218	"

SOLUBILITY OF ANHYDROUS CUPRIC CHLORIDE IN ALCOHOLS.

(Lloyd, Brown, Glynwyn, Bonnell and Jones, 1928.)

Results for Methyl Alcohol

t^o	Gms. $CuCl_2$ per 100 gms. CH_3OH	Solid Phase
0	56.5	$CuCl_2.2CH_3OH$
10	57.4	"
20	58.6	"
30	60.0	"
40	61.8	"
50	64.4	"
60	66.4	"

Results for Ethyl Alcohol

t^o	Gms. $CuCl_2$ per 100 gms. C_2H_5OH	Solid Phase
0	42.3	$CuCl_2.2C_2H_5OH$
10	46.0	"
20	50.0	"
30	54.1	"
40	58.3	"
50	63.9	"
60	70.8	"

Results for n Propyl Alcohol

t^o	Gms. $CuCl_2$ per 100 gms. n C_3H_7OH
10	20.0
20	24.7
30	29.4
40	34.2
50	37.7
60	41.1

Results for iso Amyl Alcohol

t^o	Gms. $CuCl_2$ per 100 gms. iso $C_5H_{11}OH$
10	10.7
20	12.1
30	14.2
40	16.2
50	21.0
60	25.2

Results for Benzyl Alcohol

t^o	Gms. $CuCl_2$ per 100 gms. $C_6H_5.CH_2.OH$
10	1.40
20	1.65
30	2.14
40	3.02
50	4.40
60	6.12

The solid phase is the di alcoholate except with n Propyl which forms no alcoholate under the conditions of the present experiments 100 gms. sat. sol. of $CuCl_2$ in Abs. Ethyl Alcohol contain 33.84 gms. $CuCl_2$ at 25°. (Partington and Soper, 1929.)

SOLUBILITY OF CUPROUS CHLORIDE IN ETHYL ALCOHOL CONTAINING INCREASING AMOUNTS OF HYDROCHLORIC ACID AT 25°.

(Kiang-Su Chang and Yeu Ming Liu, 1934.)

Gm. Equiv. per 1000 gms. C_2H_5OH	
HCl	CuCl
0.07839	0.06078
0.1524	0.1281
0.2775	0.2336
0.3223	0.2766
0.3953	0.3338
0.4303	0.3660
0.4356	0.3660
0.4676	0.4035
0.5368	0.4663
0.6108	0.5230
0.6479	0.5538
0.7254	0.6299

SOLUBILITY OF CUPRIC CHLORIDE IN AQUEOUS ALCOHOL AT 11.5°.

(Bödtker, 1897.)

10 gms. of $CuCl_2 2H_2O$ and the indicated amounts of $CuCl_2$ were added to 20 cc. portions of alcohol. The solutions shaken two hours and 5 cc. portions withdrawn.

Vol. % Alcohol.	Gms. $CuCl_2$ Added.	Gms. per 5 cc. Solution.		Vol. % Alcohol.	Gms. $CuCl_2$ Added.	Gms. per 5 cc. Solution.	
		H_2O.	$CuCl_2$.			H_2O.	$CuCl_2$.
89.3	0	0.794	1.137	99.3	0.223	0.330	1.295
92.3	0	0.648	1.090	99.3	0.887	0.247	1.639
96.3	0	0.478	1.116	99.3	1.540	0.191	2.086
99.3	0	0.369	1.208	99.3	1.957	0.164	2.400

SOLUBILITY OF CUPRIC CHLORIDE IN SEVERAL SOLVENTS.

(Etard — Ann. chim. phys. [7] 2, 564, '94; de Bruyn — Z. physik. Chem. 10, 783, '92; de Coninck — Compt. rend. 131, 59, '00; St. von Laszczynski — Ber. 27, 2285, '94.)

Solvent.	Grams $CuCl_2$ per 100 Grams Sat. Solution at:				
	0°.	15°.	20°.	40°.	80°.
Methyl Alcohol	36	40.5 (de B.)	36.5	37.0	...
Ethyl Alcohol	32	35.0 (de B.)	35.7	39.0	...
Propyl Alcohol	29	...	30.5	30.5	...
Iso Propyl Alcohol	...	...	...	16.0	30.0
n Butyl Alcohol	15	...	15.3	16.0	16.5
Allyl Alcohol	23	...	23.0	...	...
Ethyl Formate	10	...	9.0	8.0	...
Ethyl Acetate	...	...	3.0	2.5	1.3 (72°)
Acetone (abs.)	8.86*	8.92†	2.88 (18°)	...	1.40 (56°)
Acetone (80%)	...	...	18.9‡	...	...
Ether	....	0.043 (11°)	0.11	...	...

* ($CuCl_2$.2 Aq.) † ($CuCl_2$.2 Aq.) ‡ (23° $CuCl_2$.2 Aq.)

For the solubility of cupric chloride in mixtures of a number of organic solvents, see de Coninck.

Solvent.	t°.	Gms. $CuCl_2$ per 100 Gms. Sat. Sol.	Sp. Gr. Sat. Sol.	Authority.
Acetonitrile	18	1.57	...	(Naumann and Schier, 1914.)
Ethyl Acetate	18	0.4	0.9055	(Naumann, 1904.)
Methyl Acetate	18	0.55	0.939	(Naumann, 1909.)
Anhydrous Hydrazine	ord. temp.	5 (decomp.)	...	(Welsh and Broderson, 1915.)

SOLUBILITY OF CUPROUS CHLORIDE IN ACETONITRILE.

(Naumann and Schier, 1914.)

100 gms. acetonitrile of boiling point 81.6° dissolve 13.33 gms. CuCl at 18°.

SOLUBILITY OF CUPRIC CHLORIDE IN PYRIDINE.

(Mathews and Spero, 1917.)

t°.	Gms. $CuCl_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°	Gms. $CuCl_2$ per 100 Gms. Sat. Sol.	Solid Phase.
−17.3	0.140	$CuCl_2.6C_5H_5N$	45	0.422	$CuCl_2.2C_5H_5N$
−12.1	0.195	"	53	0.493	"
−10	0.295	" (unstable)	60	0.565	" (unstable)
− 8.9 tr. pt.	0.270	" $+CuCl_2.2C_5H_5N$	62	0.616	" "
+ 2	0.275	$CuCl_2.2C_5H_5N$	58 tr. pt.	...	" $+2CuCl_2.3C_5H_5N$
10	0.293	"	63	0.543	$2CuCl_2.3C_5H_5N$
25	0.348	"	75	0.631	"
35	0.382	"	95	0.917	"

DISTRIBUTION OF CUPRIC CHLORIDE BETWEEN AQ. HCl AND ETHER

When 1 gm. of copper as chloride is dissolved in 100 cc. of 10% HCl and shaken with 100 cc. of ether, 0.05% of the metal enters the ethereal layer. (Mylius, 1911.)

COPPER Ammonium **CHLORIDE** $CuCl_2.NH_4Cl$.

SOLUBILITY IN ABSOLUTE ALCOHOL AT 25°. (Foote and Walden, 1911.)

Gms. per 100 Gms. Sat. Sol. $CuCl_2$.	Gms. per 100 Gms. Sat. Sol. NH_4Cl.	Solid Phase.
4.7	not det.	$NH_4Cl+CuCl_2.NH_4Cl$
6.45	"	$CuCl_2.NH_4Cl$
12.90	"	"
34.7	"	" $+CuCl_2.C_2H_5OH$

COPPER Potassium **CHLORIDE** $CuCl_2.KCl$.

SOLUBILITY IN ABSOLUTE ALCOHOL AND IN ACETONE AT 25°. (Foote and Walden, 1911)

Cl

In Absolute Alcohol. Gms. per 100 Gms. Sat. Sol. $CuCl_2$.	KCl.	Solid Phase.	In Acetone. Gms. per 100 Gms. Sat. Sol. $CuCl_2$.	KCl.	Solid Phase.
1.40	0.28	$KCl+CuCl_2.KCl$	0.34	0.38	$KCl+CuCl_2.KCl$
2.15	not. det.	$CuCl_2.KCl$	0.48	not det.	$CuCl_2.KCl$
5.25	"	"	1.50	"	"
30.16	"	"	2.06	"	"
34.45	0.21	" $+CuCl_2.C_2H_5OH$	2.40	0.27	" $+CuCl_2.C_3H_6O$
33.97	0	$CuCl_2.C_2H_5OH$			

Freezing-point data (solubility, see footnote, p. 1) are given for the following mixtures of cuprous chloride and other chlorides.

$CuCl + CuCl_2$	(Biltz and Fischer, 1927.)
" $+ FeCl_3$	(Hermann, 1911.)
" $+ PbCl_2$	(Pelabon and Lande, 1929.)
" $+ LiCl$	(Sandonnini, 1911, 1914; Korreng, 1914.)
" $+ RbCl$	(Sandonnini, 1914; Sandonnini and Aureggi, 1912.)
" $+ AgCl$	(Sandonnini, 1911, 1914; Poma and Gabbi, 1911, 1912.)
" $+ KCl$	(Sandonnini, 1911, 1914; Korreng, 1914; Sackur, 1913; Poma and Gabbi, 1911, 1912.)
" $+ NaCl$	(Sandonnini, 1911, 1914; Korreng, 1914; Sackur, 1913; de Cesari, 1911.)
" $+ TlCl$	(Sandonnini, 1911, 1914.)
" $+ SnCl_2$	(Hermann, 1911.)
" $+ ZnCl_2$	" "

Freezing-point lowering data for mixtures of $CuCl + Cu_2O$ and $CuCl + Cu_2S$ are given by Truthe, 1912.

ClO **COPPER CHLORATE** (ic) $Cu(ClO_3)_2.4H_2O$.

SOLUBILITY IN WATER.

(Meusser, 1902.)

t°.	Gms. $Cu(ClO_3)_2$ per 100 Gms. Solutions.	Mols. $Cu(ClO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Cu(ClO_3)_2$ per 100 Gms. Solutions.	Mols. $Cu(ClO_3)_2$ per 100 Mols. H_2O.	Solid Phase.
−12	30.53	3.43	Ice	18	62.17	12.84	$Cu(ClO_3)_2.4H_2O$
−31	54.59	9.39	$Cu(ClO_3)_2.4H_2O$	45	66.17	15.28	"
−21	57.12	10.41	"	59.6	69.42	17.73	"
+ 0.8	58.51	11.02	"	71	76.9	25.57	"

Density of solution saturated at 18° = 1.695.

COPPER PerCHLORATE $Cu(ClO_4)_2.6H_2O$

100 gms. sat. solution of copper perchlorate, $Cu(ClO_4)_2.6H_2O$, in water contain 54.3 gms. $Cu(ClO_4)_2$ at 0°. (Portillo and Alberola, 1930.)

EQUILIBRIUM IN THE SYSTEM COPPER PERCHLORATE, AMMONIUM PERCHLORATE AND WATER AT 30°.

(Craven and Bryce, 1934.)

ClO

Gms. per 100 gms. H_2O NH_4ClO_4	Gms. per 100 gms. H_2O $Cu(ClO_4)_2$	Solid Phase	Gms. per 100 gms. H_2O NH_4ClO_4	Gms. per 100 gms. H_2O $Cu(ClO_4)_2$	Solid Phase
0.0	141.6	$Cu(ClO_4)_2.6H_2O$	11.42	30.00	NH_4ClO_4
2.075	141.0	" - NH_4ClO_4	14.28	22.51	"
3.059	90.93	NH_4ClO_4	17.99	14.89	"
5.322	58.12	"	28.00	0.0	"
10.13	34.04	"			

100cc Furfural, C_4H_3OCHO, $d\frac{25}{4}$ = 1.1550 dissolve about 80 gms. $Cu(ClO_4)_2.6H_2O$ at about 20°.

100cc Furfural, C_4H_3OCHO, $d\frac{25}{4}$ = 1.1550 dissolve about 20+ gms. $Cu(ClO_4)_2.2H_2O$ at about 20°.

100cc Cellosolve (mono ethyl ether of ethylene glycol) dissolve about 100+ gms. $Cu(ClO_4)_2.6H_2O$ at about 20°. (Chaney and Mann, 1931.)

COPPER FLUORIDE (ic) $CuF_2.2H_2O$

100cc sat. sol. of Copper Fluoride in Water contain 0.075 gm. CuF_2 at 25°. (Carter, 1928.) F

SOLUBILITY OF COPPER FLUORIDE IN AQUEOUS SOLUTIONS OF HYDROFLUORIC ACID AT 20°.

(Furtenacker, Finger and Hey, 1933.)

Gms. per 100 gms. sat. sol. CuF_2	Gms. per 100 gms. sat. sol. HF	Solid Phase
7.4	6.6	$CuF_2.2H_2O$
9.6	14.0	"
12.1	21.2	"
7.4	34.5	"

EQUILIBRIUM IN THE SYSTEM CUPRIC FLUORIDE, AMMONIUM FLUORIDE AND WATER AT 20°.

(Kurtenacker, Finger and Hey, 1933.)

Gms. per 100 gms. sat. sol. CuF_2	Gms. per 100 gms. sat. sol. NH_4F	Solid Phase	Gms. per 100 gms. sat. sol. CuF_2	Gms. per 100 gms. sat. sol. NH_4F	Solid Phase
2.15	2.2	$CuF_2.2H_2O$	0.69	35.5	$CuF_2.2NH_4F.2H_2O$
0.44	19.2	"	0.53	41.9	" + NH_4F
0.36	22.1	$CuF_2.2NH_4F.2H_2O$	0.52	44.1	NH_4F
0.55	27.8	"			

EQUILIBRIUM IN THE SYSTEM CUPRIC FLUORIDE, POTASSIUM FLUORIDE AND WATER AT 20°.

(Kurtenacker, Finger and Hey, 1933.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
CuF_2	KF		CuF_2	KF	
1.5	1.2	Mixed crystals	—	22.9	Mixed crystals
0.16	11.2	"	—	23.4	"
—	12.5	"			

F **COPPER** Silico **FLUORIDE** $CuSiF_6.4H_2O$

100 gms. sat. solution of $CuSiF_6.4H_2O$ in Water contain 59.08 gms. $CuSiF_6$ at 25°. (Worthington and Haring, 1931.)

COPPER Antipyrine Boro **FLUORIDE** $[Cu(COC_{10}H_{12}N_2)_5](BF_4)_2$

100cc sat. solution of the Salt in Water contain 4.8 gm $[Cu(COC_{10}H_{12}N_2)_5](BF_4)_2$ at 20°. (Wilke-Dörfurt and Mureck, 1929.)

COPPER IODIDE (ous) Cu_2I_2.

SOLUBILITY OF CUPROUS IODIDE IN AQUEOUS SOLUTIONS OF AMMONIUM BROMIDE AND OF POTASSIUM BROMIDE.

(Kohn, 1909, Kohn, and Klein, 1912.)

I

Results for Aq. NH_4Br at 20°.		Results for Aq. KBr Solutions.					
Normality NH_4Br Sol.	Gms Cu_2I_2 per 1000 cc. Sat. Sol.	t°.	Normality of KBr Sol.	Gms Cu_2I_2 per 1000 cc. Sat. Sol.	t°.	Normality of KBr Sol.	Gms Cu_2I_2 per 1000 Gms. Sat. Sol
2	1.9068	19.5	2	1.467	23	3	3.595
3	3.6540	24	2	1.558	22	4	7.126
4	6.0588	19.5	3	3.409	22	4	6.977

SOLUBILITY OF CUPROUS IODIDE IN AQUEOUS SOLUTIONS OF IODINE AT 20° AND VICE VERSA. (Fedotieff, 1910–11.)

Gms per Liter		Solid Phase.	Gms per Liter		Solid Phase.		Gms per Liter		Solid Phase.
Cu	I.		Cu.	I			Cu	I	
0.285	0.5848	CuI	0.964	5.0854	CuI		0.748	4.7112	I
0.482	1.3053	"	1.032	5.6854	"		0.606	3.8562	"
0.583	1.9218	"	1.090	6.2816	"		0.448	2.9493	"
0.678	2.5573	"	1.112	6.5301	"		0.300	2.0689	"
0.756	3.2042	"	1.232	7.6529	" +I		0.159	1.2304	"
0.844	3.9539	"	1.040	6.4440	I	at 0° =	0.925	5.4609	CuI+I
0.898	4.4359	"	0.898	5.5941	"	at 40° =	1.658	11.3658	"

Constant agitation and temperature. Iodine determined by thiosulfate titration; copper, electrolytically.

Additional data for the solubility of cuprous iodide in aqueous solutions of iodine in presence of acids and salts at 25°, are given by Bray and MacKay (1910). These authors state that cuprous iodide is difficultly soluble in water, but in the presence of iodine a considerable amount dissolves, owing to the formation of cupric iodide and tri-iodide.

The Solubility Product of CuI in Water is 5.10^{-12}. (Ruff, 1929.)

100 gms. acetonitrile dissolve 3.52 gms. Cu_2I_2 at 18°. (Naumann and Schier, 1914.)

100cc Pyridine dissolve 1.74 gm. CuI at 25°. (Müller, R., 1924.)

Freezing-point lowering data for mixtures of CuI + AgI are given by Quercigh, 1914.

COPPER IODIDE (ic) CuI_2.

One liter sat. aqueous solution contains 11.07 gms. CuI_2 at 20°.
(Fedotieff, 1911–12.)

COPPER IODATE (ic) $Cu(IO_3)_2H_2O$.

One liter sat. aqueous solution contains 1.36 gms. $Cu(IO_3)_2$ at 25°, determined by measurement of single potential differences against a 0.1 *n* calomel electrode.
(Spencer, 1913.) IO

One liter sat. aqueous solution contains 0.003693 gm. mol. (= 1.527 gm.) $Cu(IO_3)_2$ at 25°, determined by titrametric analysis of the saturated solution (Peterson and Heyers, 1930.). These authors also determined the solubility of $Cu(IO_3)_2$ in aq. solutions of KCl, K_2SO_4, $MgCl_2$ and $MgSO_4$ but their tables do not show the concentrations of salts employed but only the resulting calculated activity coefficients.

COPPER AMMONIUM COMPOUNDS of the type $[Cu(NH_3)_6]X_2$.

[Solubility of Copper Ammoniates in Aqueous Alcohol at 16°.
(Ephraim and Mosimann, 1922.)

The solvent was in all cases a mixture of 66.6 vol. per cent of aqueous ammonia of $d_{16} = 0.912$ and 33.3 vol. per cent of 96 % alcohol. NH

Compound.		Formula.	Per liter of sat. sol. Gms. Cu.	Per liter of sat. sol. Gm. mols. salt.
Copper hexammine	Bromide....	$[Cu(NH_3)_6]Br_2$	5.686	0.0903
»	Chloride....	$[$ » $]Cl_2$	47.7	0.757
»	Iodide......	$[$ » $]I_2$	4.11	0.065
»	Nitrate.....	$[$ » $](NO_3)_2$	10.15	0.161
»	Sulfate.....	$[$ » $]SO_4$	0.0425	0.00063

Data for the solubility of the blue cupro-cupri-cyanide-ammonia salt, $[Cu_2(CN)_4(NH_3)_4]Cu$ and of the corresponding green salt, $[Cu_2(CN)_4(NH_3)_2]Cu$ in ammonia water of various concentrations, are given by Benrath and Schröder, 1924. It was desired to learn by solubility determinations whether the ammonia rich salt could be obtained from the ammonia poor salt by treatment of the latter with aqueous ammonia.

COPPER NITRATE (ic) $Cu(NO_3)_2.6H_2O$ NO

Solubility of Copper Nitrate in Water.

The results of Funk, 1900; Kazantzev, 1923, 1925; Massink, 1918; Wilcox and Bailey, 1927; and Bruylants and Mund, 1919, for the Eutectic, were plotted on cross section paper and the following average results read from the curve.

t°	Gms. $Cu(NO_3)_2$ per 100 gms. sat. solution	Solid Phase	t°	Gms. $Cu(NO_3)_2$ per 100 gms. sat. solution	Solid Phase
-10	29.0	Ice	25.4 (tr.pt.)	60.8	$Cu(NO_3)_2.6H_2O$+*
-20	34.0	"	30	61.0	$Cu(NO_3)_2.3H_2O$ *
-26.37 (Eutec)	39.0	"+$Cu(NO_3)_2.6H_2O$	40	62.0	"
-20	40.0	$Cu(NO_3)_2 6H_2O$	50	63.2	"
-10	42.5	"	60	64.5	"
0	45.5	"	70	66.0	"
+10	50.0	"	80	67.5	"
20	55.5	"	90	69.0	"
25	60.1	"	100	71.2	"

* Wilcox and Bailey give results showing this hydrated to be $Cu(NO_3)_2.2\frac{1}{2}H_2O$.

Density of solution saturated at 18° = 1.681.

100 gms. H_2O dissolve 127.4 gms. $Cu(NO_3)_2$ at 20°, d_{20} sat. sol. = 1.688. (Fedotieff, 1911-12.)

Data for the solubility of copper nitrate in aq. ammonia solutions are given by Stasevich, 1913.

Data for the solubility of copper nitrate in aq. solutions of copper sulfate and of sodium nitrate at 20° are given by Massink, 1916 and 1917.

100 cc. anhydrous hydrazine dissolve 1 gm. copper nitrate, with decomposition, at room temp. (Welsh and Broderson, 1915.)

SOLUBILITY OF COPPER NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID.

(Kazantzev, 1923, 1925.)

NO

Gms. HNO_3 per 100 gms. sat. sol.	Tr. t° of $.6H_2O \rightarrow .3H_2O$.	Gms. $Cu(NO_3)_2$ per 100 gms. sat. sol. at 0°.	10°.	15°.	25°.	50°.	75°.
0	25.4	46.3	50.3	52.4	60.3	63.5	67.3
5	23.2	41.3	45.4	48.2	55.3	59.0	63.0
10	21.0	36.5	40.7	44.3	50.5	54.6	58.9
15	18.8	31.9	36.6	40.8	45.7	50.1	54.7
20	16.6	27.6	32.6	37.7	41.0	45.7	50.4
30	12.2	19.7	26.5	30.5	31.9	36.9	41.8
40	7.8	14.3	21.0	21.5	23.0	28.2	33.6
50	–	11.4	12.2	13.6	15.0	19.8	25.3
60	–	–	–	7.2	8.5	12.0	17.5
70	–	–	–	2.6	3.6	5.9	11.2
80	–	0.3	–	1.2	1.3	3.2	11.7
95	–	0.9	–	1.3	1.7	–	–

The figures in the second column show the temperatures below which, in each case, the solid phase is $Cu(NO_3)_2.6H_2O$ and above which, it is $Cu(NO_3)_2.3H_2O$.

SOLUBILITY OF COPPER NITRATE IN AQUEOUS SOLUTIONS OF COPPER SULFATE AND VICE VERSA (Massink, 1918.)

At 20°.

Gms. per 100 gms. sat. sol. $CuSO_4$.	$Cu(NO_3)_2$.	Solid Phase.
0.0	54.94	$Cu(NO_3)_2.6H_2O$
1.2	55.28	»
1.08	55.08	» + $CuSO_4.5H_2O$
1.69	40.24	$CuSO_4.5H_2O$
2.42	34.24	»
7.77	11.51	»
17.52	0.0	»

At 35°.

Gms. per 100 gms. sat. sol. $CuSO_4$.	$Cu(NO_3)_2$.	Solid Phase.
0.0	60.92	$Cu(NO_3)_2.3H_2O$
1.27	60.53	» + $CuSO_4.5H_2O$
1.02	59.11	$CuSO_4.5H_2O$
0.70	54.67	»
0.86	51.90	»
1.62	43.10	»
11.04	11.37	»
21.00	0.0	»

SOLUBILITY OF COPPER NITRATE IN AQUEOUS SOLUTIONS OF SODIUM NITRATE AT 20° AND VICE VERSA. (Massink, 1918.)

Gms. per 100 gms. sat. sol. $NaNO_3$.	$Cu(NO_3)_2$.	Solid Phase.
0.0	55.94	$Cu(NO_3)_2.6H_2O$
2.07	55.76	»
4.29	54.34	»
5.27	53.30	» + $NaNO_3$
8.19	46.32	$NaNO_3$
19.89	29.25	»

Gms. per 100 gms. sat. sol. $NaNO_3$.	$Cu(NO_3)_2$.	Solid Phase.
43.50	3.38	$NaNO_3$
46.80	0.0	»
1.98	57.0	$Cu(NO_3)_2.3H_2O$*
3.59	57.0	» *
5.66	56.57	» + $NaNO_3$*

*Unstable.

SOLUBILITY OF AMMONIUM NITRATE IN AQUEOUS SOLUTIONS OF COPPER NITRATE AND VICE VERSA AT 30° AND AT 40°.

(Schreinemakers, Berkhoff and Posthumus, 1924.)

Results at 30°.			Results at 40°.		
Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
$Cu(NO_3)_2$.	NH_4NO_3.	Solid Phase.	$Cu(NO_3)_2$.	NH_4NO_3	Solid Phase.
0.0	71.18	NH_4NO_3	0.0	74.0	NH_4NO_3
9.80	59.95	»	8.2	65.2	»
26.37	44.82	»	14.17	58.4	»
33.96	39.95	»	36.8	43.6	»
38.07	38.35	»	42.0	43.9	» + D
43.01	38.24	»	43.9	41.7	D
43.90	40.60	» + D	48.0	36.7	»
45.04	39.21	D	47.9	36.7	» + $Cu(NO_3)_2.2\frac{1}{2}H_2O$
45.30	38.8	» + $Cu(NO_3)_2.2\frac{1}{2}H_2O$	48.1	36.4	$Cu(NO_3)_2.2\frac{1}{2}H_2O$
50.00	27.41	$Cu(NO_3)_2.2\frac{1}{2}H_2O$	50.7	24.1	»
55.80	12.75	»	56.9	11.9	»
61.00	0.0	»	62.6	0.0	»

D = $Cu(NO_3)_2.[NH_4NO_3]_2$. The authors criticise the results of Meyer, 1924, who did not analyze the solid phases and failed to detect the double salt D. They also think that $Cu(NO_3)_2.3H_2O$, reported by Meyer, does not exist.

COPPER OXIDE (ous) Cu_2O.

SOLUBILITY IN AQUEOUS AMMONIUM SOLUTIONS AT 25°. O

(Donnan and Thomas, 1911.)

The cuprous oxide was prepared by adding KOH solution to a mixture of equal weights of $CuSO_4.5H_2O$ and sucrose dissolved in water, until nearly all the precipitate had redissolved. The solution was kept at 70° until the cuprous oxide had separated. Two batches were prepared. The first, No. I, obtained from the more dilute solution, was bulky and dark red in color, Cu = 88.62%. The second, No. II, was bright red, Cu = 88.59%. The solubility determinations were made with extreme care. A special apparatus was used. By means of this, the constituents of the mixtures were introduced into the bottles in an atmosphere of hydrogen and every precaution taken to prevent oxidation. The bottles were sealed and rotated for 2-4 weeks at constant temperature. In case the slightest tinge of blue developed in a bottle (indicating oxidation), it was rejected.

Results for Preparation No. I.				Results for Preparation No. II.			
Gms. per 1000 Gms. Sol.		Mols. per 1000 Gms. Sol.		Gms. per 1000 Gms. Sol.		Mols. per 1000 Gms. Sol.	
Cu.	NH_3.	Cu.	NH_3.	Cu.	NH_3.	Cu.	NH_3.
0.3593	3.91	0.00566	0.23	0.4229	7.82	0.00665	0.46
0.6869	13.77	0.01080	0.81	0.6678	8.16	0.01050	0.48
1.0144	27.03	0.01597	1.59	0.9890	22.61	0.01555	1.33
1.0462	32.64	0.01645	1.92	1.0494	28.39	0.01650	1.67
1.3229	68.68	0.02081	4.04	1.3528	54.15	0.02127	3.19
1.4882	74.12	0.02340	4.36	1.5048	72.08	0.02366	4.24
1.6313	98.52	0.02565	5.56	1.5963	78.20	0.02510	4.60
1.6981	122.40	0.02670	7.20	1.6555	102.05	0.02603	6

COPPER OXIDE (ic) CuO.

SOLUBILITY IN AQUEOUS SOLUTIONS AT 25°.

(Jaeger, 1901.)

In Aq. Hydrofluoric Acid.		In Aq. HF + KF.		In Aq. HNO_3 and CH_3COOH.	
Normality of HF.	Gm. Atoms Cu per Liter.	Normality of HF.	Gm. Atoms Cu per Liter.	Solvent.	Gm. Atoms Cu per Liter.
0.12	0.0307	0.12	0.0356	1 *n* CH_3COOH	0.1677
0.28	0.1164	0.28	0.06437	1 *n* HNO_3	0.4802
0.57	0.2494	0.57	0.1442		
1.08	0.388	1.11	0.2451		
2.28	0.463	2.17	0.2517		

Cu determined electrolytically.

COPPER HYDROXIDE (ic) $Cu(OH)_2$.

OH

1000 cc. of H_2O saturated with copper (oxide) hydroxide contain :

6.1^{-5} Gm. mols $Cu(OH)_2$ at room temperature. (Jellinek and Gordon, 1924.)

6.9^{-5} Gm. mols $Cu(OH)_2$ at 18°. (Remy, 1925; Remy and Kuhlmann, 1924.)

The determinations were made in both cases by electrolytic methods.

3.0×10^{-5} gm. mol. $Cu(OH)_2$ at 25°, determined by electrometric titration with potassium ferrocyanide as precipitant. (McDowell and Johnston, 1936.)

THE SOLUBILITY OF CUPRIC HYDROXIDE IN CONCENTRATED SOLUTIONS OF SODIUM HYDROXIDE AND OF POTASSIUM HYDROXIDE. (Justin-Mueller, 1918.)

The determinations were made by adding 20 cc. of a 10 % solution of $CuSO_4.5H_2O$, corresponding to 0.78 gm. of $Cu(OH)_2$, to Na OH and K OH solutions of different concentrations, untill a point was reached at which the initial precipitate of cupric hydroxide redissolved completely. In this way it was found that 0.78 gm. $Cu(OH)_2$ dissolved completely in 100 cc. of aq. Na OH of $d = 1.345 - 1.370$, and in 100 cc. of aq. K OH of $d = 1.453 - 1.498$. At lower concentrations of the caustic, or with increased amounts of copper, solution was incomplete.

EQUILIBRIUM IN THE SYSTEM COPPER OXIDE, COPPER HYDROXIDE, CUPRIT AND CAUSTIC SODA. (E. Müller, 1920 and 1923.)

The author gives numerical data for the solubility of Cu O and of $Cu(OH)_2$ in caustic soda solutions of concentrations varying from 0 to 20 normal, at various temperatures and lengths of time of shaking. The rapidity with which equilibrium was reached varied with the concentration of the sodium hydroxide. A selection of the results representing final equilibrium is difficult and their value for practical purposes is uncertain. For this reason a choice of the author's determinations was not made for the present compilation. Among the conclusions drawn from the work, may be mentioned the following :

(1) Blue copper hydroxide dissolves in considerable amount in strong caustic soda solutions of less than 17 normal, and from such solutions a brownish black precipitate gradually separates. The undissolved material also gradually becomes brown. These dark colored compounds are probably solid solutions of Cu O and $Cu(OH)_2$ in which the relation of $Cu(OH)_2$ to water content has a general connection with the copper concentration of the supernatant solution. The dehydration of $Cu(OH)_2$ takes place gradually over a considerable series of these solid solutions but does not go to anhydrous Cu O.

(2) The solubility of Cu O and of $Cu(OH)_2$ increases at first with the strength of the caustic, but beyond a certain concentration it diminishes. The solubility of $Cu(OH)_2$ is considerably greater than that of Cu O, especially in dilute solutions. Both Cu O and $Cu(OH)_2$ are converted to cuprit, by treatment with strong caustic solutions.

(3) A copper (2) acid sodium can be crystallized from aqueous alkali solutions and it possesses a cobalt color and probably has the composition Na_2CuO_2.

(4) The opinion that copper hydroxide dissolves as a colloid is no longer justified.

A series of determinations by Melbye, 1922, made by the very gentle addition of a solution of copper sulfate to sodium hydroxide solutions untill turbidity appeared, gave results which showed that between 2.65 and 6.6 normal Na OH, the solubility of copper hydroxide increases at a linear rate (from 0.028 to 0.195 normal) with the concentration of the Na OH. These results did not agree with previous determinations by Fischer (Z. anorg. allgem. chem., **40**, 39, 1904) and by Muller (Z. anorg. allgem. chem., **54**, 417, 1907).

Data for the system Cu $(OH)_2$ + Ag NO_3 + H_2O at 20° are given by Malquori, 1925. The results show the range of Ag NO_3 concentration over which basic Cu $(OH)_2$ — Ag NO_3 salts exist.

SOLUBILITY OF CUPRIC OXIDE IN AQUEOUS SOLUTIONSOF POTASSIUM HYDROXIDE AT 25°.

(McDowell and Johnston, 1936.)

The present results at the lower concentrations of alkali supplement those of Müller, 1923. The cupric oxide was prepared by dropping 0.05 N solutions of $CuSO_4$ and KOH simultaneously into boiling conductivity water. The precipitation and subsequent washing was performed in an atmosphere of nitrogen. Equilibrium was approached from below and from above. The solutions were agitated at least 14 days and 7 days allowed for sedimentation. The clear supernatant solutions were filtered through a No. 1 sintered jena glass filter, discarding the first portions. The copper was determined by electrometric titration with potassium ferrocyanide as precipitant.

Molality of KOH	Gm. Mols. Cu x 10^{-5} per 1000 gms. H_2O	Molality of KOH	Gm. Mols. Cu x 10^{-5} per 1000 gms. H_2O	Molality of KOH	Gm. Mols. Cu x 10^{-5} per 1000 gms. H_2O
0.0417	0.070	0.2637	1.30	2.848	92.9
0.0586	0.154	0.3163	3.88	3.18	119.3
0.0741	0.192	0.544	5.13	4.151	147.0
0.0932	0.412	0.753	11.35	4.227	160.0
0.1150	0.316	1.000	16.1	5.065	175.0
0.1385	0.385	1.633	33.3	5.253	192.0
0.1772	0.526	1.963	68.3	0.05	297.0
0.2165	0.85	2.333	81.2	8.38	435.0

Three determinations in aqueous sodium hydroxide gave the following results:

Molality of NaOH	2.212	3.247	4.227
Gm. Mols. Cu x 10^{-5} per 1000 gms. H_2O	70.7	92.5	180.0

COPPER HYDROXIDE (ic) $Cu(OH)_2$.

SOLUBILITY IN AQUEOUS SOLUTIONS OF AMMONIA AT 18°. (Dawson, 1909.)

Mols. NH_3 per Liter.	Gm. Atoms Cu per Liter.	Mols. NH_3 per Liter.	Gm. Atoms Cu per Liter.
0.2	0.00054	3	0.0548
0.5	0.0033	4	0.0784
1	0.0109	5	0.1041
1.5	0.0204	6	0.1254
2	0.0314	8	0.1599
2.5	0.0442	9.96	0.1787

Three series of results at 25°, somewhat higher than the above, are given by Bonsdorff, 1904.

Data showing the effect of increasing amounts of $(NH_4)_2SO_4$, $Ba(OH)_2$, NaOH and of Na_2SO_4 upon the solubility of cupric hydroxide in aqueous ammonia solution at 18°, are given by Dawson, 1909 a.

COPPER SULFIDE (ous) Cu_2S

SOLUBILITY OF CUPROUS SULFIDE IN WATER.

Calculating from the results of Jellinek and Czerwinski, 1922, Ravitz, 1936, found the Solubility of Cuprous Sulfide, Cu_2S, in Water to be 4.24×10^{-15} gm. mols. per liter at 10° and 1.19×10^{-14} gm. mols. per liter at 25°. The Solubility Product is 1.0×10^{-51} at 10° and 3.6×10^{-50} at 25°.

Fusion-point data are given for mixtures of:

Cu_2S + Ag_2S (Friederich, 1907-08.)
" + FeS (Shad and Bornemann, 1916; Carpenter and Haywood, 1923.)
" + PbS (Friederich, 1907-08; Schwarz and Romero, 1927.)
" + Sb_2S (Chikashigi and Yamanchi, 1916.)
" + ZnS (Friederich, 1907-08.)

S **COPPER SULFIDE** (ic) CuS

SOLUBILITY OF CUPRIC SULFIDE IN WATER.

Critical reviews of the published determinations of the solubilities of the metal sulfides in water are given by Kolthoff, 1931, and Ravitz, 1936. Kolthoff calls attention to the incorrectness of Weigel's, 1906, figures. The preferred value for cupric sulfide, calculated by Ravitz with the aid of recent activity data, is 2.55×10^{-16} gm. mols. per liter at 25°. The Solubility Product is 3.48×10^{-38} at 25°.

The Solubility Product of Cuprous Sulfide (Coveline) in Water is 8.5×10^{-45}. (Ruff, 1929.)

100 cc. sat aq. sodium sulfide solution (of *d.* = 1.225) dissolve 0.0032 gm. CuS. (Holland, 1897.)

SOLUBILITY OF COPPER SULFIDE IN AQUEOUS SUGAR SOLUTIONS.

(Stolle, 1900.)

% Sugar in Solvent.	Gms. CuS per Liter of Aq. Sugar Solution at:		
	17.5°.	45°.	75°.
10	0.5672	0.3659	1 1345
30	0.8632	0.7220	1.2033
50	0.9076	1.0589	1.2809

SO **COPPER SULFITE** $CuSO_3.2H_2O$

The equilibrium diagram for the system CuO + So + H_2O at 15 and at 25°, determined by the synthetic method, is given by Terres and Rühl, 1934, but the numerical results are communicated only in the detailed report published as Beihefte zu den Zeitschriften des Vereins deutscher Chemiker No. 8 1934, Verlag Chemie, Berlin W. 35 Cornelius str, 3.

COPPER Fluoro **SULFONATES**

SOLUBILITY OF EACH IN WATER.

(Lange, 1927.)

Compound	Formula	t°	Gms. Compound per 100 cc. sat. sol.
Copper Tetra Ammine Fluoro Sulfonate	$Cu(SO_3F)_2 4NH_3$	12	52.9
" " Pyridine " "	$Cu(SO_3F)_2 4Py$	12.5	2.747

COPPER SULFATE $CuSO_4.5H_2O$.

SOLUBILITY IN WATER.

(Etard, 1894; Patrick and Aubert, 1874; at 15°, Cohen, 1903; at 25°, Trevor, 1891.)

t°.	Gms. $CuSO_4$ per 100 Gms. Solution.	Gms. $CuSO_4$ per 100 Gms. Water.	t°.	Gms. $CuSO_4$ per 100 Gms. Solution.	Gms. $CuSO_4$ per 100 Gms. Water.
0	12.5	14.3	60	28.5	40
10	14.8	17.4	80	35.5	55
20	17.2	20.7	100	43	75.4
25	18.5	22.7	120	44	78.6
30	20	25	140	44.5	80.2
40	22.5	28.5	160	44	78.6
50	25	33.3	180	43	75.4

Sp. gr. of sat. solution of $CuSO_4.5H_2O$ in H_2O at 16° = 1.193. (Greenish, 1902.)
100 gms. sat. solution in H_2O contain 20.32 gms. $CuSO_4$ at 30°. (Schreinemakers, 1910.)

More recent determinations of the Solubility of Copper Sulfate in Water are as follows: SO-

t^0	d. of sat. sol.	Gms. $CuSO_4$ per 100 gms. sat. sol.	Solid Phase
0	—	12.87(1), 12.93(2)	$CuSO_4.5H_2O$
12	—	16.19(3)	"
15	1.1839	16.12(4)	"
20	1.1905	17.30(4), 17.52(5)	"
25	1.2111	18.49(4), 18.45(2), 18.47(3), 18.56(2)	"
37.5	—	21.88(2)	"
55.	—	26.90(6)	"

(1) Crockford and Brawley, 1932, (2) Caven and Johnston, 1927, (3) Foote, 1919, (4) Flottmann, 1928, (5) Massink, 1917-18, (6) Crockford and Webster, 1930.

SOLUBILITY OF COPPER SULFATE IN WATER. (Agdo and Barkholt, 1926.)

t°.	d_4 of sat. sol.	Gms. $CuSO_4.5H_2O$ per 100 gms. sat. sol.	t°.	d_4 of sat. sol.	Gms. $CuSO_4.5H_2O$ per 100 gms. sat. sol.
— 1.4	1.146	19.85	60.0	1.343	44.36
+ 0.5	1.149	20.15	70.0	1.398	50.13
10.0	1.176	23.40	80.0	1.433	54.52
20.0	1.198	26.60	93.0	1.504	61.30
30.0	1.232	30.55	96.0	1.521	63.25
40.0	1.262	34.78	100.0	1.550	65.92
50.0	1.299	39.38			

The freezing-point of a 0.1 normal aqueous $CuSO_4$ solution is —0.209°; that of a 0.25 normal solution is —0°.469 and of a 0.5 normal solution it is —0°.859. (Klein and Svanberg, 1920-1921.)

SOLUBILITY OF CUPRIC SULFATE IN ORDINARY WATER AND IN DEUTERIUM (98.1%D_2O) WATER.

(Miles and Menzies, 1937.)

t°	Gm. Mols. $CuSO_4$ (159.61) per 1000 gms. (55.51 mols.) Water In H_2O	In D_2O	Solid Phase
-1.5 (Eutec)	0.85	—	Ice + $CuSO_4$.5 aq.
0	0.88	—	$CuSO_4$.5 aq.
2.7 (Eutec)	—	0.79	Ice + $CuSO_4$.5 aq.
5	0.96	0.83	$CuSO_4$.5 aq.
10	1.06	0.93	"
15	1.17	1.05	"
20	1.27	1.16	"
25	1.39	1.29	"
30	1.51	1.42	"
35	1.65	1.56	"
40	1.80	1.71	"
45	1.95	1.86	"
50	2.12	2.04	"
55	2.30	2.22	"
60	2.49	2.42	"
65	2.71	2.64	"
70	2.95	2.88	"
75	3.21	3.14	"
80	3.51	3.44	"
85	3.84	3.77	"
90	4.23	4.16	"
95	4.70	4.62	"
95.9 (tr.pt.)	4.80	—	$CuSO_4$.5 aq + $CuSO_4$.3 aq.
96.2 (tr.pt.)	—	4.75	"
100	4.82	4.77	$CuSO_4$.3 aq.
105	4.85	4.80	"
110	4.88	4.83	"

SOLUBILITY OF COPPER SULFATE IN AQUEOUS SOLUTIONS OF COPPER CHLORIDE AT 30°.

(Schreinemakers, 1910.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms per 100 Gms.* Sat. Sol.		Solid Phase.
$CuCl_2$.	$CuSO_4$.		$CuCl_2$	$CuSO_4$	
0	20.32	$CuSO_4.5H_2O$	39.48	3.21	$CuSO_4.5H_2O$
6.58	13.62	"	42.62	2.90	"+$CuCl_2.2H_2O$
15.68	8.93	"	43.25	1.14	$CuCl_2.2H_2O$
25.67	4.77	"	43.95	0	"

DATA FOR EQUILIBRIUM IN COMPLEX SYSTEMS CONTAINING COPPER SULFATE.

System.	Authority.
$CuSO_4 + CuCl_2 + (NH_4)_2SO_4 + NH_4Cl + H_2O$	(Schreinemakers, 1910.)
" + " + $K_2SO_4 + KCl + H_2O$	(Schreinemakers and de Baat, 1914 a.)
" + " + $Na_2SO_4 + NaCl + H_2O$	(Schreinemakers, 1911.)
" + $Li_2SO_4 + (NH_4)_2SO_4 + H_2O$	(Schreinemakers, 1909.)

SOLUBILITY OF COPPER SULFATE IN AQUEOUS SOLUTIONS OF FERROUS SULFATE AND VICE VERSA. (Agde and Barkholt, 1926.)

Results at 25°.			Results at 56°.			
d of sat. sol.	Gms. per 100 gms. sat. sol.		d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase at both temperatures.
	$CuSO_4.5H_2O$.	$FeSO_4.7H_2O$.		$CuSO_4.5H_2O$.	$FeSO_4.7H_2O$.	
1.256	28.64	5.03	1.357	41.92	4.50	$CuSO_4.5H_2O$
1.275	28.87	7.08	1.383	41.61	6.28	"
1.320	28.26	12.46	1.408	41.10	10.12	"
1.320	27.44	15.09	1.469	41.24	17.90	"
1.343	27.62	17.65	1.537	39.31	26.55	"
1.314	23.23	18.68	1.512	31.15	34.07	$FeSO_4.7H_2O$
1.308	22.09	20.28	1.505	27.62	37.92	"
1.308	19.78	23.05	1.482	21.25	43.49	"
1.305	19.84	22.29	1.472	19.52	45.00	"
1.300	14.96	27.56	1.477	19.81	45.04	"
–	14.64	28.40	1.470	15.01	50.31	"
1.291	12.18	29.84	1.460	11.95	52.95	"
1.289	10.76	31.39	1.450	10.73	54.65	"
1.275	5.52	36.29	1.457	5.35	60.21	"
1.266	3.88	37.45	1.437	3.80	60.48	"

Similar determinations are also given at 10°, 15°, 20°, 30°, 35° and 40°. Saturation was, in general, approached from above. The mixtures were stirred constantly and protected from the air by means of a mercury seal.

SO

The following additional determinations for this ststem at 30° are given by Cameron and Crockford, 1929.

Gms. per 100 gms. H_2O		Solid Phase	Gms. per 100 gms. H_2O		Solid Phase
$CuSO_4$	$FeSO_4$		$CuSO_4$	$FeSO_4$	
23.53	3.13	$CuSO_4.5H_2O$	20.67	11.82	$CuSO_4.5H_2O$
21.98	3.29	"	20.54	17.16	" + Solid Solution
21.56	6.86	"	18.95	19.61	Solid Solution
22.49	11.51	"	16.02	22.75	" "

EQUILIBRIUM IN THE SYSTEM CUPRIC OXIDE, FERRIC OXIDE, SULFUR TRIOXIDE AND WATER AT 50°.

(Tunell and Posnjak, 1931.)

The purpose of this study was to gain some knowledge of the changes which occur during the natural oxidation of the iron and copper sulfide ore bodies in altered porphry. Mixtures of known composition were sealed in glass tubes and there kept at 50° and shaken daily for from one to three years. The mixtures contained in all cases 93.5 percent or more of water and 6.5 percent or less of each of the other constituents. The five crystalline solid phases which were formed, namely, $Fe_2O_3.H_2O$ (Goethite), $3Fe_2O_3.4SO_3.9H_2O$, CuO (Tenorite), $4CuOSO_3.3H_2O$ (Brochantite), and $3CuOSO_3.2H_2O$ (Antherite) were identified analytically and by optical properties and X-ray diffraction patterns. No double salt was formed in this limited portion of the system.

EQUILIBRIUM IN THE SYSTEM COPPER SULFATE, FERROUS SULFATE, SULFURIC ACID AND WATER AT 30°.

(Cameron and Crockford, 1929.)

The mixtures were prepared by adding in some cases an excess of ferrous sulfate to aqueous solutions of cupric sulfate and in others an excess of cupric sulfate to aqueous solutions of ferrous sulfate. An equal excess of sulfuric acid was added to each of these and the mixtures so prepared were kept in a thermostat at 30° and frequently shaken during about three weeks. The analyses of the solutions and solid phases gave very irregular results indicating that equilibrium had not been reached. The solid phase contained both $CuSO_4$ and $FeSO_4$ in all cases with variable amounts of H_2SO_4 and H_2O. If the authors' results are arranged in the order of increasing percentage of H_2SO_4 in solution it will be noted that the sum of the $CuSO_4$ + $FeSO_4$ diminishes with increasing concentration of H_2SO_4.

SO

Gms. per 100 gms. sat. sol.			
H_2SO_4	$CuSO_4$	$FeSO_4$	$CuSO_4 + FeSO_4$
0.0	20.54	17.16	37.70
4.51	16.21	7.17	23.38
4.50	13.22	12.09	25.31
4.58	13.99	11.32	24.31
4.69	13.82	11.24	25.06
5.06	13.38	11.62	24.00
5.50	11.09	13.55	24.64
5.38	13.67	11.09	24.76
5.49	13.89	10.85	24.74
5.71	16.05	2.09	18.14
6.16	15.40	3.58	18.98
6.21	18.36	3.63	21.99
7.62	13.93	5.39	19.32
9.46	9.17	9.68	18.85
11.13	3.44	11.33	14.77
11.35	5.86	10.40	16.26
12.49	1.91	12.41	13.32

EQUILIBRIUM IN THE SYSTEM CUPRIC OXIDE, SULFUR TRIOXIDE AND WATER AT 22°.

(Binder, 1936.)

Gm. Mols. per 100 gm. Mols. $CuO + SO_3 + H_2O$		Solid Phase
CuO	SO_3	
0.52	0.50	$4CuO.SO_3.4H_2O$
1.24	1.22	"
1.55	1.52	"
1.08	1.80	"
3.69	3.78	"
5.05	5.15	"
7.04	7.19	"
8.12	8.20	"
8.77	8.92	" + $CuO.SO_3.5H_2O$
7.59	10.95	$CuO.SO_3.5H_2O$
7.87	11.32	"
7.26	12.03	"
6.53	13.21	"
5.72	15.23	"
4.92	17.54	$CuO.SO_3.5H_2O$
4.08	20.09	"
3.07	24.26	"
2.09	27.54	"
1.26	34.30	"
1.23	40.25	"
1.12	44.08	$CuO.SO_3.3H_2O$
0.82	45.16	"
0.73	48.31	"
0.08	54.22	"
0.07	63.24	"
0.09	72.00	" + $CuO.SO_3$
0.12	72.52	$CuO.SO_3$
0.19	76.52	"

The author also made determinations at 100° which agree in general with those of Posnjak and Tunell, 1929, at that temp.

EQUILIBRIUM IN THE SYSTEM COPPER OXIDE, SULFUR TRIOXIDE AND WATER AT 25°. (Britton, 1925.)

Quantities of amorphous basic sulfate of copper were suspended in aqueous solutions containing different amounts of copper sulfate and sulfuric acid. The mixtures were kept in a thermostat and shaken daily for about a week and the solutions and air dried solid phases were analyzed. After an additional period of 2 to 3 months they were again analyzed. Less than a week was sufficient for equilibrium. In the most basic part of the isotherm it was necessary to use hydrated copper oxide. The terms in which the results are expressed are not clearly defined.

Liquid Phase.		Solid Phase.	Liquid Phase.		Solid Phase.
% CuO.	% SO_3.		% CuO.	% SO_3.	
0.0	0.0	$4CuO.SO_3.4H_2O$+CuO (hydrated)	3.17	3.19	$4CuO.SO_3.4H_2O$
0.02	0.02	$4CuO.SO_3.4H_2O$	5.54	5.56	»
0.09	0.09	»	7.17	7.18	»
0.12	0.12	»	9.28	9.33 (Eutec.)	» + $CuSO_4.5H_2O$
0.58	0.58	»			

EQUILIBRIUM IN THE SYSTEM COPPER OXIDE, SULFUR TRIOXIDE AND WATER AT 50°, 100° AND 200°.

(Posnjak and Tunell, 1929; Tunell & Posnjak, 1931.)

SO

Results at 50°			Results at 100°			Results at 200°		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
CuO	SO_3		CuO	SO_3		CuO	SO_3	
0.00	0.002	CuO + 4.1.3	0.001	0.002	CuO + 4.1.3	0.02	0.05	3.1.2
0.05	0.05	4.1.3	0.008	0.009	3.1.2 + "	0.17	0.30	"
0.13	0.13	"	0.02	0.02	" "	2.37	2.96	"
1.65	1.68	"	0.38	0.40	3.1.2	4.57	5.58	"
3.54	3.58	" + 3.1.2	1.16	1.24	"	8.58	10.08	"
7.53	7.57	3.1.2	3.69	3.87	"	11.93	13.03	"
8.98	9.06	"	4.56	4.72	"	17.16	18.94	"
10.98	11.08	"	5.61	5.81	"	18.46	19.83	" + 1.1.1
12.44	12.52	" + 1.1.5	8.62	8.69	"	18.72	21.65	1.1.1
9.34	16.12	1.1.5	14.57	14.82	"	14.36	30.99	"
4.74	29.28	"	21.07	21.44	" + 3.2.5	13.36	33.36	"
3.83	34.46	"	21.14	21.52	3.2.5	8.21	43.62	"
3.6	37.5	" + 1.1.3	21.37	21.74	" + 1.1.3	6.35	45.81	"
3.28	38.5	1.1.3	17.92	22.73	1.1.3	2.14	65.48	"
2.1	40.0	" + 1.1.1	15.89	25.44	"	2.0	67	" + 1.1
2.35	43.04	1.1.1	12.60	31.40	" + 1.1.1	1.0	70	1.1
1.54	45.40	"	10.49	33.67	1.1.1			
1.09	47.43	"	2.92	45.04	"			
0.23	56.81	"	1.64	49.20	"			
0.16	71.42	"	0.84	53.60	"			
0.17	72.40	" + 1.1	0.2	70.6	" + 1.1			

4.1.3 = $4CuO.SO_3.3H_2O$; 3.1.2 = $3CuO.SO_3.2H_2O$; 1.1.5 = $CuO.SO_3.5H_2O$; 1.1.3 = $CuO.SO_3.3H_2O$; 1.1.1 = $CuO.SO_3.H_2O$; 1.1 = $CuO.SO_3$; 3.2.5 = $3CuO.2SO_3.5H_2O$

COPPER SULFATE

EQUILIBRIUM IN THE SYSTEM COPPER SULFATE, SULFURIC ACID AND WATER AT VARIOUS TEMPERATURES.

(Agde and Barkholt, 1927.)

Results at 0.5°

d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	H_2SO_4	$CuSO_4.5H_2O$	
1.161	8.58	14.91	$CuSO_4.5H_2O$
1.184	13.98	11.92	"
1.228	24.70	6.25	"
1.245	28.80	4.42	"
1.360	44.90	0.76	"
1.379	47.00	1.17	"
1.405	49.74	0.82	"
1.441	52.76	0.80	$CuSO_4.3H_2O$

Results at 10°

d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	H_2SO_4	$CuSO_4.5H_2O$	
1.184	8.40	16.95	$CuSO_4.5H_2O$
1.195	13.50	14.00	"
1.204	15.23	12.75	"
1.220	21.00	9.00	"
1.250	28.30	5.77	"
1.273	32.04	4.10	"
1.365	44.60	1.73	"
1.381	46.50	1.53	"
1.409	49.47	1.45	"
1.442	52.48	1.35	$CuSO_4.3H_2O$

Results at 20°

d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	H_2SO_4	$CuSO_4.5H_2O$	
1.210	12.56	17.30	$CuSO_4.5H_2O$
1.244	20.92	10.54	"
1.254	27.44	7.10	"
1.274	31.40	5.52	"
1.366	43.90	3.05	"
1.384	46.00	3.00	"
1.409	48.62	2.73	"
1.442	51.64	2.76	$CuSO_4.3H_2O$

Results at 40°

d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	H_2SO_4	$CuSO_4.5H_2O$	
1.252	7.40	28.00	$CuSO_4.5H_2O$
1.261	11.03	25.25	"
1.261	13.25	23.40	"
1.276	23.16	15.75	"
1.283	24.92	15.32	"
—	29.14	12.42	"
1.368	41.00	8.30	"
1.388	42.80	8.56	"
1.390	43.22	8.63	"
1.445	49.24	7.84	$CuSO_4.3H_2O$

Results at 60°

d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	H_2SO_4	$CuSO_4.5H_2O$	
1.318	6.25	38.76	$CuSO_4.5H_2O$
1.333	9.80	35.75	"
1.327	11.50	33.48	"
1.341	19.55	27.76	"
1.342(?)	21.46	26.52	"
1.365	25.02	24.63	"
1.398	35.05	18.40	"
1.417	38.90	16.53	"+$CuSO_4.3H_2O$
1.418	39.20	16.60	$CuSO_4.5H_2O$

Results at 80°

d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	H_2SO_4	$CuSO_4.5H_2O$	
1.414	4.40	50.15	$CuSO_4.5H_2O$
1.417	7.80	47.55	"
1.408	9.15	45.80	"
1.413	15.14	40.80	"
1.414	18.00	38.00	"
1.450	31.15	28.30	$CuSO_4.3H_2O$
1.455	35.25	25.35	"
1.463	36.10	24.80	"

Similar results are also given for 30°, 50° and 70°.

The accuracy of the above values which were determined by the cooling curve method is questioned by Crockford and Warrick, 1930.

SOLUBILITY OF COPPER SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 0°. (Engel, 1887.)

Milligram Equiv. per 10 Gms. H_2O.		Sp. Gr. of Solutions.	Grams per 100 Grams H_2O.	
H_2SO_4.	$CuSO_4$.		H_2SO_4.	$CuSO_4$.
0	18.6	1.144	0	14.85
4.14	17.9	1.143	2.03	14.29
14.6	15.6	1.158	7.16	12.45
31	12.4	1.170	15.20	9.90
54.2	8.06	1.195	26.57	6.43
56.25	7.75	1.211	27.57	6.19
71.8	5	1.224	35.2	3.99

SOLUBILITY OF COPPER SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°.

(Goodwin and Horsch, 1919.)

$d_{\frac{25}{4}}$ of sat. sol.	Gram. Equivalents per liter.	
	$CuSO_4$.	H_2SO_4.
1.2140.....	2.818	0.0000
1.2105.....	2.784	0.1488
1.2070.....	2.634	0.4208
1.2115.....	2.457	0.8680
1.2130.....	2.320	1.3450
1.2165.....	2.181	1.876
1.2162.....	2.153	1.914
1.2229.....	1.837	3.077
1.2267.....	1.649	3.659

SOLUBILITY OF COPPER SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID.

(Foote, 1919.)

SO

Results at 12°.

Gms. per 100 gms. sat. sol.		Solid Phase.
$CuSO_4$.	H_2SO_4.	
16.15	0.0	$CuSO_4.5H_2O$
1.67	51.5	» $+CuSO_4.3H_2O$
0.81	61.54	$CuSO_4.H_2O$ + »

Results at 25°.

Gms. per 100 gms. sat. sol.		Solid Phase.
$CuSO_4$.	H_2SO_4.	
18.44	0.0	$CuSO_4.5H_2O$
2.83	49.20	» $+CuSO_4.3H_2O$
2.13	55.72	$CuSO_4.H_2O$ + »

100 gms. aqueous solution saturated simultaneously with $CuSO_4.5H_2O$ and $Na_2SO_4.10H_2O$ at 12° contain 14.60 gms $CuSO_4$ + 10.43 gms. Na_2SO_4.

Data for the system $CuSO_4 + Na_2SO_4 + H_2SO_4 + H_2O$ at 12° and at 25° are also given.

SOLUBILITY OF COPPER SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°. (Bell and Taber, 1908; Foote, 1915.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.
H_2SO_4.	$CuSO_4$.	
0	18.47	$CuSO_4.5H_2O$
11.14	12.62	"
25.53	5.92	"
36.77	3.25	"
42.15	2.63	"
47.66	2.59	"
49	2.83	" $+CuSO_4.3H_2O$
50.23	2.70	$CuSO_4.3H_2O$
54.78	2.19	"
55.72	2.13	$CuSO_4.3H_2O+CuSO.H_2O$
61.79	0.95	$CuSO_4.H_2O$
77.93	0.17	"
83.29	0.15	"
85.46	0.19	"
85.76	0.43	" $+CuSO_4$
86.04	0.40	$CuSO_4$
92.70	0.19	"

The following additional values for this system at 30° are given by Cameron and Crockford, 1929.

Gms. per 100 gms. H_2O	
H_2SO_4	$CuSO_4$
7.38	20.14
17.13	18.62
20.65	16.22
27.76	14.08
49.61	7.82

SOLUBILITY OF COPPER SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT VARIOUS TEMPERATURES.

(Crockford and Warrick, 1930.)

SO

Results at 0°

Gms. per 100 gms. sat. sol.		Solid Phase
CuO	SO_3	
7.34	7.40	Cu5
3.14	14.55	"
1.50	21.23	"
1.18	23.52	"
0.15	34.60	"
0.30	41.07	"
0.59	43.39	" + Cu3
0.47	47.44	Cu3
0.09	48.54	Cu1
0.05	65.52	"
0.09	71.93	"
0.02	73.58	" + Cu

Results at 20°

Gms. per 100 gms. sat. sol.		Solid Phase
CuO	SO_3	
8.43	8.89	Cu5
7.06	12.24	"
4.51	18.49	"
3.97	21.03	"
1.68	29.32	"
1.25	35.84	"
1.04	43.11	" + Cu3
0.23	45.32	Cu3
0.71	48.44	" + Cu1
0.18	53.42	Cu1
0.05	60.17	"
0.09	72.19	" + Cu

Results at 40°

Gms. per 100 gms. sat. sol.		Solid Phase
CuO	SO_3	
10.21	10.34	Cu5
8.63	13.37	"
6.91	17.09	"
4.03	26.05	"
2.75	31.95	"
2.19	38.78	Cu3
1.98	42.35	"
1.56	47.09	"
0.87	48.64	Cu1
0.10	59.64	"
0.18	68.88	"
0.33	70.25	" + Cu

Results at 55°

Gms. per 100 gms. sat. sol.		Solid Phase
CuO	SO_3	
13.16	13.41	Cu5
9.88	17.82	"
6.07	24.45	"
5.75	29.82	"
5.05	34.42	" + Cu3
3.45	40.62	Cu3
2.98	42.69	"
1.85	45.04	Cu1
0.55	52.39	"
0.08	64.16	"
0.22	71.89	" + Cu
0.08	72.62	Cu

Cu5 = $CuSO_4.5H_2O$; Cu3 = $CuSO_4.3H_2O$; Cu1 = $CuSO_4.H_2O$; Cu = $CuSO_4$

A discussion of some of the above results is given by Tunell and Posnjak, 1931, in which doubt is expressed as to the attainment of equilibrium for certain of the triple points. The designation of the system as $CuSO_4 + H_2SO_4 + H_2O$ instead of $CuO + SO_3 + H_2O$ is also criticised.

SOLUBILITY OF COPPER SULFATE IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE AND VICE VERSA. (Caven and Mitchell, 1924.)

The mixtures were kept in a thermostat and shaken intermittently. The solutions were analyzed repeatedly untill concordant results were obtained.

Results at 25°.

Mols. per 100 gms. H_2O.			Mols. per 100 gms. H_2O.		
$CuSO_4$.	K_2SO_4.	Solid Phase.	$CuSO_4$.	K_2SO_4.	Solid Phase.
0.1410	0.00	$CuSO_4.5H_2O$	0.0955	0.0270	1.1.6
0.1415	0.0014	"	0.0365	0.0331	"
0.1430	0.0037	"	0.0350	0.0350	"
0.1457	0.0086	"	0.0237	0.0412	"
0.1477	0.0110	"	0.0120	0.0598	"
0.1504	0.0150	"	0.0092	0.0737	"+K_2SO_4
0.1570	0.0225	"+1.1.6	0.0060	0.0708	K_2SO_4
0.1525	0.0228	1.1.6	0.0000	0.0661	"
0.1145	0.0261	"			

Results at 51°.			Results at 61°.		
Mols. per 100 gms. H_2O.			Mols. per 100 gms. H_2O.		
$CuSO_4$.	K_2SO_4.	Solid Phase.	$CuSO_4$.	K_2SO_4.	Solid Phase.
0.2073	0.00	$CuSO_4.5H_2O$	0.2419	0.00	$CuSO_4.5H_2O$
0.2266	0.0618	"+1.1.6	0.2586	0.0838	"+1.1.6
0.0677	0.0706	1.1.6	0.0728	0.0932	1.1.6
0.0312	0.1036	"+K_2SO_4	0.0422	0.1187	"+K_2SO_4
0.0000	0.0923	K_2SO_4	0.000	0.1064	K_2SO_4

1.1.6 = $CuSO_4.K_2SO_4.6H_2O$.

COPPER Potassium SULFATE $CuSO_4.K_2SO_4.6H_2O$

SO

SOLUBILITY OF COPPER POTASSIUM SULFATE IN WATER.

(Lattey, 1928.)

t°	Gms. $CuSO_4.K_2SO_4$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $CuSO_4.K_2SO_4$ per 100 gms. sat. sol.	Solid Phase
0	4.84	$CuSO_4.K_2SO_4.6H_2O$	25	10.47	$CuSO_4.K_2SO_4.6H_2O$
10	6.71	"	30	11.97	"
15	7.84	"	40	15.37	"
20	9.09				

100 gms. H_2O dissolve 11.14 gms. $CuSO_4.K_2SO_4$ at 25°. (Trevor, 1891.)

" " " " 11.69 " " " " " (Locke, 1902.)

SOLUBILITY OF MIXED CRYSTALS OF POTASSIUM COPPER SULFATE AND AMMONIUM COPPER SULFATE IN WATER.

$CuSO_4.K_2SO_4.6H_2O$ and $CuSO_4(NH_4)_2SO_4.6H_2O$ at 13°-14°. (Fock, 1897.)

Mols. per 100 Mols. H_2O.		Mol. per cent K Salt.		Mols. per 100 Mols. H_2O.		Mol. per cent K Salt.	
K. Salt.	NH_4 Salt.	in Solution.	in Solid.	K Salt.	NH_4 Salt.	in Solution.	in Solid.
0	1.035	0	0	0.2946	0.5096	36.63	58.20
0.0897	0.8618	5.06	10.34	0.3339	0.3319	50.15	75.34
0.2269	0.6490	16.76	33.05	0.4560	0.1961	69.93	83.86
0.2570	0.5887	30.40	46.22	0.4374	0	100	100

Additional data for the system Copper sulfate + Potassium sulfate + H_2O are given by Meerburg, 1909.

Data for the solubility in water of mix-crystals of copper sulfate and manganese sulfate at 0° and 17°, and of copper sulfate and zinc sulfate at 12°, 18°, 25°, 35°, 40° and 45°, are given by Hollemann, 1905-06.

SOLUBILITY OF MIXED CRYSTALS OF COPPER POTASSIUM SULFATE AND COBALT POTASSIUM SULFATE IN WATER.

(Ploin, 1926.)

Results at 0°.

d of sat. sol.	Gms. per 1000 cc. sat. sol. $CuSO_4.K_2SO_4.6H_2O$.	Gms. per 1000 cc. sat. sol. $CoSO_4.K_2SO_4.6H_2O$.	Wt. per cent $CuSO_4.K_2SO_4.6H_2O$ in Solid Phase.
1.0462	67.67	0.00	100.00
1.0488	58.33	13.46	89.04
1.0524	53.71	22.09	81.60
1.0538	46.32	33.30	69.67
1.0566	39.48	44.15	58.74
1.0601	31.19	56.68	49.46
1.0612	25.43	65.31	40.85
1.0673	11.40	87.06	21.41
1.0719	0.00	106.81	0.00

Results at 7°.8.

d of sat. sol.	Gms. per 1000 cc. sat. sol. $CuSO_4.K_2SO_4.6H_2O$.	Gms. per 1000 cc. sat. sol. $CoSO_4.K_2SO_4.6H_2O$.	Wt. per cent $CuSO_4.K_2SO_4.6H_2O$ in Solid Phase.
1.0587	85.99	0.00	100.00
1.0617	74.48	17.21	87.78
1.0639	66.14	29.49	79.89
1.0668	56.02	44.02	70.84
1.0703	46.92	58.54	59.53
1.0730	37.08	73.90	47.13
1.0760	32.18	82.36	41.27
1.0796	25.30	94.53	29.75
1.0825	14.59	110.20	20.40
1.0852	5.90	124.47	9.56
1.0879	0.00	133.80	0.00

SOLUBILITY OF MIXED CRYSTALS OF COPPER POTASSIUM SULFATE AND NICKEL POTASSIUM SULFATE.

(Halpern. 1926.)

SO

Results at 0°.

d of sat. sol.	Gms. per 1000 cc. sat. sol. $CuSO_4.K_2SO_4.6H_2O$	Gms. per 1000 cc. sat. sol. $NiSO_4.K_2SO_4.6H_2O$.	Wt. per cent $CuSO_4.K_2SO_4.6H_2O$ in Solid Phase
1.0466	70.71	0.00	100.00
1.0456	65.45	3.04	88.88
1.0454	57.00	9.43	77.98
1.0433	53.04	11.52	69.02
1.0434	45.85	15.83	54.56
1.0395	37.39	21.37	45.22
1.0393	27.89	28.50	32.39
1.0357	14.70	37.64	14.05
1.0224	0.00	48.07	0.00

Results at 8°.5.

d of sat. sol.	Gms. per 1000 cc. sat. sol. $CuSO_4.K_2SO_4.6H_2O$.	Gms. per 1000 cc. sat. sol. $NiSO_4.K_2SO_4.6H_2O$.	Wt. per cent $CuSO_4.K_2SO_4.6H_2O$ in Solid Phase.
1.0582	92.12	0.00	100.00
1.0281	79.73	6.47	80.46
1.0563	69.71	13.53	71.41
1.0521	60.13	20.53	61.12
1.0547	55.38	21.29	47.98
1.0496	43.51	29.61	39.83
1.0472	35.60	33.79	29.34
1.0426	24.46	39.13	21.07
1.0451	15.36	47.85	12.32
1.0397	0.00	60.18	0.00

SOLUBILITY OF MIXED CRYSTALS OF COPPER POTASSIUM SULFATE AND ZINC POTASSIUM SULFATE AT 6°.8. (Ploin 1926.)

d of sat. sol.	Gms. per 1000 cc. sat. sol. $CuSO_4.K_2SO_4.6H_2O$.	Gms. per 1000 cc. sat. sol. $ZnSO_4.K_2SO_4.6H_2O$.	Wt. per cent $CuSO_4.K_2.SO_4.6H_2O$ in Solid Phase.
1.0581	85.32	0.00	100.00
1.0595	75.83	12.11	87.82
1.0620	68.79	22.53	77.17
1.0634	58.14	34.58	66.05
1.0644	49.28	45.55	55.55
1.0658	42.93	54.10	45.64
1.0672	33.40	65.60	36.81
1.0682	24.74	75.91	27.64
1.0690	16.99	84.80	18.69
1.0707	0.00	106.08	0.00

The above pairs of crystals mix in all proportions and the curves of solubility are continuous. The results confirm the proportionality between the solubility and the chemical composition of the mixed crystals.

Solubility of Copper Sulfate in Aqueous Solutions of Lithium and Other Chlorides at 25°.

(Herz, 1910.)

In Lithium Chloride. Gms. per 100 cc. Sat. Sol. $LiCl$.	$CuSO_4$.	In Potassium Chloride. Gms. per 100 cc. Sat. Sol. KCl.	$CuSO_4$.	In Rubidium Chloride. Gms. per 100 cc. Sat. Sol. $RbCl$.	$CuSO_4$.	In Sodium Chloride. Gms. per 100 cc. Sat. Sol. $NaCl$.	$CuSO_4$.
3.10	20.06	4.19	23.89	0	22.34	2.10	22.41
5.93	18.78	8.75	24.92	13.22	25.02	7.72	22.76
12	17.03	17.50	29.03			14.79	24.05

Solubility of Copper Sulfate in Aqueous Solutions of Lithium Sulfate at 30°.

(Schreinemakers, 1908, 1909.)

Gms. per 100 Gms. Sat. Sol. Li_2SO_4.	$CuSO_4$.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. Li_2SO_4.	$CuSO_4$.	Solid Phase.
0	20.32	$CuSO_4.5H_2O$	17.92	11.04	$CuSO_4.5H_2O$
3.54	17.59	"	20.55	10.05	" $+Li_2SO_4.H_2O$
6.08	16.10	"	22.23	6.41	$Li_2SO_4.H_2O$
11.94	13.55	"	23.59	3.39	"
15.72	12.14	"	25.24	0	"

SO

Solubility of Copper Sulfate in Aqueous Solutions of Lithium Sulfate at Several Temperatures.

(Crockford and Webster, 1930.)

Results at 0°			Results at 25°			Results at 55°		
Gms. per 100 gms. sat. sol. Li_2SO_4	$CuSO_4$	Solid Phase	Gms. per 100 gms. sat. sol. Li_2SO_4	$CuSO_4$	Solid Phase	Gms. per 100 gms. sat. sol. Li_2SO_4	$CuSO_4$	Solid Phase
0.0	14.22	Cu	0.0	18.50	Cu	0.0	26.90	Cu
4.90	11.47	"	7.52	14.54	"	3.36	24.45	"
8.57	10.47	"	12.36	12.77	"	6.22	23.08	"
20.00	6.95	"	17.06	10.80	"	12.70	18.75	"
23.78	5.57	" + Li	18.03	10.46	"	17.27	16.53	"
25.21	2.49	Li	21.32	9.18	" + Li	18.36	15.85	" + Li
25.95	1.14	"	24.32	3.64	Li	19.85	12.90	Li
26.33	0.0	"	25.50	0.0	"	22.55	6.07	"
						24.62	0.0	"

Cu = $CuSO_4.5H_2O$, Li = $Li_2SO_4.H_2O$

Solubility of Copper Sulfate in Aqueous Solutions of Magnesium Sulfate at 0°.

(Diacon, 1866.)

Gms. per 100 Gms. H_2O. $CuSO_4$.	$MgSO_4$.	Solid Phase.	Gms. per 100 Gms. H_2O. $CuSO_4$.	$MgSO_4$.	Solid Phase.
0	26.37	$MgSO_4.6H_2O$	12.03	15.67	$CuSO_4.5H_2O$
2.64	25.91	"	13.61	8.64	"
4.75	25.30	"	14.99	0	"
9.01	23.30	$MgSO_4.6H_2O+CuSO_4.5H_2O$			

SOLUBILITY OF MANGANESE SULFATE, COPPER SULFATE MIXED CRYSTALS IN WATER AT 18°.

(Stortenbecker, 1900.)

Mols. per 100 Mols. H_2O. Cu.	Mols. per 100 Mols. H_2O. Mn.	Mol. per cent Cu in: Solution.	Mol. per cent Cu in: Crystals.
Solid Phase, $CuMnSO_4.5H_2O$, Triclinic.			
2.282	0	100	100
...	...	90.5	...
2.23	0.44	83.5	...
...	...	74.1	97.3
...	...	57.7	95.1
....	...	31.0	81.3
1.54	3.76	29.0	...
...	...	26.1	70.4
1.31	4.70	21.8	...
...	...	21.2	42.6
...	...	20.0	34.4
[1.06	5.58	15.9	22.9]
...	...	13.9	15.2*
[0.73	6.37	10.27	10.5]
...	...	5.0	4.9
0.34	7.03	4.60	...
...	...	2.31	2.15
...	7.375	0.0	0.0
Solid Phase. $CuMnSO_4$. Monoclinic. $7H_2O$.			
...	...	20.4	28.2*
[1.06	5.58	15.9	23.5]
...	...	12.45	20.8
[0.73	6.37	10.27	16.0]
...	...	4.60	5.8*
...	±8	0.0	0.0

* Indicates meta stabil points.

$CuMnSO_4.5H_2O$ = 100–90.8 and 2.11–0 mol. per cent Cu.

SO $CuMnSO_4.7H_2O$ = 37.8–4.92 mol. per cent Cu.

COPPER SULFATE, MANGANESE SULFATE, MIXED CRYSTALS AT 25°.

(Stortenbecker, 1900.)

Gms. per 100 Gms. H_2O. $CuSO_4$.	Gms. per 100 Gms. H_2O. $MnSO_4$.	Mols per 100 Mols. H_2O. Cu.	Mols per 100 Mols. H_2O. Mn.	Mol. % Cu in Solution.	Mol. % Cu in Crystals.
Triclinic Crystals with $5H_2O$.					
20.2	0	2.282	0	100	100
				90.5	99.3
19.76	3.69	2.23	0.44	83.5	...
				74.1	97.3
				57.7	95.1
				31.0	81.3
13.65	31.52	1.54	3.76	29.0	...
				26.1	70.4
11.61	39.41	1.31	4.70	21.8	...
				21.2	42.6
				20.0	34.4
9.39	46.77	1.06	5.59	15.9	22.9
				13.45*	15.2*
6.47	53.39	0.73	6.37	10.27	10.5
				5.0	4.9
3.01	58.93	0.34	7.03	4.6	...
				2.31	2.15
0.0	61.83	0.0	7.375	0.0	100.0
Monoclinic Crystals with $7H_2O$.				20.0	28.2
9.39	46.77	1.06	5.58	15.9	23.5
				13.45	20.8
6.47	53.39	0.73	6.37	10.27	16.0
				4.6*	5.8*
0.0	67.07±	0.0	8±*	0.0	100

* Indicates points of labil equilibrium.

SOLUBILITY OF COPPER SULFATE IN AQUEOUS SOLUTIONS OF AMMONIUM SULFATE AT 0°.

(Engel, 1886.)

Milligram Equiv. per 10 cc. Solution. $(NH_4)_2SO_4$.	CuSO.	Sp. Gr. of Solutions.	Grams per 100 cc. Solution. $(NH_4)_2SO_4$.	$CuSO_4$.
0	18.52	1.144	0	14.79
5.45	20.15	1.190	3.61	16.09
7	10.5	1.108	4.63	8.38
7.4	9.1	1.099	4.90	7.26
8.45	6.425	1.0815	5.59	5.13
11.35	3.7	1.071	7.51	2.95
18.6	1.178	1.082	12.31	0.94
31.2	1	1.116	20.65	0.80

SOLUBILITY OF AMMONIUM SULFATE IN AQUEOUS SOLUTIONS OF COPPER SULFATE AT 30° AND VICE VERSA.

(Schreinemakers, 1910)

Gms. per 100 Gms. Sat. Solution. $(NH_4)_2SO_4$.	$CuSO_4$.	Solid Phase.	Gms. per 100 Gms. Sat. Solution. $(NH_4)_2SO_4$.	$CuSO_4$.	Solid Phase.
44	0	$(NH_4)_2SO_4$	8.19	13.65	1.1.6
38.32	0.77	$(NH_4)_2SO_4$+1.1.6	6.08	16.77	"
29.27	1.57	1.1.6	5.79	20.53	1.1.6+$CuSO_4.5H_2O$
17.53	4.05	"	2.45	20.19	$CuSO_4.5H_2O$
*9.33	11.03	"	0	20.32	"

SO

* = Solubility of 1.1.6 in water.

1.1.6 = $CuSO_4(NH_4)_2SO_4.6H_2O$.

Several additional determinations for the above system at 19°, are given by Rüdorff (1873), and by Schiff (1859).

SOLUBILITY OF AMMONIUM SULFATE IN AQUEOUS SOLUTIONS OF COPPER SULFATE AT 25°, 51° AND 61° AND VICE VERSA.

(Caven and Mitchell, 1924.)

t°.	Mols. per 100 gms H_2O. $CuSO_4$.	$(NH_4)_2SO_4$.	Solid Phase.	t°.	Mols. per 100 gms H_2O. $CuSO_4$.	$(NH_4)_2SO_4$.	Solid Phase.
25.	0 0	0.5801	$(NH_4)_2SO_4$	51.	0.00	0.6462	$(NH_4)_2SO_4$
25.	0.0042	0.5762	"+1.1.6	51.	0.180	0.6733	"+1.1.6
25.	0.0070	0.3826	1.1.6	51.	0.1302	0.1351	1.1.6
25.	0.0112	0.3233	"	51.	0.2365	0.0861	"+$CuSO_4.5H_2O$
25.	0.0507	0.0989	"	51.	0.2073	0 0000	$CuSO_4.5H_2O$
25.	0.0779	0.0779	"	61.	0.000	0.6714	$(NH_4)_2SO_4$
25.	0.1259	0.0601	"	61.	0 0249	0.7079	"+1.1.6
25.	0.1413	0.0572	"	61.	0.0396	0.5387	1.1.6
25.	0.1646	0.0534	"+$CuSO_4.5H_2O$	61.	0.1631	0.1695	"
25	0.1558	0.0293	$CuSO_4.5H_2O$	61.	0.2753	0.0998	"+$CuSO_4.5H_2O$
25.	0 1494	0.0158	"	61.	0.2419	0.000	$CuSO_4.5H_2O$
25.	0.1470	0.0096	"				

1.1.6 = $(NH_4)_2SO_4.CuSO_4 6H_2O$

Data for equilibrium in the quarternary system $(NH_4)_2SO_4$ + $CuSO_4$ + K_2SO_4 - H_2O at 25° are given by Hayami, 1921; and by Janecke, 1938.

Data for equilibrium in the quarternary system $(NH_4)_2SO_4$ + $LiSO_4$ + H_2SO_4 - H_2O at 30° are given by Van Dorp, 1923.

COPPER Ammonium SULFATE $CuSO_4.(NH_4)_2SO_4.6H_2O$

SOLUBILITY OF COPPER AMMONIUM SULFATE IN WATER.

(Lattey, 1923.)

t°	Gms. $CuSO_4.(NH_4)_2SO_4$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $CuSO_4.(NH_4)_2SO_4$ per 100 gms. sat. sol.	Solid Phase
0	10.27	$CuSO_4.(NH_4)_2SO_4.6H_2O$	50	27.34	$CuSO_4.(NH_4)_2SO_4.6H_2O$
10	13.10	"	60	31.63	"
15	14.63	"	70	36.21	"
20	16.22	"	80	41.08	"
25	17.89	"	90	46.25	"
30	19.64	"	100	51.71	"
40	23.34	"			

SOLUBILITY OF MIXED CRYSTALS OF COPPER AMMONIUM SULFATE AND OF COBALT AMMONIUM SULFATE IN WATER : (Bertisch, 1926.)

SO

at 0°.				at 8°.			
	Gms. per 1000 cc. sat. sol.				Gms. per 1000 cc. sat. sol.		
d of sat. sol.	$CuSO_4.(NH_4)_2SO_4.6H_2O$.	$CoSO_4.(NH_4)_2SO_4.6H_2O$.	Wt per cent $CuSO_4(NH_4)_2SO_4.6H_2O$ in Solid Phase	*d* of sat. sol.	$CuSO_4.(NH_4)_2SO_4.6H_2O$	$CoSO_4.(NH_4)_2SO_4.6H_2O$	Wt. per cent $CuSO_4.(NH_4)_2SO_4.6H_2O$ in Solid Phase.
1.0931	162.82	0.00	100.00	1.1112	197.62	0.00	100.00
1.0905	138.11	15.70	85.73	1.1094	178.04	12.09	90.57
1.0886	127.89	22.56	75.87	1.1059	157.65	28.44	81.56
1.0863	110.93	35.53	67.10	1.1027	144.14	34.93	74.09
1.0836	92.28	49.49	56.78	1.0985	120.61	51.75	63.59
1.0809	80.87	56.92	47.14	1.0960	96.99	69.22	51.24
1.0758	50.70	77.68	30.86	1.0923	82.50	77.75	42.09
1.0687	16.14	101.36	9.94	1.0846	40.45	105.76	22.71
1.0646	0.00	111.65	0.00	1.0757	27.76	112.79	14.32
				1.0757	0.00	130.78	0.00

SOLUBILITY OF MIXED CRYSTALS OF COPPER AMMONIUM SULFATE AND OF IRON AMMONIUM SULFATE IN WATER : (Haber-Chuwis, 1926.)

at 0°.				at 8°.2.			
	Gms. per 1000 cc. sat. sol.				Gms. per 1000 cc. sat. sol.		
d of sat. sol.	$CuSO_4(NH_4)_2SO_4.6H_2O$.	$FeSO_4.(NH_4)_2SO_4.6H_2O$.	Mol. per cent $CuSO_4(NH_4)_2SO_4.6H_2O$ in Solid Phase.	*d* of sat. sol.	$CuSO_4.(NH_4)_2SO_4.6H_2O$.	$FeSO_4.(NH_4)_2SO_4.6H_2O$.	Mol. per cent $CuSO_4.(NH_4)_2SO_4.6H_2O$ in Solid Phase.
1.1020	163.92	0.00	100.00	1.1178	197.58	0.00	100.0
1.1032	151.88	18.17	92.82	1.1202	173.56	31.95	89.43
1.1069	131.14	47.52	82.40	1.1245	160.29	52.61	81.77
1.1105	110.43	78.30	69.63	1.1287	141.70	79.28	72.65
1.1175	93.50	104.30	59.30	1.1331	119.77	110.95	59.83
1.1218	79.41	125.98	49.08	1.1366	98.70	140.93	48.80
1.1260	61.39	153.09	37.91	1.1410	62.44	191.76	31.64
1.1369	34.49	199.69	20.12	1.1448	50.42	208.84	25.47
1.1392	0.00	245.32	0.00	1.1495	32.07	233.63	16.58
				1.1538	17.03	256.05	8.78
				1.1562	0.00	279.68	0.00

SOLUBILITY OF MIXED CRYSTALS OF COPPER AMMONIUM SULFATE AND OF MANGANESE AMMONIUM SULFATE IN WATER AT 7°. (Bertisch, 1926.)

d of sat. solut.	Gms. per 1000 cc. sat. solution		$CuSO_4.(NH_4)_2SO_4.6H_2O$ in Solid Phase	
	$CuSO_4(NH_4)_2SO_4.6H_2O$.	$MnSO_4(NH_4)_2SO_4.6H_2O$.	Wt. per cent.	Mol. per cent.
1.1129	192.36	0.00	100.00	100.00
1.1179	162.83	43.93	93.28	93 15
1.1 43	143.75	81.27	85.23	84.96
1.1349	116.69	126.64	75.93	75.53
1.1430	90.77	170.59	63. 6	62.76
1.1576	68.58	232.19	53.37	52.83
1.1684	38.55	281.70	35.40	34.90
1.1787	28.39	312.03	24.68	24.28
1.1889	0.00	382.80	0.00	0.00

SOLUBILITY OF MIXED CRYSTALS OF COPPER AMMONIUM SULFATE AND OF NICKEL AMMONIUM SULFATE IN WATER: (Ostersetzer, 1926.)

at 0°.				at 8°.			
d of sat. sol.	Gms per 1000 cc. sat. sol.		Wt. per cent $CuSO_4.(NH_4)_2SO_4.6H_2O$ in Solid Phase.	*d* of sat. sol.	Gms. per 1000 cc. sat. sol.		Wt. per cent $CuSO_4.(NH_4)_2SO_4.6H_2O$ in Solid Phase.
	$CuSO_4.(NH_4)_2SO_4.6H_2O$.	$NiSO_4.(NH_4)_2SO_4.6H_2O$.			$CuSO_4.(NH_4)_2SO_4.6H_2O$.	$NiSO_4.(NH_4)_2SO_4.6H_2O$.	
1.0954	161.71	0.00	100.00	1.1115	195.74	0.00	100.00
1.0813	125.86	11.59	77.84	1.0937	150.12	13.25	76 70
1.0765	113.89	15.43	69.09	1.0869	126.21	22.98	62.40
1.0703	99.25	18.33	58.91	1.0784	110.71	23.47	52.36
1.0639	85.89	19.77	48.25	1.0687	88.64	30.43	41.49
1.0576	70.52	24.21	38.71	1.0631	70.23	37.70	32.23
1.0480	51.42	32.69	28.55	1.0574	47.84	49.17	21.97
1.0434	36.77	35 06	19.39	1.0506	33.65	51.74	15.25
1.0334	0.00	54.73	0.00	1.0457	17.13	58.27	7.54
				1.0404	0.00	67.13	0.00

SO

SOLUBILITY OF MIXED CRYSTALS OF COPPER AMMONIUM SULFATE AND OF ZINC AMMONIUM SULFATE AT 6°.8. (Halpern, 1926.)

d of sat. sol.	Gms. per 1000 cc. sat. sol.		Wt. per cent $CuSO_4(NH_4)_2SO_4.6H_2O$ in Solid Phase.
	$CuSO_4(NH_4)_2SO_4.6H_2O$.	$ZnSO_4.(NH_4)_2SO_4.6H_2O$.	
1.1090	191.90	0.00	100.00
1.1033	158.06	22.27	83.24
1.0942	120.93	43 85	59.51
1.0934	108.48	50.64	52.28
1.0887	87.92	63.22	42.62
1.0847	69.82	73.62	32.36
1.0804	44.59	92.31	21.36
1.0755	11 09	113.69	6.11
1.0725	0.00	121.14	0.00

In the case of the above pairs of salts the crystals mix in all proportions and the curves of their solubilities are continuous. The results confirm the proportionality between the solubility and the chemical composition of the mixed crystals. The solubility of the mixed crystals is a linear function of the solubilities of the single salts and the of molecular proportion in which they mix.

COPPER Ammonium SULFATE $CuSO_4.(NH_4)_2SO_4.6H_2O$.

SOLUBILITY OF MIXTURES OF COPPER AMMONIUM SULFATE AND NICKEL AMMONIUM SULFATE IN WATER AT 13°–14°:

(Fock, 1897.)

$CuSO_4.(NH_4)_2SO_4.6H_2O + NiSO_4.(NH_4)_2SO_4.6H_2O$.

Mol. % in Solution.		Mols. per 100 Mols. H_2O.		Mol. % in Solid Phase.	
Cu Salt.	Ni Salt.	Cu Salt.	Ni Salt.	Cu Salt.	Ni Salt.
0	100	0	0.521	0	100
33.34	66.66	0.1476	0.295	10.29	89.71
56.05	43.95	0.2664	0.2089	30.59	69.41
73.89	26.20	0.4165	0.1449	52.23	47.77
79.92	20.08	0.4785	0.1202	78.80	21.20
100	0	1.0350	0	100	0

SOLUBILITY OF MIXTURES OF COPPER AMMONIUM SULFATE AND ZINC AMMONIUM SULFATE IN WATER AT 13°–14°.

(Fock, 1897.)

$CuSO_4.(NH_4)_2SO_4.6H_2O + ZnSO_4.(NH_4)_2SO_4.6H_2O$.

Mol. % in Solution.		Mols. per 100 Mols. H_2O.		Mol. % in Solid Phase.	
Cu Salt	Zn Salt.	Cu Salt.	Zn Salt.	Cu Salt.	Zn Salt.
4.97	95.03	0.0422	0.8069	2.39	97.61
10.65	89.35	0.0666	0.5638	4.52	95.48
19.24	80.76	0.1218	0.5115	90.3	90.97
30.19	69.81	0.2130	0.4924	14.67	85.33
44.44	55.56	0.3216	0.4022	22.62	77.38
100	0	1.035	0	100	0

EQUILIBRIUM IN THE SYSTEM COPPER AMMONIUM SULFATE, NICKEL AMMONIUM SULFATE AND WATER AT 25°

(Hill and Taylor, Jr., 1938.)

The determinations were made by a method insuring that equilibrium was attained. Duplicate samples were prepared for each ratio of the two double salts. In one case one of the two salts was dissolved completely and the second added in solid form. In the other the sequence was reversed. Thus equilibrium conditions in the solid solution of the two salts was approached from the two compositions of the two pure double salts. This method avoids the uncertainties of the results obtained in the majority of the investigations which have been made of such systems.

Wt. percent composition of original complex		Wt. percent composition of sat. solution		Wt. percent composition of solid phase	
$CuSO_4.(NH_4)_2SO_4$	$NiSO_4.(NH_4)_2SO_4$	$CuSO_4(NH_4)_2SO_4$	$NiSO_4.(NH_4)_2SO_4$	$CuSO_4.(NH_4)_2SO_4$	$NiSO_4.(NH_4)_2SO_4$
—	0.0	18.58	0.0	72.97	0.0
17.89	2.29	15.81	0.64	48.90	23.87
17.08	5.43	14.60	0.90	35.87	36.79
13.78	5.74	12.60	1.44	26.06	46.80
9.00	6.21	8.87	2.50	12.14	60.68
4.29	6.67	4.28	4.58	4.93	67.67
0.0	—	0.0	7.09	0.0	72.63

EQUILIBRIUM IN THE SYSTEM COPPER AMMONIUM SULFATE, ZINC AMMONIUM SULFATE AND WATER AT 25°

(Hill and Taylor, Jr., 1938.)

Wt. percent composition of original complex		Wt. percent composition of sat. solution		Wt. percent composition of solid phase	
$CuSO_4 \cdot (NH_4)_2SO_4$	$ZnSO_4 \cdot (NH_4)_2SO_4$	$CuSO_4 \cdot (NH_4)_2SO_4$	$ZnSO_4 \cdot (NH_4)_2SO_4$	$CuSO_4 \cdot (NH_4)_2SO_4$	$ZnSO_4 \cdot (NH_4)_2SO_4$
—	0.0	18.58	0.0	72.97	0.0
17.51	3.80	14.75	2.39	51.75	21.08
16.07	9.55	11.99	4.13	36.69	36.33
11.51	10.39	9.84	5.75	25.05	48.00
8.53	10.81	7.82	6.78	16.47	57.08
4.23	11.53	4.28	9.22	3.53	69.53
0.0	—	0.0	12.24	0.0	73.09

SOLUBILITY OF COPPER SULFATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE AT 20° AND VICE VERSA. (Massink, 1918.)

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
$CuSO_4$.	Na_2SO_4.	Solid Phase.	$CuSO_4$.	Na_2SO_4.	Solid Phase.
0.0	16.25	$Na_2SO_4.10H_2O$	15.54	11.85	$1.1.2+CuSO_4.5H_2O$
5.69	15.99	"	16.51	6.09	$CuSO_4.5H_2O$
11.22	15.45	" +1.1.2	17.52	0.0	"
13.30	13.78	1.1.2			

80

$1.1.2 = CuSO_4.Na_2SO_4.2H_2O$

Data for the system $CuSO_4 + Cu(NO_3)_2 + Na_2SO_4 + NaNO_3 + H_2O$ at 20°, are also given.

SOLUBILITY OF COPPER SULFATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE AT 0°, 25°, AND 37.5°, AND VICE VERSA.

(Caven and Johnston, 1927.)

Results at 0°			Results at 25°			Results at 37.5°		
Gm. mols. per 1000 gms. H_2O		Solid Phase	Gm. mols. per 1000 gms. H_2O		Solid Phase	Gm. mols. per 1000 gms. H_2O		Solid Phase
$CuSO_4$	Na_2SO_4		$CuSO_4$	Na_2SO_4		$CuSO_4$	Na_2SO_4	
0.0	0.324	Na10	0.0	1.472	Na10	0.0	3.406	Na
0.213	0.348	"	0.256	2.005	"	0.162	3.391	" + 1.1.2
0.415	0.377	"	0.593	2.038	"	0.280	2.667	1.1.2
0.590	0.392	"	0.781	2.062	" + 1.1.2	0.678	1.713	"
1.047	0.441	" + Cu5	0.847	1.724	1.1.2	0.821	1.509	"
0.998	0.250	Cu5	0.979	1.438	"	1.209	1.179	"
0.970	0.147	"	1.068	1.343	"	1.402	1.041	"
0.929	0.0	"	1.457	1.109	Cu5	1.770	0.843	" + Cu5
			1.433	0.641	"	1.754	0.0	Cu5
			1.428	0.0				

Na10 = $Na_2SO_4.10H_2O$; Cu5 = $CuSO_4.5H_2O$; 1.1.2 = $CuSO_4.Na_2SO_4.2H_2O$; Na = Na_2SO_4.

Note: The author's original figures for the Na_2SO_4 values have been corrected by multiplying by the factor 0.838 as requested in the supplementary note to their paper.

SOLUBILITY OF COPPER SULFATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE AT 97° AND VICE VERSA.

(Benrath and Benrath, 1929.)

Gms. per 100 gms. sat. sol. $CuSO_4$	Gms. per 100 gms. sat. sol. Na_2SO_4	Solid Phase	Gms. per 100 gms. sat. sol. $CuSO_4$	Gms. per 100 gms. sat. sol. Na_2SO_4	Solid Phase
0.0	30.50	Na_2SO_4	18.80	8.75	1.1.2
1.43	29.91	" + 1.1.2	22.46	7.44	"
1.95	27.00	1.1.2	20.48	5.90	"
2.95	22.40	"	34.91	3.42	" + $CuSO_4.3H_2O$
4.13	19.22	"	36.06	3.20	" + "
5.92	16.91	"	36.40	2.46	$CuSO_4.3H_2O$
9.97	13.57	"	37.52	0.97	"
12.52	11.92	"	38.30	0.0	"

1.1.2 = $CuSO_4.Na_2SO_4.2H_2O$

SO

SOLUBILITY OF COPPER SULFATE, SODIUM SULFATE MIXTURES IN WATER.

(Koppel, 1901–02; Massol and Maldes, 1921.)

t°.	Gms. per 100 Gms. Solution. $CuSO_4$.	Gms. per 100 Gms. Solution. Na_2SO_4.	Mols. per 100 Mols. H_2O. $CuSO_4$.	Mols. per 100 Mols. H_2O. Na_2SO_4.	Solid Phase.
0	13.40	6.23	1.88	0.98	$CuSO_4.5H_2O+Na_2SO_4.10H_2O$
10	14.90	9.46	2.23	1.56	"
15	15.18	11.64	2.34	2.02	"
17.7	14.34	13.34	2.24	2.34	$CuSO_4.Na_2SO_4.2H_2O$
23	14.36	12.76	2.23	2.21	"
40.15	13.73	12.26	2.10	2.10	"
17.7	14.09	13.48	2.37	2.39	$CuSO_4.Na_2SO_4.2H_2O+CuSO_4.5H_2O$
23	16.41	11.35	2.57	1.99	"
40.15	20.56	8	3.25	1.47	"
18	13.53	13.84	2.10	2.41	$CuSO_4.Na_2SO_4.2H_2O+Na_2SO_4.10H_2O$
20	11.34	15.70	1.76	2.73	"
25	6.28	21.20	0.98	3.70	"
30	2.607	28.38	0.43	5.21	"
33.9	1.475	32.30	0.25	6.18	"
37.2	1.494	31.96	0.25	6.08	"
30	5.38	22.17	...	...	$CuSO_4.Na_2SO_4.2H_2O$+increasing amts. of $Na_2SO_4.10H_2O$
30.1	3.69	25.37			
30	1.57	32.09			

Data for the system copper sulfate, sodium sulfate, water, at 20° and 35° are given by Massink, 1916, 1917.

SOLUBILITY OF MIXTURES OF NICKEL SULPHATE AND COPPER SULPHATE.

(Fock — Z. Kryst. Min. 28, 387, '97.)

Results at 35°.

Gms. per 100 Gms. H_2O.		Mol. per cent in Solution.		Mol. per cent in Solid Phase.		Crystal Form.
$CuSO_4$.	$NiSO_4$.	$CuSO_4$.	$NiSO_4$.	$CuSO_4$.	$NiSO_4$.	
9.62	583.9	1.57	98.43	0.35	99.65	Rhombic
41.66	484.4	7.69	92.31	2.12	97.88	"
75.39	553.5	11.66	88.34	4.77	95.23	Tetragonal
106.40	506.5	16.92	83.08	6.52	93.48	"
172.0	483.8	25.63	74.37	13.88	86.17	"
186.9	468.0	27.90	72.10	18.77	81.23	Tetragonal
				94.91	5.09	Triclinic

Results at 67°.

Gms. per 100 Gms. H_2O.		Mol. per cent in Solution.		Mol. per cent in Solid Phase.		Crystal Form.
$CuSO_4$.	$NiSO_4$.	$CuSO_4$.	$NiSO_4$.	$CuSO_4$.	$NiSO_4$.	
20.04	729.3	2.65	97.35	0.93	99.07	Monoclinic
66.01	706.2	8.31	91.69	2.86	97.14	"
88.08	501.6	13.55	86.45	3.92	96.08	"
47.94	675.0	16.39	83.61	6.66	93.34	"
249.9	747.8	24.46	75.54	22.32	77.68	Monoclinic Triclinic

SO

COPPER SULFATE, ZINC SULFATE, MIXED CRYSTALS IN WATER AT 18°.

(Stortenbecker, 1897.)

Mols. per 100 Mols. H_2O.		Mol. % Cu in Solution.	Mol. % Cu in Crystals.	
Cu.	Zn.			
2.28	0	100	100	Triclinic Crystals with $5H_2O$.
1.83	2.08	46.8	94.9	
1.41	3.60	28.1		
1.19	5.01	19.2	77.9	
1.86	3.36	36.2	40.4	Monoclinic Crystals with $7H_2O$.
1.22	4.45	21.5	29.5–31.9	
1.01	4.72	17.6	24.1–28.	
0.82	5.03	14.0	19.0–22.	
0.51	5.59	8.36	12.4–14.9	
0.30	5.56	4.87	7.02	
0.0	6.42	0.0	0	
1.19	5.01	19.2	5.01	Rhombic Crystals with $7H_2O$.
0.51	5.59	8.36	1.97	
0.267	5.77	4.42	1.15	
0.0	5.94	0.0	0.00	

SOLUBILITY OF COPPER SULFATE IN METHYL AND ETHYL ALCOHOL, ETC.

(de Bruyn, 1892; de Coninck, 1905.)

Solvent.	t°.	Gms. per 100 Gms. Solv. $CuSO_4$.	Gms. per 100 Gms. Solv. $CuSO_4.5H_2O$.	
Methyl Alcohol Abs.	18	1.05	15.6	
" " 93.5%	18	...	0.93	
" " 50%	18	...	0.40	
" " Abs.	3	...	13.4	
Ethyl Alcohol Abs.	3	...	1.1	
Glycol	14.6	...	7.6*	
Glycerol	15.5	...	30	
Glycerol	15–16	...	36.3	(Ossendowski, 1907.)
95% Formic Acid	18.5	...	0.05	(Aschan, 1913.)
Anhy. Hydrazine	ord. t.	2	...†	(Welsh and Broderson, 1915.)

* Per 100 gms. solution. † decomp.

SOLUBILITY IN AQUEOUS ALCOHOL AT 15°.

(Schiff, 1861.)

Wt. % Alcohol.	Gms. $CuSO_4.5H_2O$ per 100 g. Solvent.
10	15.3
20	3.2
40	0.25

Data for the solubility of copper sulfate in methyl alcohol are given by Carrara and Minozzi, 1897.

SOLUBILITY OF COPPER SULFATE IN ABSOLUTE METHYL ALCOHOL.

(Gibson, Driscol and Jones, 1929.)

SO

When copper sulfate is added to a large excess of methyl alcohol the amount of salt dissolved at first increases and then decreases as the sparingly soluble basic salt, $CuO.4CuSO_4.6CH_3OH$, is formed. The mono-alcoholate is prepared by wetting anhydrous copper sulfate with absolute methyl alcohol and allowing to stand at 15°.

t°	Gms. $CuSO_4$ per 100 gms. sat. sol.	Solid Phase
15	0.76	$CuSO_4.CH_3OH$
25	1.40	"
35	2.15	"
45	2.90	"

SOLUBILITY OF COPPER SULFATE IN AQUEOUS SOLUTIONS OF ETHYLENE GLYCOL (CH_2OHCH_2OH) AT 30°.

(Trimble, 1931.)

d of sat. sol.	Gms. per 100 gms. sat. sol. CH_2OHCH_2OH	Gms. per 100 gms. sat. sol. $CuSO_4$	Solid Phase	d of sat. sol.	Gms. per 100 gms. sat. sol. CH_2OHCH_2OH	Gms. per 100 gms. sat. sol. $CuSO_4$	Solid Phase
1.2259	0.0	27.65	$CuSO_4.5H_2O$	1.1202	50.25	9.26	$CuSO_4.5H_2O$
1.1941	7.34	25.46	"	1.1406	66.66	9.16	"
1.1502	22.26	18.02	"	1.2535	71.61	23.62	"
1.1363	28.50	14.84	"	1.3267	67.71	32.21	"

100 gms. sat. sol. of anhydrous $CuSO_4$ in pure glycol contain 0.5 gm. $CuSO_4$ at 30°.

SOLUBILITY OF COPPER SULFATE IN AQUEOUS SOLUTIONS. OF URETHAN ($NH_2COOC_2H_5$) AT 25°.

(Pelitzsch, 1928, 1929.)

Gm. mols. per 1000 gms. H_2O $NH_2COOC_2H_5$	Gm. mols. per 1000 gms. H_2O $CuSO_4$	Solid Phase
0.0	1.42	$CuSO_4.?H_2O$
1.24	0.85	"
9.119	0.122	

COPPER Di THIONATE $CuS_2O_6.4H_2O$.

100 gms. sat. solution of copper dithionate in water contain 43.82 gms. CuS_2O_6 at 0°, 44.91 gms. at 20° and 45.51 gms. at 30°. (de Baat, 1926.)

SOLUBILITY OF AMMONIUM DITHIONATE IN AQUEOUS SOLUTIONS OF COPPER DITHIONATE AT 30° AND VICE VERSA. (de Baat, 1926.)

Gms. per 100 gms. sat. sol. CuS_2O_6.	Gms. per 100 gms. sat. sol. $(NH_4)_2S_2O_6$.	Solid Phase.	Gms. per 100 gms. sat. sol. CuS_2O_6.	Gms. per 100 gms. sat. sol. $(NH_4)_2S_2O_6$.	Solid Phase.
10.45	52.62	$(NH_4)_2S_2O_6.{}^1/_2H_2O$	36.19	18.39	$D_s + CuS_2O_6.4H_2O$
24.17	38.30	" $+ D_s$	37.26	16.16	$CuS_2O_6.4H_2O$
29.70	29.28	D_s	41.06	8.91	"
36.04	18.50	"	45.51	0.00	"

D_s = Double salt, the composition of which is not stated.

COPPER SELENIDES Cu_2Se, CuSe
COPPER SELENITE $CuSeO_3.2H_2O$

SOLUBILITY OF EACH SEPARATELY IN SEVERAL SOLVENTS AT ROOM TEMPERATURE.

(Gellmann and Wriggs, 1931.)

The determinations were made for the purpose of separating copper selenides from copper selenite by means of solubility differences. Two grams of each compound were digested in 250cc of each solvent, with active shaking by hand, and the dissolved Cu and Se determined after 24 hours.

SeO

Compound	Conc. of Solvent, Normality	Milligrams Cu and Se dissolved per 250 cc in: Ammonia Cu	Ammonia Se	HCl Cu	HCl Se	H_2SO_4 Cu	H_2SO_4 Se	CH_3COOH Cu	CH_3COOH Se
$CuSeO_3.2H_2O$	0.0	1.6	2.0	1.6	2.0	1.0	2.0	1.6	2.0
"	0.01	2.2	13.8	38.9	48.9	55.8	68.7	3.2	3.9
"	0.02	6.6	26.1	72.6	115.0	109.0	134.7	13.4	16.6
"	0.05	45.5	116.5	232.2	288.0	244.8	301.4	19.0	28.8
"	0.10	181.1	285.1	560.6	698.4	560.6	698.4	25.1	31.3
"	0.20	560.6	698.4	560.6	698.4	560.6	698.4	32.1	40.0
"	2.00	560.6	698.4	560.6	698.4	560.6	698.4	85.7	106.5
Cu_2Se	0.00	trace	—	trace	—	trace	—	trace	—
"	0.01	trace	—	4.2	—	4.8	—	8.5	—
"	0.02	trace	—	5.1	—	5.0	—	12.6	—
"	0.05	2.8	trace	7.4	—	9.4	—	12.8	—
"	0.10	9.1	0.4	9.0	—	9.5	—	14.1	—
"	0.20	19.5	0.6	11.0	—	9.5	—	14.3	—
"	0.50	26.2	0.7	16.2	—	10.0	—	14.6	—
"	1.00	43.0	0.9	25.4	—	10.2	—	14.6	—
"	2.0	54.5	0.8	25.1	—	10.5	—	14.9	—
CuSe	0.02	trace	trace	trace	—	trace	—	—	—
"	0.10	trace	—	slight	—	slight	—	trace	—
"	0.20	1.8	slight	2.5	—	2.2	—	2.0	—
"	0.50	3.1	1.1	5.0	—	2.6	—	2.5	—
"	1.00	3.4	1.9	5.2	—	3.2	—	2.8	—
"	2.00	3.6	2.8	5.8	—	3.1	—	2.8	—

The authors also give experiments showing the comparative action of ammonia and acids upon the selenides, during a shorter period of time, in the absence of and in the presence of air and hydrogen peroxide.

COPPER SELENATE $CuSeO_4.5H_2O$

EQUILIBRIUM IN THE SYSTEM CUPRIC SELENATE, SELENIC ACID AND WATER AT 25°.

(Macalpine and Sayce, 1932.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$CuSeO_4$	H_2SeO_4		$CuSeO_4$	H_2SeO_4	
15.89	6.0	$CuSeO_4.5H_2O$	2.82	42.55	$CuSeO_4.5H_2O$
13.44	6.16	"	1.98	50.16	"
11.84	11.11	"	1.91	53.46	"
10.09	15.27	"	2.01	54.03	"
7.96	20.25	"	0.97	61.05	$CuSeO_4.3H_2O$
6.79	25.06	"	0.89	62.82	"
5.49	28.28	"	0.70	66.00	"
3.94	35.39	"	trace	70.36	"
3.15	38.96	"	0.0	82.42	"

DIDYMIUM Ammonium NITRATE $Di(NO_3)_3.2NH_4NO_3$.

100 gms. H_2O dissolve 292 gms. of the salt at 15°. (Holmberg, 1907.)

DIDYMIUM SULFATE $Di_2(SO_4)_3$.

SOLUBILITY IN WATER. (Marignac, 1853.)

SO

t°.	Gms. $Di_2(SO_4)_3$ per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. $Di_2(SO_4)_3$ per 100 Gms. H_2O.	Solid Phase.
12	43.1	$Di_2(SO_4)_3$	?	34.0	$Di_2(SO_4)_3.6H_2O$
18	25.8	"	19	11.7	$Di_2(SO_4)_3.8H_2O$
25	20.6	"	40	8.8	"
38	13	"	50	6.5	"
50	11	"	100	1.8	"

DIDYMIUM POTASSIUM SULFATE $K_2SO_4.Di_2(SO_4)_3.2H_2O$. (Marignac.)

100 gms. H_2O dissolve 1.6 grams of the double salt at 18°.

DIDYMIUM SULFONATES.

SOLUBILITY IN WATER. (Holmberg, 1907.)

Salt.	Formula.	t°.	Gms. Anhydrous Salt per 100 Gms. H_2O.
Didymium Benzene Sulfonate	$Di(C_6H_5SO_3)_3.9H_2O$	15	53.1
" *m* Nitro Benzene Sulfonate	$Di(C_6H_4(NO_2)SO_3)_3.6H_2O$	15	47.8
" *m* Chloro " "	$Di(C_6H_4ClSO_3)_3.9H_2O$	15	12.7
" *m* Bromo " "	$Di(C_6H_4BrSO_3)_3.9H_2O$	15	14.3
" Chloro Nitro " "	$Di(C_6H_4Cl(NO_2)SO_3{}^*)_3.16H_2O$	15	25.3
" *α* Naphthalene Sulfonate	$Di(C_{10}H_7SO_3)_3.6H_2O$	15	6.1
" 1.5 Nitro " "	$Di(C_{10}H_6(NO_2)SO_3)_3.6H_2O$	15	0.52
" 1.6 " "	$Di(C_{10}H_6(NO_2)SO_3)_3.9H_2O$	15	0.18
" 1.7 " "	$Di(C_{10}H_6(NO_2)SO_3)_3.9H_2O$	15	1.3

* ($SO_3:NO_2:Cl$ = 1.3.6.)

DYSPROSIUM OXALATE $Dy_2(C_2O_4)_3.10H_2O$

SOLUBILITY OF DYSPROSIUM OXALATE IN AQUEOUS SOLUTIONS OF NITRIC ACID ALONE AND CONTAINNING OXALIC ACID AT 90°.

(Neckers and Kremers,-1928.)

Solvent	t°	Gms. Dy_2O_3 per 100 cc sat. sol.	Solid Phase
Aq. 2.5 normal HNO_3	90	1.8458	$Dy_2(C_2O_4)_3.10H_2O$
" " " " + 5%$(COOH)_2$	90	0.4215	"
" 5.0 " "	90	4.8470	"
" " " " + 5%$(COOH)_2$	90	3.4135	"

DYSPROSIUM OXALATE $Dy_2(C_2O_4)_3.10H_2O$.

100 cc. aq. 20% methylamine oxalate	dissolve 0.276 gm. $Dy_2(C_2O_4)_3$.	(Grant and James, 1917.)	COO
" " ethylamine "	" 1.787 " "		
" " triethylamine "	" 1.432 " "		

DYSPROSIUM Dimethyl PHOSPHATE $Dy[(CH_3)_2PO_4]_3$

SOLUBILITY OF DYSPROSIUM DIMETHYL PHOSPHATE IN WATER.

(Marsh, 1939.)

t°	Gms. $Dy[(CH_3)_2PO_4]_3$ per 100 gms. H_2O	Gms. Dy_2O_3 per liter sat. sol.
0	15.0	52
25	8.24	28.5
50	4.83	16.7

DYSPROSIUM SULFATE $Dy_2(SO_4)_3.8H_2O$

SO

100 gms. H_2O dissolve 5.072 gms. $Dy_2(SO_4)_3.8H_2O$ at 20° and 3.34 gms. at 40°. Jackson and Rienacker, 1930.

ERBIUM OXALATE $Er_2(C_2O_4)_3.14H_2O$.

SOLUBILITY IN AQ. SULFURIC ACID AT 25°.

(Wirth, 1912)

Normality of Aq. H_2SO_4.	Gms per 100 Gms Sat Sol. Er_2O_3	Gms per 100 Gms Sat Sol. $Er_2(C_2O_4)_3$	Solid Phase.
2.16	0.329	0.5144	$Er_2(C_2O_4)_3.14H_2O$
3.11	0.493	0.7708	"
4.32	0.7036	1.10	"
6.175	1.10	1.72	"

ERBIUM NITRATE $Er(NO_3)_3.6H_2O$

100 cc of a sat. solution of $Er(NO_3)_3.6H_2O$ in Ethyl Ether prepared by frequent agitation and allowing to stand over night at about 20°, contain 1.62 gms. Er_2O_3. A saturated solution prepared in the same way with erbium nitrate dehydrated at 150° contains 1.90 gms. Er_2O_3 per 100 cc.

ERBIUM OXIDE Er_2O_3

One liter sat. solution of Erbium Oxide in Water contains 1.28×10^{-6} gm. mols. Er_2O_3 at 29°, determined by electrometric titration.

(Busch, 1927.)

ERBIUM Dimethyl **PHOSPHATE** $Er_2[(CH_3)_2PO_4]_6$.

100 gms. H_2O dissolve 1.78 gm. $Er_2[(CH_3)_2PO_4]_6$ at 25°. (Morgan and James, 1914.)

SOLUBILITY OF ERBIUM DIMETHYL PHOSPHATE IN WATER.
(Marsh, 1939.)

t°	Gms. $Er[(CH_3)_2PO_4]_3$ per 100 gms. H_2O	Gms. Er_2O_3 per liter sat. sol.
0	6.91	24.4
25	3.36	11.9
50	2.03	7.2

These values were obtained by extrapolation from experimental determinations made with a sample containing 85% Er and 15% Yt. The saturated solutions were prepared by stirring the mixture for 3-4 hours at 0°. A portion of this solution was then diluted somewhat and stirred occasionally for 3-4 hours at 25° and at 50°.

ERBIUM SULFATE $Er_2(SO_4)_3.8H_2O$.

SO

SOLUBILITY IN WATER AND AQ. H_2SO_4 AT 25°.
(Wirth, 1912.)

Normality of H_2SO_4.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Normality of H_2SO_4.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
	Er_2O_3.	$Er_2(SO_4)_3$.			Er_2O_3.	$Er_2(SO_4)_3$.	
Water alone	7.339	11.94	$Er_2(SO_4)_3.8H_2O$	2.16	3.98	6.473	$Er_2(SO_4)_3.8H_2O$
0.1	7.389	12.02	"	6.175	0.9352	1.521	"
0.505	6.249	10.164	"	12.6	0.0852	0.1386	"
1.1	5.256	8.549	"				

100 gms. H_2O sat. with Erbium Sulfate dissolve 16.0 gms. $Er_2(SO_4)_3.8H_2O$ at 20° and 6.53 gms. at 40°. (Jackson and Rienacker, 1930.)

ERBIUM Bromonitrobenzene **SULFONATE** $Er(C_6H_3Br.NO_2.SO_3.1.4.2)_3.12H_2O$.

100 gms. sat. solution in water contain 6.056 gms. anhydrous salt at 25°. (Katz and James, 1913.)

EUROPIUM SULFATE $Eu_2(SO_4)_3.8H_2O$

100 gms. H_2O sat. with Europium Sulfate dissolve 2.563 gms. $Eu_2(SO_4)_3.8H_2O$ at 20° and 2.19 gms. at 40°. (Jackson and Rienacker, 1930.)

FERRUM (Iron)) Fe

Experiments upon the solubility of iron in milk made by immersing highly polished 4 x 7.5 cm. strips of steel (18% chromium steel))in raw milk and rocking 46 times per minute for 30 minutes, showed an amount dissolved, as determined by difference in weight of the metal strip, so slight as to be well within the limits of error of the method. (Quam, 1929.)

The percentage solubility of iron in Mercury at 20°, determined by filtering an amalgam of the metal through a sintered glass filter, was found by Irvin and Russell, 1932, to be less than 1×10^{-6}.

FERROUS BROMIDE $FeBr_2.6H_2O$

SOLUBILITY OF FERROUS BROMIDE IN WATER.

(Schimmel, 1929.)

The determinations were made in an atmosphere of carbon dioxide.

t°	Gms. per 100 gms. sat. sol.	Solid Phase	t°	Gms. per 100 gms. sat. sol.	Solid Phase
- 6.1	18.5	Ice	- 1.8	50.3	$FeBr_2.6H_2O$
-10.7	22.8	"	+12.0	52.2	"
-25.0	35.2	"	21.0	53.9	"
-36.5	40.0	"	30.0	55.4	"
-40.0	41.0	"	41.8	57.2	"
-47.0	43.4*	"	46.5	58.0	"
-60	46.5*	"	49.0	58.45	" + $FeBr_2.4H_2O$
-43.6	42.25	" + $FeBr_2.9H_2O$	49.5	58.5	$FeBr_2.4H_2O$
-39	43.1	$FeBr_29H_2O$	52.0	58.6	"
-37	43.5	"	57.0	58.8	"
-34.6	44.1	"	65.0	59.5	"
-30.7	46.25	"	75.0	61.5	"
-29.3	47.65	" + $FeBr_2.6H_2O$	83.0	63.3	" + $FeBr_2.2H_2O$
-28.0	47.7	$FeBr_2.6H_2O$	88.0	63.6	$FeBr_2.2H_2O$
-22.0	48.0	"	100.0	64.8	"
-12.8	48.7	"	116.0	66.6	"
- 9.0	49.4	"	124	68.5	"
- 7.0	49.6	"	132	(b.pt.)70.2	"

EQUILIBRIUM IN THE SYSTEM FERROUS BROMIDE, AMMONIUM BROMIDE AND WATER AT 25°.

(Mercier, 1937.)

The determinations were made in an atmosphere of nitrogen. Numerical results are given only for the two triple points. The following approximate values were estimated from the author's diagram.

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$FeBr_2$	NH_4Br		$FeBr_2$	NH_4Br	
56.0	0.0	$FeBr_2.4H_2O$	30	16.0	NH_4Br
55.1	2.4	" + 1.1.6	20	25.0	"
50.0	6.0	1.1.6	10	34.0	"
47.8	9.0	" + NH_2Br	0	43.5	"
40.0	10.0	NH_4Br			

1.1.6 = $FeBr_2.NH_4Br.6H_2O$

100 cc Pyridine dissolve 0.49 gm. $FeBr_2$ at 25°. (R. Müller, 1924.)

FERRIC FORMATE (Ferric) $Fe_3(OH)_2(HCOO)_7.4H_2O$.

SOLUBILITY IN WATER AND IN ABSOLUTE ALCOHOL.

(Hampshire and Pratt, 1913.)

Solubility in Water.

t°.	Gms. Salt per 100 Gms. H_2O.	Solid Phase.
15	5.08	$Fe_3(OH)_2(HCOO)_7.4H_2O$
20	5.52	"
25	6.10	"
30	6.78	"
35	7.52	"

Solubility in Abs. Alcohol.

t°.	Gms. Salt per 100 Gms. C_2H_5OH.
19	4.59
22	6.25
23	7.62

(The sat. solutions are not stable.)

FERRIC Nitroso β Phenyl **HYDROXYL AMINE** $Fe[C_6H_5.N(NO)O]_2$

One liter of Water dissolves 3.10^{-7} gm. atom (= 0.02 mgm.) of the compound at 18°. (Pinkus and Martin, 1927.)

IRON Benzene **SULFONATE** (Ferrous) and Naphthalene **SULFONATE**.

CH

SOLUBILITY OF EACH IN WATER.

Compound	Formula	t°.	Gms anhydrous cmpd. per 100 cc sat. sol.	Authority.
Ferrous benzene sulfonate..	$Fe(C_6H_5SO_3)_2.6H_2O$	20	9.234	(Ephraim and Pfister, 1925.)
Ferrous naphthalene.2. sulfonate.	$Fe(C_{10}H_7SO_3)_2.6H_2O$	16.5	0.243	(Ephraim and Pfister, 1925 *a*.)

SOLUBILITY OF FERRUM PHENANTHRENE SULFONATES IN WATER AT 20°.

(Sandquist, 1912)

Salt.		Gms. Anhydrous Salt per 100 Gms H_2O.
FERRUM 2-Phenanthrene Monosulfonate	$5H_2O$	0.044
" 3- " "	$5H_2O$	0.20
" 10- " "	$6H_2O$	0.16

FERRUM OLEATE

100 gms. glycerol (d = 1.114) dissolve 0.71 gm. ferrum oleate. (Asselin, 1873.)

FERRIC HELIANTHATE (Ferrous and Ferric).

1000 cc. H_2O dissolve 0.109 gm. $Fe(C_{14}H_{14}N_3SO_3)_2.4H_2O$ (ous salt.) at 20-25°.
" " 0.118 " $Fe(C_{14}H_{14}N_3SO_3)_3.6H_2O$ (ic salt.) "
(Stark and Dehn, 1918.)

CNS **FERRIC THIOCYANATE** $Fe(CNS)_3.3H_2O$.

DISTRIBUTION BETWEEN WATER AND ETHER. (Hantzsch and Vagt, 1901.)

Results at 25°.

Gm Mols Fe(CNS)₃ per Liter.		
H_2O Layer (c).	Ether Layer (c′)	$\frac{c}{c'}$.
0.0202	0.0108	1.87
0.0119	0.0034	3.51
0.0066	0.00093	7.07
0.0035	0.00025	13.95

Results at Several Temperatures.

t°.	Gm Mols Fe(CNS)₃ per Liter.		
	H_2O Layer (c)	Ether Layer (c′)	$\frac{c}{c'}$
0	0.0089	0.0167	0.532
10	0.0127	0.0128	0.995
20	0.0165	0.0091	1.814
30	0.0196	0.0059	3.303
35	0.0207	0.0048	4.32

Results for the effect of HNO_3 upon the distribution at 25° are also given.

Additional results for this system are also given by Wosnessensky, 1923; and Nesterow and Petine, 1931.

FERROUS CARBONATE $FeCO_3$.

100 gms. of a sat. solution of $FeCO_3$ in water at 18° and in contact with CO_2 at a pressure of 1 atmosphere contain 0.072 gm. $FeCO_3$. At a pressure of 56 atmospheres of CO_2, 0.077 gm. $FeCO_3$ are dissolved. (Haehnel, 1924.)

FERROUS CARBONATE $FeCO_3$.

SOLUBILITY OF FERROUS CARBONATE IN AQUEOUS SALT SOLUTIONS, BOTH WITH AND WITHOUT THE PRESENCE OF CARBON DIOXIDE.

(Ehlert and Hempel, 1912.)

(Each mixture was 1000 cc. in volume and was rotated constantly for 24 hours. Temp., probably 5-8°.)

Aqueous Solution of:	Solubility in Presence of CO_2 (2 atmospheres pressure).		Solubility in Absence of CO_2.	
	Gms. Salt per 1000 Gms. H_2O.	Gms. $FeCO_3$ per 1000 cc. Solvent.	Gms. Salt per 1000 Gms. H_2O.	Gms. $FeCO_3$ per 1000 cc. Solvent.
Water alone	0	6.191	...	...
NaCl	...	...	351.2	0.350
$MgCl_2.6H_2O$	86.9	5.840	...	...
"	700	4.555	...	...
"	1150	4.459	...	...
"	1437.5	4.693	...	...
"	1725	5.398	...	...
"	2300	9.052	2300	4.205
$Na_2SO_4.10H_2O$	137.7	7.943	137.7	0.701
"	Sat. at 14°	9.578	Sat. at 14°	0.934
$MgSO_4.7H_2O$	105.3	6.242	105.3	1.467
"	Sat. at 14°	7.392	Sat. at 14°	2.933

CO

FERROUS BICARBONATE $Fe(HCO_3)_2$.

SOLUBILITY OF FERROUS BICARBONATE IN CARBONATED WATER AT 30°.

(Smith, H. J., 1918.)

Pure white ferrous carbonate was prepared by heating to 100° for several days in a steel bottle, an aqueous solution of ferrous sulfate, sodium bicarbonate and carbon dioxide (introduced at 400 lbs. pressure). The crystalline product was similar to the mineral siderite and was probably isomorphous with calcite. Fifty to one hundred gram portions were placed in a two-liter steel bottle, coated on the inside with a mixture of beeswax and Venice turpentine. Water was added and CO_2 introduced through a needle valve from a cylinder of the liquefied gas. The pressure was read on a gauge. The bottle was rotated at constant temperature for several days or until equilibrium was reached. The portion of the saturated solution for analysis was withdrawn through a brass tube attached to the valve on the inside of the bottle and packed with cotton to act as a filter. The filtered portion was received in a tared evacuated flask, containing a few cc. of conc. H_2SO_4. The CO_2 was determined by absorption and the iron by precipitation, resolution, reduction and titration with permanganate. The results show that the decomposition tension of $Fe(HCO_3)_2$ is greater than 25 atmospheres at 25°.

Gms Mols. per Liter.		Gms per Liter.		Gms. Mols. per Liter.		Gms. per Liter.	
H_2CO_3.	$Fe(HCO_3)_2$.	H_2CO_3.	$Fe(HCO_3)_2$.	H_2CO_3	$Fe(HCO_3)_2$.	H_2CO_3.	$Fe(HCO_3)_2$.
0.1868	0.00245	11.58	0.436	0.3294	0.00311	20.43	0.553
0.1985	0.00256	12.31	0.455	0.3745	0.00315	23.23	0.560
0.2168	0.00262	13.45	0.466	0.4046	0.00332	25.09	0.590
0.2327	0.00274	14.43	0.487	0.4750	0.00348	29.45	0.619
0.2960	0.00303	18.35	0.539	0.6600	0.00402	40.93	0.715
0.3116	0.00304	19.32	0.541	0.7154	0.00418	44.36	0.744
0.3153	0.00318	19.55	0.566	0.7600	0.00434	47.13	0.772

FERROUS OXALATE $FeC_2O_4.2H_2O$

SOLUBILITY IN WATER DETERMINED BY ELECTROLYTIC CONDUCTIVITY.

t°	Milligrams FeC_2O_4 per liter sat. sol.	Solid Phase	Authority
18	35.3	$FeC_2O_4.2H_2O$	Scholder, Gadenne and Niemann, 1927.
25	77.5	"	Schafer, 1905.

FERROUS CHLORIDE $FeCl_2.4H_2O$

SOLUBILITY OF FERROUS CHLORIDE IN WATER IN AN ATMOSPHERE OF CARBON DIOXIDE.

(Schimmel, 1928.)

Cl

t°	Gms. $FeCl_2$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $FeCl_2$ per 100 gms. sat. sol.	Solid Phase
- 9.0	14.5	Ice	+ 1.5	33.6	$FeCl_2.6H_2O$
-11.6	17.0	"	5.0	34.05	"
-13.3	17.7	"	8.0	36.7	"
-22.5	23.3	"	12.3	37.6	" + $FeCl_2.4H_2O$
-29.0	26.6	"	16.0	38.0	$FeCl_2.4H_2O$
-35.0	29.8	"	20.5	38.6	"
-38.0	30.85*	"	25.0	39.2	"
-40.0	31.8*	"	36.2	40.4	"
-43.5	33.1*	"	52.0	42.6	"
-50.0	35.5*	"	63.0	44.4	"
-36.5	30.4	" + $FeCl_2.6H_2O$	70.5	45.8	"
-20.0	31.0	$FeCl_2.6H_2O$	76.5	47.4	" + $FeCl_2.2H_2O$
-11.0	31.7	"	86.0	47.7	$FeCl_2.2H_2O$
- 6.8	32.1	"	96	48.3	"
- 3.0	32.6	"	117.5	50.4	"

* Metastable

100 gms. sat. sol. of Ferrous Chloride in Water contain 39.82 gms. $FeCl_2$ at 22.8° and 42.8 gms. at 43.2°. (Boecke, 1911.)

SOLUBILITY OF THE SALT PAIR $FeCl_3.CsCl$ IN WATER AT 21°.

(Hinrichsen and Sachsel, 1904-05.)

Gms. Used.		Gms. per 100 Gms. Solution.		Gms. Mols. per 100 Mols. H_2O.		Solid Phase.
$FeCl_3$.	CsCl.	$FeCl_3$.	CsCl.	$FeCl_3$.	CsCl.	
0	65	0	65	0	6.95	CsCl
0.6	11.6	0.45	55.18	0.05	5.9	$FeCl_3.3CsCl.H_2O$
1.4	10.2	2.1	52.38	0.23	5.6	"
2.2	8.8	5.24	51.44	0.57	5.5	"
2	7.4	7.8	47.70	0.86	5.1	$FeCl_3.2CsCl\ H_2O$
3.8	6	8.93	41.15	0.99	4.4	"
4.6	4.6	15.34	25.25	1.70	2.7	"
5.4	2.8	21.65	14.96	2.40	1.6	"
6.2	1.4	27.96	8.42	3.10	0.9	"
35	0.2	48.71	0.94	5.40	0.1	"
35	0	83.89	0	9.3	0	$FeCl_3$

SOLUBILITY OF IRON CHLORIDE (FERRIC) Fe_2Cl_6, IN WATER.

(Roozeboom — Z. physik. Chem 10, 477, '92.)

t°.	Mols. Fe_2Cl_6 per 100 Mols. H_2O.	Gms. $FeCl_3$ per 100 Gms. H_2O.	Gms. $FeCl_3$ per 100 Gms. Solution.
Solid Phase, $Fe_2Cl_6.12H_2O$.			
−55	2.75	49.52	33.12
−27	2.98	53.60	34.93
0	4.13	74.39	42.66
+20	5.10	91.85	47.88
30	5.93	106.8	51.64
37	8.33	150.0	60.01
30	11.20	201.7	66.85
20	12.83	231.1	69.79
8	13.7	246.7	71.15
Solid Phase, $Fe_2Cl_6.7H_2O$.			
20	11.35	204.4	67.14
32	13.55	244.0	70.92
30	15.12	272.4	73.13
25	15.54	280.0	73.69
Solid Phase, $Fe_2Cl_6.5H_2O$.			
12	12.87	231.8	69.87
27	14.85	267.5	72.78
Solid Phase, $Fe_2Cl_6.5H_2O$ (con.).			
35	15.64	281.6	73.79
50	17.50	315.2	75.91
55	19.15	344.8	77.52
55	20.32	365.9	78.54
Solid Phase, $Fe_2Cl_6.4H_2O$.			
50	19.96	359.3	78.23
55	20.32	365.9	78.54
60	20.70	372.8	78.86
69	21.53	387.7	79.50
73.5	25.0	450.2	81.81
70	27.9	502.4	83.41
66	29.2	525.9	84.03
Solid Phase, Fe_2Cl_6.			
66	29.2	525.9	84.03
75	28.92	511.4	83.66
80	29.20	525.9	84.03
100	29.75	535.8	84.26

C1

A theoretical discussion of the system ferric chloride, ferric oxide and water, especially of the phase diagram above 400°, is given by Baur, 1926.

RESULTS FOR THE SYSTEM FERRIC OXIDE, HYDROCHLORIC ACID, WATER AT 25°.

(Cameron and Robinson, 1907.)

(Excess of ferric hydroxide was added to aq. ferric chloride solutions and agitated for 3 months.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
Fe_2O_3.	HCl.			Fe_2O_3.	HCl.	
34.61	59.88	$FeCl_3.HCl.2H_2O$	1.485	21.84	29.33	$FeCl_3.6H_2O$+ $Fe_2O_3.xHCl.H_2O$
33.27	60.23	"	1.349	16.82	22.55	$Fe_2O_3.xHCl.H_2O$
32.78	54.71	" + $FeCl_3$	1.321	15.83	21.10	"
31.95	58.20	$FeCl_3$+$FeCl_3.2H_2O$	1.284	14.62	19.53	"
34.42	54.12	$FeCl_3.2H_2O$	1.242	12.59	16.61	"
35.22	59.28	"	1.220	11.76	15.28	"
34.07	55.71	"	1.195	10.56	13.76	"
34.21	55.47	" +$FeCl_3.2\frac{1}{2}H_2O$	1.158	8.60	11.24	"
34.44	51.11	$FeCl_3.3\frac{1}{2}H_2O$+ "	1.115	6.47	8.39	"
33.04	46.72	" +$FeCl_3.6H_2O$	1.070	4.04	5.36	"
24.42	33.40	$FeCl_3.6H_2O$	1.047	2.85	3.66	"

SOLUBILITY OF FERRIC CHLORIDE IN AQUEOUS HYDROCHLORIC ACID SOLUTIONS AT DIFFERENT TEMPERATURES.

(Roozeboom and Schreinemaker — Z. physik. Chem. 15, 633, '94.)

Mols. per 100 Mols. H_2O.		Gms. per 100 Gms. H_2O.		Solid Phase.
HCl.	$FeCl_3$	HCl.	$FeCl_3$.	
Results at 0°.				
0	8.25	0	74.30	$Fe_2Cl_6.12H_2O$
7.52	6.51	15.22	58.62	
13.37	6.33	27.06	57.01	
16.80	8.70	33.99	78.34	
18.45	10.23	37.34	92.10	
20.40	15.40	41.28	138.7	
20.10	16.00	40.67	144.1	
19.95	17.70	40.37	159.4	
19.00	22.75	38.45	204.8	
18.05	23.41	36.53	210.8	
18.05	23.40	36.53	210.8	$Fe_2Cl_6.7H_2O$
17.50	25.93	39.55	233.5	
24.12	30.04	48.81	270.5	$Fe_2Cl_6.5H_2O$
26.00	32.16	52.60	289.6	
26.00	32.16	52.60	289.6	$Fe_2Cl_6.4H_2O$
34.60	38.11	70.01	343.2	
37.27	36.60	75.41	329.6	$Fe_2Cl_6.2HCl + 4H_2O$
34.60	38.11	70.01	343.2	
Results at 25°				
0.0	10.90	0.0	98.15	$Fe_2Cl_6.12H_2O$
2.33	23.72	4.715	213.6	
0.0	24.5	0.0	220.7	
0.0	23.5	0.0	211.6	$Fe_2Cl_6.7H_2O$
2.33	23.72	4.715	213.4	
7.50	29.75	15.18	267.9	
0.0	31.50	0.0	283.6	
Results at 25° (con.).				
0.0	29.00	0.0	261.1	$Fe_2Cl_6.5H_2O$
7.5	29.75	15.18	267.9	
19.5	35.25	39.46	317.4	
19.5	35.25	39.46	317.4	$Fe_2Cl_6.4H_2O$
20.6	35.34	41.68	318.3	
31.34	41.58	63.42	374.4	
33.00	43.00	66.77	387.3	
34.65	44.80	70.11	403.4	
40.41	40.25	81.77	362.4	$Fe_2Cl_6.2HCl + 4H_2O$
39.03	41.38	78.98	372.7	
35.74	45.24	72.33	407.4	
Results at 40°.				
0	32.4	0.0	291.7	$Fe_2Cl_6.5H_2O$
13.4	37.45	27.11	337.3	
13.4	37.45	27.11	337.3	$Fe_2Cl_6.4H_2O$
27.0	50.80	54.64	457.5	
0	58.0	0.0	522.3	Fe_2Cl_6
27	50 8	54.64	457.5	
42.01	48.64	85.00	438 0	
42.50	47.52	86.72	428.0	$Fe_2Cl_6.2HCl + 4H_2O$
42.01	48.64	85.00	438.0	

Cl

Results for other temperatures are also given in the original paper.

EQUILIBRIUM IN THE SYSTEM FERRIC CHLORIDE, ANILINE HYDROCHLORIDE, HYDROCHLORIC ACID AND WATER AT 25°.

(Osaka, Shima and Yoshida, 1924)

The mixtures were constantly rotated at 25°. Both the liquid phase and the solid residues were analyzed.

Gms. per 100 gms. sat. sol.			Solid Phase
$C_6H_5NH_2HCl$	$FeCl_3$	HCl	
11.29	0.20	21.20	–
12.46	0.49	19.57	–
10.77	0.11	21.64	–
8.94	1.35	19.41	–
7.11	0.69	22.48	–
5.85	1.10	23.87	–
5.05	1.86	22.03	–
4.61	3.01	22.28	–
3.99	3.35	23.04	–
4.05	3.58	22.35	–
5.59	6.37	19.17	–
3.44	6.31	22.36	–
22.78	0.0	11.08	$FeCl_3.6C_6H_5NH_2.HCl$
20.24	1.29	11.78	"
18.09	1.03	13.02	"
19.59	1.31	12.08	"
17.19	2.82	11.88	"
13.81	5.18	11.32	$FeCl_3.6C_6H_5NH_2.HCl$
10.92	8.51	10.82	"
8.85	8.83	12.66	"
7.06	12.12	11.44	"
7.09	14.30	10.21	"
5.29	16.06	11.69	"
4.49	18.16	11.91	"
3.96	19.95	11.49	"
3.57	21.50	12.89	-
3.45	22.84	11.22	-
3.47	23.82	10.21	-
2.58	23.36	12.96	$FeCl_3.2C_6H_5NH_2.HCl$
2.10	25.59	12.48	"
2.07	26.20	12.53	"
1.77	28.61	11.71	"
1.35	33.10	10.98	"
1.57	35.17	7.22	–
1.34	36.24	7.52	

Data for the System $FeCl_3$ + HCl + KCl + H_2O at 25° are given by Malquori, 1929.

EQUILIBRIUM IN THE SYSTEM FERRIC CHLORIDE, POTASSIUM CHLORIDE AND WATER AT SEVERAL TEMPERATURES.

(Malquori, 1928a.)

Results at 0°

Gms. per 100 gms. sat. sol. KCl	Gms. per 100 gms. sat. sol. $FeCl_3$	Solid Phase
0.0	42.66	Fe6
1.07	42.53	" + 1.2.2
2.85	38.55	1.2.1
6.03	35.67	" + MC
6.18	38.12	MC
6.14	33.54	"
6.22	28.85	"
6.73	25.78	"
7.54	23.25	"
10.19	16.38	"
21.60	0.0	KCl

Results at 25°

Gms. per 100 gms. sat. sol. KCl	Gms. per 100 gms. sat. sol. $FeCl_3$	Solid Phase
0.0	49.76	Fe6
1.22	49.33	" + 1.2.1
2.01	47.27	1.2.1

Results at 25° (Con.)

Gms. per 100 gms. sat. sol. KCl	Gms. per 100 gms. sat. sol. $FeCl_3$	Solid Phase
5.65	43.02	1.2.1
10.29	38.02	"
11.97	35.88	" + KCl
12.26	27.27	KCl
14.99	22.14	"
17.40	14.90	"
26.02	0.0	"

Results at 35°

Gms. per 100 gms. sat. sol. KCl	Gms. per 100 gms. sat. sol. $FeCl_3$	Solid Phase
0.0	73.79	Fe_25
1.65	73.03	" + 1.2.1
2.21	65.81	1.2.1
2.35	57.53	"
3.52	49.57	"
5.05	45.94	"
8.60	40.25	"

Results at 35° (Con.)

Gms. per 100 gms. sat. sol. KCl	Gms. per 100 gms. sat. sol. $FeCl_3$	Solid Phase
13.81	36.02	1.2.1 + KCl
13.11	34.44	KCl
14.02	29.21	"
16.82	20.12	"
20.21	10.91	"
27.80	0.0	"

Results at 60°

Gms. per 100 gms. sat. sol. KCl	Gms. per 100 gms. sat. sol. $FeCl_3$	Solid Phase
0.0	78.80	Fe2
1.90	77.13	" + 1.2.1
2.25	74.08	1.2.1
3.10	61.70	"
4.90	53.98	"
14.41	36.78	" + KCl
16.30	28.73	KCl
31.30	0.0	"

Fe6 = $FeCl_3.6H_2O$; 1.2.1 = $FeCl_3.2KCl.H_2O$; Fe_25 = $Fe_2Cl_6.5H_2O$; Fe2 = $FeCl_3.2H_2O$; MC = Mixed Crystals.

Cl

Data for the systems $FeCl_2$ + $MgCl_2$ + KCl + H_2O at 22.8° and for $FeCl_3$ + KCl + NaCl are given by Boeke, 1911.

SOLUBILITY OF THE SALT PAIR $FeCl_3$.KCl IN WATER AT 21°.

(Hinrichsen and Sachsel, 1904-05.)

Gms. Used.		Gms. per 100 Gms. Solution		Gms. Mols per 100 Mols H_2O.		Solid Phase.
$FeCl_3$.	KCl.	$FeCl_3$.	KCl	$FeCl_3$.	KCl.	
0	35	0	34.97	0	8.45	KCl
13	28	13.44	24.45	1.49	5.90	Mix Crystals
18	21	23.18	16.54	2.57	3.99	"
23	18.5	28.05	11.69	3.11	2.82	"
28	16	35.72	11.68	3.96	2.82	"
31	10.5	36.62	11.19	4.06	2.70	$FeCl_3.2KCl.H_2O$
36.2	9	37.35	13.67	4.14	3.30	"
46.5	6	51.69	7.54	5.73	1.82	"
155	0	83.89	0	9.3	0	$FeCl_3$

SOLUBILITY OF FERRIC CHLORIDE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE AT 15°.

(Roozeboom — Z. physik. Ch. 10, 148, '92.)

Mols. per 100 Mols. H_2O.		Grams per 100 Gms. H_2O.		Solid Phase.
NH_4Cl.	$FeCl_3$.	NH_4Cl.	$FeCl_3$.	
0.0	9.30	0.0	83.88	$Fe_2Cl_6.12H_2O$
1.09	9.57	3.24	86.32	"
1.36	9.93	4.03	91.61	$Fe_2Cl_6.12H_2O$ + Double Salt
2.00	9.27	5.92	83.64	Double Salt
2.79	8.71	8.31	78.77	"
4.05	8.09	12.08	73.20	"
6.41	7.18	19.12	64.83	"
10.78	6.21	32.04	56.00	"
7.82	6.75	23.21	60.83	Mixed Crystals containing 7.29% $FeCl_3$
7.62	5.94	22.63	53.47	" " 5.55 "
7.70	5.03	22.90	45.42	" " 4.4 "
7.81	4.34	23.23	39.13	" " 3.8 "
8.52	2.82	25.33	25.43	" " 1.64 "
10.95	0.68	32.55	6.15	" " 0.31 "
11.88	0.0	35.30	0.0	NH_4Cl

C1

SOLUBILITY OF FERRIC CHLORIDE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE AT 25°, 35°, AND 45°.

(Mohr — Z. physik. Chem. 27, 197, '98.)

Results at 25°.		Results at 35°.		Results at 45°.		
Mols. per 100 Mols. H_2O.		Mols. per 100 Mols. H_2O.		Mols. per 100 Mols. H_2O.		Solid Phase in Each Case.
NH_4Cl.	$FeCl_3$.	NH_4Cl.	$FeCl_3$.	NH_4Cl.	$FeCl_3$.	
0	10.98	0	13.36	0.0	33.4	$Fe_2Cl_6.12H_2O$ ($5.H_2O$ at 45°)
1.57	10.74	1.41	13.05	...	...	Hydrate + Double Salt
2.48	9.02	3.08	9.28	4.08	9.58	Double Salt
5.28	7.73	6.98	7.64	...	...	"
9.59	6.77	10.76	6.70	13.09	6.31	"
9.83	6.70	11.60	6.52	13.54	6.28	Double Salt + Mixed Crystals
9.65	6.07	12.28	6.08	12.91	5.49	Mixed Crystals
9.93	5.23	11.57	3.98	13.49	4.84	"
9.92	3.97	11.89	3.38	13.46	4.99	"
10.31	2.05	13.23	1.38	...	...	"
13.30	0.0	14.79	0.0	16.28	0.0	NH_4Cl

THE SYSTEM AMMONIUM CHLORIDE + FERRIC CHLORIDE + WATER.

(Clendinnen, 1923.)

Results at 25°.

$d_{\frac{25}{4}}$ of sat. sol.	Gms. per 100 gms. sat. sol. NH_4Cl.	Gms. per 100 gms. sat. sol. $FeCl_3$.	Solid Phase.
1.132	24.14	7.64	Mixed crystals Series AB
1.177	21.19	13.26	
1.228	18.54	19.27	
1.327	16.05	28.97	
1.358	16.63	30.45	B and C
1.356	15.59	31.61	Mixed crystals Series CD
1.369	13.41	33.46	
1.412	8.70	38.10	
1.455	5.13	42.82	
1.513	2.93	47.63	
1.536	2.29	49.50	$D+FeCl_3.6H_2O$
1.525	1.30	48.80	$FeCl_3.6H_2O$

Results at 60°.

$d_{\frac{60}{4}}$ of sat. sol.	Gms. per 100 gms. sat. sol. NH_4Cl.	Gms. per 100 gms. sat. sol. $FeCl_3$.	Solid Phase.
1.133	31.37	7.75	Mixed crystals Series AB
1.268	25.40	22.95	
1.298	24.73	25.78	B and C
1.310	22.49	27.47	Mixed crystals Series CD
1.418	10.57	39.20	
1.534	4.56	53.10	
1.639	8.85	65.08	
1.643	9.50	65.30	$D + NH_4Cl.FeCl_3$
1.629	8.57	65.70	$NH_4Cl.FeCl_3$
1.677	3.78	69.47	
1.745	1.57	75.37	
1.793	0.40	77.36	$NH_4Cl.4FeCl_3.6H_2O$
–	0.18	78.20	» $+FeCl_3.2H_2O$
1.798	0.00	78.42	$FeCl_3.2H_2O$

The existence of the alleged compound $2NH_4Cl.FeCl_3.H_2O$ has not been confirmed, but a series of mixed crystals with narrow limits, the members of which approximate this compound, has been found.

Cl

THE SYSTEM AMMONIUM CHLORIDE + FERROUS CHLORIDE + WATER AT 70°.

(Clendinnen, 1922.)

d of sat. sol.	Gms. per 100 gms. sat. sol. NH_4Cl.	Gms. per 100 gms. sat. sol. $FeCl_2$.	% NH_4Cl in mixed crystals (extrapolated).	d of sat. sol.	Gms. per 100 gms. sat. sol. NH_4Cl.	Gms. per 100 gms. sat. sol. $FeCl_2$.	% NH_4Cl in mixed crystals (extrapolated).
1.162	31.39	9.52	86.0	1.475	7.28	40.72	31.6
1.260	24.24	19.78	69.3	1.479	6.72	41.37	26.5
1.307	19.97	25.22	50.9	1.485	6.28	41.98	24.1
1.338	17.04	28.38	43.6	1.520	4.19	44.71	18.0
1.362	14.99	30.53	40.0	–	2.69	46.42	8.0
1.420	10.23	36.05	37.1	1.533	1.33	46.66	$FeCl_2.4H_2O$

Additional determinations for this System at 25°, in the region of mixed crystal formation are given by Benrath and Schackmann, 1935.

SOLUBILITY OF THE SALT PAIR $FeCl_3.NaCl$ IN WATER AT 21°.

(Hinrichsen and Sachsel, 1904–05.)

Gms. Used. $FeCl_3$.	Gms. Used. NaCl.	Gms. per 100 Gms. Solution. $FeCl_3$.	Gms. per 100 Gms. Solution. NaCl.	G. Mols. per 100 Mols. H_2O. $FeCl_3$.	G. Mols. per 100 Mols. H_2O. NaCl.	Solid Phase.
0	3.6	0	36.10	0	11.2	NaCl
1.8	3	24.27	9.10	2.69	2.8	Mix Crystals
3.6	2.5	25.40	8.45	2.81	2.6	"
5.5	2	26.40	5.25	2.93	2.54	"
7.2	1.5	38.15	3.90	4.23	1.22	"
9	1	45.38	2.45	5.03	0.75	"
10.8	0.5	46.75	2.11	5.18	0.65	"
10.8	0	83.39	0	9.3	0	$FeCl_3$

EQUILIBRIUM IN THE SYSTEM FERROUS CHLORIDE, NICKEL CHLORIDE AND WATER AT 25° IN AN ATMOSPHERE OF CO_2.

(Osaka and Yaginuma, 1927.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$FeCl_2$	$NiCl_2$		$FeCl_2$	$NiCl_2$	
39.61	0.0	$FeCl_2.4H_2O$	21.56	19.42	Solid Solution
35.26	4.44	Solid Solution	16.25	24.03	"
29.82	10.52	" "	9.26	30.68	"
22.72	17.61	" "	0.0	38.88	$NiCl_2.6H_2O$

$FeCl_2.4H_2O$ is sat. when 10.6 percent of the Fe is replaced by Ni and $NiCl_2.6H_2O$ is sat. when 65.6 percent of Ni is replaced by Fe. The liquid solution in equilibrium with the two sat. solid solutions contains 21.6 percent $FeCl_2$ and 19.30 percent $NiCl_2$.

EQUILIBRIUM IN THE SYSTEM FERRIC CHLORIDE, NICKEL CHLORIDE AND WATER AT 25°.

(Osaka and Yaginuma, 1928.)

Cl

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$FeCl_3$	$NiCl_2$		$FeCl_3$	$NiCl_2$	
49.42	0.0	$FeCl_3.6H_2O$	37.47	11.81	$NiCl_2.4H_2O$
46.08	4.37	"	31.35	16.43	"
43.39	6.80	"	29.77	18.11*	"
41.01	10.01	"	26.41	19.80	" + $NiCl_2.6H_2O$.
46.24	7.33*	$NiCl_2.4H_2O$	22.68	22.21	$NiCl_2.6H_2O$
42.22	9.89*	"	10.24	30.89	"
40.63	10.71	" + $FeCl_3.6H_2O$	0.0	38.88	"

* Metastable

DISTRIBUTION OF FERRIC CHLORIDE BETWEEN WATER AND ETHER AT 18°.

(Mylius, 1911.)

One-gram portions of iron as chloride were dissolved in 100 cc. of aq. HCl of different concentrations and shaken with 100 cc. of ether in each case. The percentage of iron in the ethereal layer was determined after separation of the two layers.

Per cent conc. of Aq. HCl	1	5	10	15	20
Per cent of Iron Extracted by Ether	(0.01)	0.1	8	92	99

DISTRIBUTION OF FERRIC CHLORIDE BETWEEN WATER AND ETHYL ETHER AT 18°.

(De Kolossowsky, 1925.)

Gm. mols. $FeCl_3$ per liter		Gm. mols. $FeCl_3$ per liter		Gm. mols. $FeCl_3$ per liter	
H_2O layer.	$(C_2H_5)_2O$ layer.	H_2O layer.	$(C_2H_5)_2O$ layer.	H_2O layer.	$(C_2H_5)_2O$ layer.
1.017	0.00216	1.624	0.0163	2.455	0.888
1.100	0.00259	1.907	0.0617	2.389	0.868
1.217	0.00382	2.062	0.110	2.432	0.925
1.404	0.0048	2.158	0.313	2.833	1.281
1.420	0.0068	2.210	0.579	2.873	1.371
1.515	0.0080	2.213	0.704	3.581	1.939
1.504	0.0117	2.442	0.837		

100 gms. sat. sol. of ferric chloride in selenium oxychloride ($SeOCl_2$) contain 23.4 gms. $FeCl_3$ at 25°.
(Wise, 1923.)

SOLUBILITY OF FERRIC CHLORIDE IN METHYL AND ETHYL ALCOHOLS.

(Lloyd, Brown, Glynwyn, Bonnel and Jones, 1928.)

At ordinary temperatures and more rapidly at higher temperatures ferric chloride reacts with methyl and with ethyl alcohol, hence solubility values for it can be accepted only with reserve.

Results for Methyl Alcohol

t°	Gms. $FeCl_3$ per 100 gms. CH_3OH
0	131
15	143
30	161

Results for Ethyl Alcohol

t°	Gms. $FeCl_3$ per 100 gms. C_2H_5OH	Solid Solid Phase
0	136	$FeCl_3.2C_2H_5OH$
15	141	"
20.6	144 (199)	"
30	149 (203)	"
40	155 (207)	"
50	176	"

The results in parentheses are for solutions in contact with $FeCl_3$

100 gms. U.S.P. Ethyl Alcohol ($d\frac{25}{40}$ 0.8063 = 93.6 Wt.%) dissolve 51.43 gms. $FeCl_3$ at 25°. (Schnellbach and Rosin, 1931.)

100 gms. abs. acetone dissolve 62.9 gms. $FeCl_3$ at 18°. (Naumann, 1904.)

100 gms. anhydrous lanolin (m. pt. about 46°) dissolve 4.17 gms. $FeCl_3$ at 45°. (Klose, 1907.)

FERROUS and FERRIC CHLORIDE Cl

Fusion-point data are given for the following mixtures.

$FeCl_2$ + $MnCl_2$ (Ferrari, Celeri and Giorgi, 1929.)
" + $PbCl_2$ (Ferrari and Colla, 1933.)
" + $SnCl_2$ (" ")
" + $SrCl_2$ (Ferrari and Inganni, 1930.)
" + $ZnCl_2$ " "
$FeCl_3$ + $PbCl_2$ (Herrmann, 1911.)
" + $ZnCl_2$ " "
" + TlCl (Scarpa, 1912.)

FERROUS Per CHLORATE $Fe(ClO_4)_2.6H_2O$

SOLUBILITY OF FERROUS PERCHLORATE IN WATER IN AN ATMOSPHERE OF NITROGEN. ClO

(Lindstrand, 1936.)

t°	d of sat. sol.	Gms. $Fe(ClO_4)_2$ per 100 gms. sat. sol.	Solid Phase	t°	d of sat. sol.	Gms. $Fe(ClO_4)_2$ per 100 gms. sat. sol.	Solid Phase
0	1.543	63.39	$Fe(ClO_4)_2.6H_2O$	42	1.569	71.05	$Fe(ClO_4)_2.6H_2O$
20	1.560	66.93	"	45	1.571	71.55	"
25	1.565	67.76	"	50	1.574	72.19	"
30	1.569	68.67	"	55	1.577	72.84	"
35	1.573	69.48	"	60	1.580	73.49	"
40	1.577	70.34	"				

Although there is a slight break in the curve at 42 an analysis showed no alteration in the solid phase.

100 gms. of a saturated solution of Ferrous Perchlorate in Ethyl Alcohol contain 67.2 gms. $Fe(ClO_4)_2$ at 20°, d of the sat. sol. = 1.290. (Lindstrand, 1936.)

SOLUBILITY OF FERROUS PERCHLORATE IN AQUEOUS SOLUTIONS OF PERCHLORIC ACID AT 20°.

(Lindstrand, 1936.)

Mols. $HClO_4$ per liter sat. sol.	d. of sat. sol.	Gms. $Fe(ClO_4)_2$ per 100 gms. sat. sol.	Mols. $HClO_4$ per liter sat. sol.	d. of sat. sol.	Gms. $Fe(ClO_4)_2$ per 100 gms. sat. sol.
0.0	1.554	67.18	7.98	1.509	1.70
2.45	1.551	46.48	9.30	1.553	1.14
4.69	1.477	26.21	10.24	1.616	1.21
5.90	1.457	15.18	11.06	1.654	1.56
7.01	1.455	6.40			

The solid phase is $Fe(ClO_4)_2 \cdot 6H_2O$ in all cases.

FERRIC Per **CHLORATE** $Fe(ClO_4)_3 \cdot 10H_2O$.

SOLUBILITY OF FERRIC PERCHLORATE IN WATER.

(Lindstrand, 1936.)

ClO

t°	d. of sat. sol.	Gms. $Fe(ClO_4)_3$ per 100 gms. sat. sol.	Solid Phase	t°	d. of sat. sol.	Gms. $Fe(ClO_4)_3$ per 100 gms. sat. sol.	Solid Phase
0	1.613	74.32	$Fe(ClO_4)_3 \cdot 10H_2O$	42	1.688	83.19	$Fe(ClO_4)_3 \cdot 10H_2O$
20	1.649	78.64	"	45	1.693	83.76	$Fe(ClO_4)_3 \cdot 9H_2O$
25	1.656	79.86	"	50	1.700	85.50	"
30	1.666	80.84	"	55	1.707	87.07	"
35	1.676	81.78	"	60	1.714	88.53	"
40	1.684	82.70	"				

100 gms. sat. solution of Ferric Perchlorate in Ethyl Alcohol contain 71.3 gms. $Fe(ClO_4)_3$ at 20°; d of sat. sol = 1.359. (Lindstrand, 1936.)

SOLUBILITY OF FERRIC PERCHLORATE IN AQUEOUS SOLUTIONS OF PERCHLORIC ACID AT 20°.

(Lindstrand, 1936.)

d. of sat. sol.	Gm. Mols. $HClO_4$ per liter sat. sol.	Gm. Mols. $Fe(ClO_4)_3$ per liter sat. sol.	Gms. $Fe(ClO_4)_3$ per 100 gms. sat. sol.	Solid Phase
1.649	0.0	2.427	78.64	$Fe(ClO_4)_3 \cdot 10H_2O$
1.629	1.72	1.971	64.65	"
1.611	3.11	1.589	52.73	"
1.597	3.81	1.400	46.83	"
1.590	4.65	1.179	39.64	"
1.559	6.15	0.772	20.47	"
1.563	7.76	0.343	11.72	"
1.579	9.19	0.127	4.25	$Fe(ClO_4)_3 \cdot 9H_2O$
1.626	10.57	0.084	2.67	"
1.713	11.10	0.066	1.99	"
1.766	13.35	0.025	0.73	"

FERRIC Hexa Antinvrine Per **CHLORATE** $[Fe(COC_{10}H_{12}N_2)_6](ClO_4)_3$

100 cc sat. solution of the Salt in Water at 20° contain 0.24 gm. $[Fe(COC_{10}H_{12}N_2)_6](ClO_4)_3$. (Wilke-Dörfurt and Schliephake, 1929.)

FERROUS Hexa Antipyrine Per **CHLORATE** $[Fe(COC_{10}H_{12}N_2)_6](ClO_4)_2$

100 cc sat. solution of the Salt in Water at 20° contain more than 7.0 gms. $[Fe(COC_{10}H_{12}N_2)_6](ClO_4)_2$. Due to the rapid oxidation of the compound the value is only approximate. (Wilke-Dörfurt and Schliephake, 1929.)

FERRIC Hexa Antipyrine Bi**CHROMATE** $[Fe(COC_{10}H_{12}N_2)_6](Cr_2O_7)_3$

100 cc sat. solution of the compound in Water contain 0.6 gm. $[Fe(COC_{10}H_{12}N_2)_6](Cr_2O_7)_3$ at 20°. (Wilke-Dorfurt and Mureck, 1929.)

FERRIC FLUORIDE FeF_3

F

100 cc sat. solution of Ferric Fluoride in Water contain 0.091 gm. FeF_3 at 25°. (Carter, 1918.)

FERRIC Hexa Antipyrine Boro **FLUORIDE** $[Fe(COC_{10}H_{12}N_2)_6](BF_4)_3$

100 cc sat. solution of Ferric Hexa Antipyrine Borofluoride in Water contain 0.7 gm. $[Fe(COC_{10}H_{12}N_2)_6](BF_4)_3$ at 20°. (Wilke-Dörfurt and Mureck, 1929.)

FERRIC IODATE $Fe(IO_3)_3$

IO

SOLUBILITY OF THE TWO MODIFICATIONS OF FERRIC IODATE IN WATER.

(v. Endrédy, 1934.)

t°	Gm. Mols. $Fe(IO_3)_3$ per liter sat. sol.	Solid Phase
20	6.2×10^{-4}	α Modification
20	5.7×10^{-4}	β "

IRON NITRATE (Ferrous) $Fe(NO_3)_2.6H_2O$.

SOLUBILITY IN WATER.

(Funk, 1900.)

NO

t°.	Gms. $Fe(NO_3)_2$ per 100 Gms. Sol.	Mols. $Fe(NO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Fe(NO_3)_2$ per 100 Gms. Sol.	Mols. $Fe(NO_3)_2$ per 100 Mols H_2O	Solid Phase.
−27	35.66	5.54	$Fe(NO_3)_2.9H_2O$	−9	39.68	6.57	$Fe(NO_3)_2.6H_2O$
−21.5	36.10	5.64	"	0	41.53	7.10	"
−19	36.56	5.76	"	18	45.14	8.23	"
−15.5	37.17	5.91	"	24	46.51	8.70	"
				60.5	62.50	16.67	"

Density of solution saturated at 18° = 1.497.

FERRIC NITRATE $Fe(NO_3)_3.9H_2O$.

SOLUBILITY OF FERRIC NITRATE IN WATER.

(Malquori, 1927(e)(f), 1929(a).)

t°	Gms. $Fe(NO_3)_3$ per 100 gms. sat. sol.	Solid Phase
0	40.15	$Fe(NO_3)_3.9H_2O$
25	46.57	"
40	51.18	"

FERRIC NITRATE $Fe(NO_3)_3.9H_2O$

EQUILIBRIUM IN THE SYSTEM, FERRIC OXIDE, NITRIC ACID AND WATER AT 25°.

(Cameron and Robinson, 1909.)

Solutions of ferric nitrate of varying concentrations were shaken with freshly precipitated ferric hydroxide at const. temp., 25°, for 4 months. The acid branch of the curve was studied in a similar manner by starting with ferric nitrate and various concentrations of nitric acid. No definite basic nitrates of iron were formed.

d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.	d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
	Fe_2O_3.	N_2O_5.			Fe_2O_3.	N_2O_5.	
1.032	1.78	2.21	$Fe_2O_3.mN_2O_5.nH_2O$	1.452	12.14	33.5	$Fe_2O_3.3N_2O_5.18H_2O$
1.079	3.99	5.61	"	1.434	9.95	36.3	"
1.127	5.79	9	"	1.417	7.25	40.3	"
1.177	7.22	12.31	"	1.404	5.02	47.5	"
1.264	9.70	16.60	"	1.428	3.55	51.5	"
1.368	12.48	22.70	"	1.450	4.51	52	"
1.435	14.62	28.13	"	1.465	4.49	55.2	"
1.498	15.40	29.52	"	1.407	3.93	47.2	$Fe_2O_3.4N_2O_5.18H_2O$*
1.496	15.22	30.50	$Fe_2O_3.3N_2O_5.18H_2O$	1.419	3.52	49.6	"

* This salt was obtained accidentally and its preparation could not be repeated.

NO

EQUILIBRIUM IN THE SYSTEM FERRIC NITRATE NITRIC ACID AND WATER AT 25°.

(Malquori, 1929b.)

Gms. per 100 gms. sat. solution		Solid Phase
$Fe(NO_3)_3$	HNO_3	
18.15	53.48	$Fe(NO_3)_3.9H_2O$
22.41	53.79	"
28.02	54.23	" + $Fe(NO_3)_2.6H_2O$
28.11	57.03	$Fe(NO_3)_3.6H_2O$

These results supplement those of Cameron and Robinson in showing that at higher concentrations of HNO_3 a lower hydrate of ferric nitrate is obtained.

Malquori, also gives results for quarternary system $Fe(NO_3)_3$ + HNO_3 KNO_3 + H_2O at 25°

EQUILIBRIUM IN THE SYSTEM FERRIC NITRATE, POTASSIUM NITRATE AND WATER.

(Malquori, 1927(f), 1929(a).)

Results at 0°

Gms. per 100 gms. sat. sol.		Solid Phase
$Fe(NO_3)_3$	KNO_3	
40.15	0.0	Fe9
38.68	0.94	"
38.55	3.92	" + KNO_3
23.87	2.36	KNO_3
21.82	2.26	"
0.0	11.70	"

Results at 25°

Gms. per 100 gms. sat. sol.		Solid Phase
$Fe(NO_3)_3$	KNO_3	
46.57	0.0	Fe9
43.01	6.03	"
41.90	8.75	"
38.11	12.92	"
39.95	11.02	" + KNO_3
38.13	15.95	KNO_3
39.85	10.25	"
40.07	6.13	"
37.43	3.22	"
21.27	5.19	"
11.29	15.91	"
0.0	27.31	"

Results at 40°

Gms. per 100 gms. sat. sol.		Solid Phase
$Fe(NO_3)_3$	KNO_3	
51.18	0.0	Fe9
50.45	16.88	"
44.01	25.31	KNO_3
45.83	21.03	"
45.65	17.99	"
45.15	17.04	"
45.10	16.81	"
40.17	7.75	"
0.0	39.00	"

Fe9 = $Fe(NO_3)_3.9H_2O$

IRON HYDROXIDE (Ferric) $Fe(OH)_3$ (Ferrous) $Fe(OH)_2$.

Using electrical methods, Jellinek and Gordon found the solubility of ferric hydroxide in water to be $3.10\ ^{10}$ gm. mol. Fe $(OH)_3$ per liter.

Using ordinary distilled water containing a little CO_2 and evaporating 2 liters of the saturated solution obtained by constant stirring, Almkvist, 1918, found 0.000151 gms. $Fe·(OH)_3$ per liter.

SOLUBILITY OF FERROUS HYDROXIDE IN WATER AND IN AQUEOUS SALT SOLUTIONS AT 25°. (Whitman, Russell and Davis, 1925.)

Solutions of ferrous hydroxide were prepared by adding pure iron powder to the deoxygenated solutions in which the solubility of ferrous hydroxide was to be determined. The solutions were allowed to stand at 40° for 18 hours and then cooled to 25°. No mention is made of constant stirring. The filtration was performed in presence of hydrogen. The dissolved iron was determined colorimetrically. The results are given in the form of charts from which the following results were read.

Normality of salt sol it.	Parts of iron per million in aqueous solution of					
	Na_2SO_4.	Na Cl.	$CaCl_2.6H_2O$.	$CaCl_2$(Anhy.).	NH_4Cl.	$MgCl_2$.
0.0(=H_2O).	3.75	3.75	3.75	3.75 (9.6)	3.75 (9.6)	3.75 (9.6)
0.5........	4.5	4.1	4.2	2.0 (9.9)	60.0 (5.2)	7.5
1.0........	4.5	4.2	4.5	1.6 (10.3)	100.0 (4.9).	10.0 (5.9)
1.5........	4.0	4.25	4.6	1.4	135.0	12.0
2.0........	2.6	4.2	4.7	1.25 (10.4)	170.0	15.0 (5.7)
2.5........	—	4.15	4.8	1.05	190.0	20.0
3.0........	—	4.0	—	0.95	220.0	22.0
4.0........	—	3.75	—	0.75	265.0 (4.5)	25.0
4.5........	—	—	—	0.70 (10.5)	—	24.0 (5.4)

OH

The figures in parentheses are the p_H values of the saturated solutions.

Results are given for aqueous solutions of sodium dichromate which show that less than 0.2 part per million of iron is dissolved. The results for the solubility in aqueous sodium hydroxide and silicate solutions are expressed only in terms of p_H.

The value for the solubility in water alone, namely 3.75 parts of iron per million, corresponds to 6.7×10^{-5} gm. mols. Fe $(OH)_2$ per liter.

One liter of water saturated with Ferrous Hydroxide at 25° contains 8.14×10^{-6} gm. mols. $Fe(OH)_2$. (Murata, 1932.)

One liter of aqueous 1.375 normal NaOH dissolve 7×10^{-5} gm. equiv $Fe(OH)_2$ at about 20°. (Schrager, 1929.)

SOLUBILITY OF FERRIC HYDROXIDE IN AQ. OXALIC ACID SOLUTION AT 25°. (Cameron and Robinson, 1909)

The solutions were constantly agitated for 3 months. The solubility is directly proportional to the concentration of the oxalic acid and no definite basic ferric oxalate is formed.

d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat. Sol.		d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat. Sol.	
	Fe_2O_3.	C_2O_3.		Fe_2O_3.	C_2O_3.
1.007	0.48	0.61	1.040	2.33	3.10
1.015	0.95	1.23	1.050	2.98	3.85
1.031	1.86	2.45	1.064	3.62	5.17

SOLUBILITY OF FERRIC HYDROXIDE, FERRIC OXIDES AND FERRIC SULFIDE IN AQUEOUS SUGAR SOLUTIONS.

(Stelle — Z. Ver Zuckerind. 50, 340, '00.)

One Liter of Sugar Solutions Dissolves Milligrams of:

% Sugar in Solvent.	$Fe_2(OH)_6$ at: 17.4°.	45°.	75°.	Fe_2O_3 at: 17.5°.	45°.	Fe_3O_4 at: 17.5°.	45°.	75°.	FeS at: 17.5°.	45°.	75°.
10	3.4	3.4	6.1	1.4	2.0	10.3	10.3	12.4	3.8	3.8	5.3
30	2.3	2.7	3.8	1.4	...	12.4	10.3	12.4	7.1	9.1	7.2
50	2.3	1.9	3.4	0.8	1.1	14.5	10.3	14.5	9.9	19.8	9.1

FERRIC PHOSPHATE $Fe_2(PO_4)_3$

THE ACTION OF WATER AND OF AQUEOUS SALT SOLUTIONS UPON FERRIC PHOSPHATE.

(Lachowicz — Monatsh. Chem. 13, 357, '92; Cameron and Hurst — J. Am. Chem. Soc. 26, 888, '04.)

The experiments show that the ordinary precipitation methods for the production of ferric phosphate give products which do not conform to the formula $Fe_2(PO_4)_2$. By digesting such samples with water very little is dissolved, but the material is decomposed to an extent depending upon the relative amounts of solid and solvent used. The amount of PO_4 dissolved per gram of $Fe_2(PO_4)_2$ varies from about 0.0026 gram removed by 5 cc. H_2O to 0.0182 gram removed by 800 cc. H_2O at the ordinary temperature.

PO **SOLUBILITY OF FERRIC PHOSPHATE IN AQ. PHOSPHORIC ACID SOLUTIONS AT 25°.**

(Cameron and Bell, 1907.)

Solid ferric phosphate of unknown composition was constantly agitated with aq. phosphoric acid solutions of concentrations up to 5% for 4 months. Analyses of the sat. solutions and solid phases were made.

d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat. Sol. Fe_2O_3.	P_2O_5.	Solid Phase.
1.0074	0.0105	0.942	Solid Solution
1.0162	0.0205	1.984	"
1.0244	0.0384	2.838	"
1.0310	0.0611	3.770	"
1.0383	0.0849	4.706	"

EQUILIBRIUM IN THE SYSTEM FERRIC OXIDE, PHOSPHORIC ACID AND WATER AT 25° AND AT 70°. (Carter and Hartshorne, 1923.)

The authors call attention to a source of error in the determinations of Cameron and Bell, 1907, and give the following new determinations at 25° for solutions in contact with $Fe_2O_3.P_2O_5.5H_2O$.

Gms. per 100 gms. sat. sol.						
	Fe_2O_3.....	trace	0.23	1.40	2.43	4.42
	P_2O_5......	5.93	10.1	14.1	19.8	21.7

The following results were obtained at 70°.

d_{70} of sat. sol.	Gms. per 100 gms. sat. sol. Fe_2O_3.	P_2O_5.	Solid Phase.	d_{70} of sat. sol.	Gms. per 100 gms. sat. sol. Fe_2O_3.	P_2O_5.	Solid Phase.
–	trace	4.07	$Fe_2O_3.P_2O_5.XH_2O+H_3PO_4$	1.65	7.25	47.87	$Fe_2O_3.2P_2O_5.8H_2O$
–	less than 0.1	6.38	$Fe_2O_3.P_2O_5.5H_2O$	1.68	7.53	49.76	»
–	0.195	14.08	»	–	8.10	52.32	»
–	0.252	16.24	»	1.82	9.79	53.2	$Fe_2O_3.3P_2O_5.10H_2O$
–	1.08	23.56	»	1.82	9.50	54.42	»
–	1.85	27.03	»	1.82	8.68	55.84	»
–	4.49	35.46	»	1.77	5.28	58.07	$Fe_2O_3.3P_2O_5.6H_2O$
1.45	5.45	37.43	»	–	4.42	59.12	»
1.58	7.12	43.92	$Fe_2O_3.2P_2O_5.8H_2O$	–	3.46	60.47	»

Equilibrium in the System Ferrous Oxide, Phosphoric Acid and Water at 70° (Carter and Hartshorne, 1926.)

The mixtures were prepared by dissolving Swedish iron (99.75 % Fe) in solutions of phosphoric acid kept in an atmosphere of CO_2. The mixtures were constantly stirred in a thermostat for at least a week and both the saturated solutions and solid phases were analyzed.

$d_{\frac{15-20}{4}}$ of sat. sol.	Gms. per 100 gms. sat. sol. FeO.	Gms. per 100 gms. sat. sol. P_2O_5.	Solid Phase.
1.08	2.76 (1.2)	7.38	$2FeO.P_2O_5.5H_2O$
1.16	4.38	12.06	»
1.22	5.53	14.46	»
1.20	5.48 (1.6)	14 96	»
1.24	5.54 (5.1)	15.1	»
1.31	7.71	21.6	$2FeO.P_2O_5.3H_2O$ (cryst.)
1.39	9.18 (0.84)	25.65	»
1.43	9.88	28.25	»
1.53	10.99	32.78	»
1.60	11.25	37.20	»
1.60	11.29	37.21	»
–	9.12	24.29	$2FeO.P_2O_5.3H_2O$ (amorp.)
1.42	10.1	27.20	»
1.44	10.6	29.05	$2FeO.P_2O_5.3H_2O$ (amorp.)
1.45	10.6 (0.87)	29.46	»
1.54	11.3 (0.62)	32.87	»
1.55	11.5 (0.92)	33.99	»
–	11.8	35.43	»
1.60	11.9 (2.75)	36.99	»
1.58	10.5 (0.7)	38.86	$FeO.P_2O_5.4H_2O$
1.60	8.77	41.52	»
–	7.38	42.88	»
1.61	6.29	46.61	»
1.63	4.87	50.49	»
1.63	4.01	52.02	»
1.71	3.15 (4-6)	57.51	»

The figures in parentheses show the per cent of iron present in the ferric state.

PO

FERRIC Pyro PHOSPHATE $Fe_4(P_2O_7)_3$

Solubility Ferric Pyrophosphate in Aq. Ammonia at 0°. (Pascal, 1909.)

The solutions containing an excess of salt were agitated violently every half hour for seven hours and filtered at 0°. The sat. sol. was analyzed for ammonia and for residue obtained by evaporation.

Gms. NH_3 per 100 Gms. Sat. Sol.	Gms. $Fe_4(P_2O_7)_3$ per 100 Gms. Sat. Sol.	Solid Phase.
0.884	5.606	$Fe_4(P_2O_7)_3$
1.59	9.75	"
3.71	14.85	"
4.72	15.94	"
5.93	13.92	viscous black deposit
7.91	14.61	"
5.92	14.71	viscous black deposit
8.26	13.89	chamois colored lumps
10.55	7.40	"
15.96	2.52	"
18.83	0.445	"

Solubility of Ferric Pyrophosphate in Aqueous Solutions of Sodium Pyrophosphate and of Sodium Citrate. (Oliveri-Mandala, 1921.)

In Aq. Sodium Pyrophosphate at 30°.4.

Gm. mols. $Na_4P_2O_7$ per liter.	Gm. mols. $Fe_4(P_2O_7)_3$ per liter (1).	Gm. mols. $Fe_4(P_2O_7)_3$ per liter (2).
0.14	0.047	0.050
0.20	0.068	0.072
0.26	0.088	0.094
0.32	0.108	0.114
0.38	0.124	0.134

In Aq. Sodium Citrate at 28°.

Gm. mols. per liter Na citrate.	Gm. mols. per liter $Fe_4(P_2O_7)_3$.
0.2004	0.1712
0.3951	0.3160
0.4760	0.3704
0.5289	0.4037
0.6355	0.4572

Solid Phase for (1) = anhydrous $Fe_4(P_2O_7)_3$, for (2) = $Fe_4(P_2O_7)_3.9H_2O$.

IRON Sodium PYROPHOSPHATE $Fe_4(P_2O_7)_3.3Na_4P_2O_7$.

SOLUBILITY OF FERRIC SODIUM PYROPHOSPHATE IN AQUEOUS SOLUTIONS OF SODIUM CITRATE AND OF SODIUM CHLORIDE. (Oliveri-Mandala, 1921).

In Aq. Sodium Citrate at 26°.5.

Gm. mols. per liter Na citrate.	Gm. mols. per liter $Fe_4(P_2O_7)_3.3Na_4P_2O_7$.
0.3456	0.0186
0.4760	0.0249
0.5374	0.0269

In Aq. Sodium Chloride at 30° and at 50°.5.

Gm. mols. NaCl per liter.	Gm. mols. $Fe_4(P_2O_7)_3.3Na_4P_2O_7$ per liter at 30°	Gm. mols. $Fe_4(P_2O_7)_3.3Na_4P_2O_7$ per liter at 50°.5.
0.0	0.0100	0.062
0.01	0.0077	0.039
0.02	0.0053	0.023
0.03	0.0037	0.015
0.04	0.0028	0.011
0.05	0.0023	0.009
0.06	0.0020	0.009

S

FERROUS and FERRIC SULFIDES FeS, Fe_2S_3

SOLUBILITY OF EACH IN WATER.

One liter of water, saturated at 18° with precipitated ferrous sulfide, contains $70.1.10^{-6}$ mols. FeS = 0.00616 gm., determined by conductivity method.
(Weigel, 1906, 1907.)

Additional data for the solubility in water are given by Bruner and Zawadzki.

Using a seleno-colorimetric method upon colloidal solutions and extrapolating to zero adsorption, Mickwitz, 1928, found 0.0044 gm. FeS per liter of saturated solution in Water at 18°(?).

In a critical review of the literature Kolthoff, 1931, calls attention to the inaccuracy of the results of Weigel. He mentions that the figures for the solubility of most sulfides in pure water are so small that it is more than doubtful whether they have any practical significance.

100 gms. anhydrous hydrazine dissolve 9 gms. FeS at room temp. with decomposition.
(Welsh and Broderson, 1915.)

1000 cc. aq. 0.01 *n* H_2SO_4 sat. with H_2S dissolve 0.2136 gm. Fe S at 20°.
(Moser and Behr, 1924.)

1000 cc. sat. solution of ferric sulfide in water contain 3.10^{-18} gm. mol. Fe_2S_3 at room temperature determined by electrical methods. (Jellinek and Gordon, 1924.)

FERROUS SULFITE $FeSO_3.5H_2O$

EQUILIBRIUM IN THE SYSTEM FERROUS OXIDE, SULFUR DIOXIDE AND WATER AT 15° AND AT 25°.

(Terres and Ruhl, 1934.)

The determinations were made by the synthetic method. The authors give a diagram in the present paper but the numerical results are published only in their report in Beihefte zu den Zeitschriften des Vereine deutscher Chemiker No. 8 1934 - Verlag chemie Berlin W 35 Cornelius str 3. Estimating from the small diagram the following approximate values were obtained.

Results at 15°			Results at 25°		
Mol. percent in sat. sol.		Solid Phase	Mol. percent in sat. sol.		Solid Phase
FeO	SO_2		FeO	SO_2	
0.5	0.3	$FeSO_2.SH_2O$(?)	0.5	0.75	$FeSO_3.5H_2O$
1.0	0.6	"	1.0	1.3	"
2.0	1.2	"	1.5	1.6	"
2.5	1.4	" + $Fe(HSO_3)_2$(?)	1.9	2.0	" + $Fe(HSO_3)_2$(?)
2.4	2.0	$Fe(HSO_3)_2$(?)	1.5	2.9	$Fe(HSO_3)_2$(?)
2.2	3.5	"	1.25	4.0	"
2.3	5.0	"	1.5	5.9	"
2.6	7.0	"	2.0	7.6	"
3.0	8.1	"	2.3	8.3	"

The mixtures separated into two liquid layers at concentrations of SO_2 between 8.5 and 93 Mol. percent.

IRON SULFATE (Ferrous) $FeSO_4.7H_2O$.

SOLUBILITY OF FERROUS SULFATE IN WATER. (Fraenckel, 1907.)

t°.	Gms. $FeSO_4$ per 100 Gms H_2O.	Solid Phase.	t°.	Gms. $FeSO_4$ per 100 Gms. H_2O.	Solid Phase.
−0.172	1.0156	Ice	45.18	44.32	$FeSO_4.7H_2O$
−0.566	4.2852	"	50.21	48.60	"
−1.063	8.7054	"	52	50.20	"
−1.511	12.713	"	54.03	52.07	"
−1.771	14.511	"	56.56 tr. pt.	54.58	" + $FeSO_4.4H_2O$
−1.82 Eutec	17.53	Ice + $FeSO_4.7H_2O$	60.01	54.95	$FeSO_4.4H_2O$
0	15.65	$FeSO_4.7H_2O$	65	55.59	" unstable
+10	20.51	"	70.04	56.08	" "
15.25	23.86	"	64.8 tr. pt.	...	$FeSO_4.4H_2O + FeSO_4.H_2O$
20.13	26.56	"	68.02	52.31	$FeSO_4.H_2O$
25.02	29.60	"	77	45.90	"
30.03	32.93	"	80.41	43.58	"
35.07	36.87	"	85.02	40.46	"
40.05	40.20	"	90.13	37.27	"

$d_{16.6}$ of sat. sol. = 1.219. (Greenish and Smith, 1903.)

SOLUBILITY OF FERROUS SULFATE IN WATER.

(Agde and Barkholt, 1926.)

t°.	d of sat. sol.	Gms. $FeSO_4.7H_2O$ per 100 gms. sat. sol.	t°.	d of sat. sol.	Gms. $FeSO_4.7H_2O$ per 100 gms. sat. sol.
1.0	1.140	25.25	34.0	1.312	48.65
9.6	1.178	31.32	43.0	1.363	55.01
21.0	1.233	39.02	54.0	1.432	63.18
25.0	1.255	42.08	80.0	1.367	55.49

SOLUBILITY OF FERRIC SULFATE IN AQUEOUS SOLUTIONS OF FERROUS SULFATE AT 25° AND AT 50°.

(Cameron, 1936.)

The mixtures were agitated for seven months.

Results at 25°

Gms. per 100 gms. sat. sol. $FeSO_4$	Gms. per 100 gms. sat. sol. $Fe_2(SO_4)_3$	Gms. per 100 gms. sat. sol. Excess SO_4	Solid Phase
0.38	44.75	1.48	B.F.S.
0.82	44.15	1.93	"
1.36	43.79	3.19	"
2.01	43.32	2.98	"
2.61	43.25	1.12	"
3.07	42.60	1.50	" + $FeSO_4.7H_2O$
5.30	38.42	3.61	" "
8.16	36.60	1.90	$Fe_2(SO_4)_3$+ "
10.47	28.36	0.25	"
15.23	16.64	0.04	"
20.24	5.73	0.21	"
22.50	1.36	0.63	"

Results at 50°

Gms. per 100 gms. sat. sol. $FeSO_4$	Gms. per 100 gms. sat. sol. $Fe_2(SO_4)_3$	Gms. per 100 gms. sat. sol. Excess SO_4	Solid Phase
0.19	48.73	0.78	B.F.S.
0.67	46.54	2.59	"
3.67	44.50	1.33	"
6.18	41.03	3.16	" + $FeSO_4.7H_2O$
8.02	38.87	5.20	" "
10.55	30.61	2.50	" "
14.74	32.94	1.09	$FeSO_4.7H_2O$
19.40	25.35	0.95	"
21.76	19.85	1.01	"
27.88	9.67	0.22	"
30.35	5.40	0.30	"
31.99	2.79	0.67	"

B.F.S.= Basic Ferric Sulfate. At concentrations of $FeSO_4$ less than 8.16 percent at 25° and 14.74 percent at 50° the nature of the solid phase is uncertain.

SO

SOLUBILITY OF FERROUS SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT VARIOUS TEMPERATURES.

(Cameron, 1930.)

Results at 0°

Gms. per 100 gms. sat. sol. H_2SO_4	Gms. per 100 gms. sat. sol. $FeSO_4$	Solid Phase
1.81	14.1	Fe7
4.10	13.8	"
8.45	11.10	"
15.56	8.93	"
17.76	7.67	"
25.98	4.80	"
32.50	3.99	"
36.05	3.64	"
38.62	3.38	" + Fe1
41.80	2.34	Fe1
53.25	0.55	"
63.60	0.28	"

Results at 25°

Gms. per 100 gms. sat. sol. H_2SO_4	Gms. per 100 gms. sat. sol. $FeSO_4$	Solid Phase
1.13	22.88	Fe7
3.41	20.64	"
6.32	18.67	"
9.37	16.79	"
13.00	15.56	"
17.34	13.25	"
24.54	11.23	"

Results at 25° Con.

Gms. per 100 gms. sat. sol. H_2SO_4	Gms. per 100 gms. sat. sol. $FeSO_4$	Solid Phase
27.78	10.70	Fe7 + Fe1
31.00	8.50	Fe1
35.60	5.89	"
41.47	3.07	"
45.70	1.75	"
54.71	0.97	"
60.23	0.56	"
64.35	0.40	"

Results at 55°

Gms. per 100 gms. sat. sol. H_2SO_4	Gms. per 100 gms. sat. sol. $FeSO_4$	Solid Phase
1.74	33.48	Fe7
2.43	32.76	"
3.87	31.91	"
5.93	29.20	Fe1
7.79	26.87	"
11.44	24.34	"
22.26	15.42	"
31.30	9.25	"
45.37	3.03	"
56.49	1.01	"
67.20	0.61	"

Results at 65°

Gms. per 100 gms. sat. sol. H_2SO_4	Gms. per 100 gms. sat. sol. $FeSO_4$	Solid Phase
1.82	34.24	Fe4
1.61	34.66	"
3.29	32.57	Fe2
10.21	25.11	"
16.32	20.48	"
29.46	10.38	"

Results at 75°

Gms. per 100 gms. sat. sol. H_2SO_4	Gms. per 100 gms. sat. sol. $FeSO_4$	Solid Phase
0.43	31.46	Fe2
3.45	28.00	"
5.60	25.58	"
8.71	22.60	"
10.78	21.29	"
21.90	14.40	"
27.72	11.26	"
34.72	7.05	"

Fe7 = $FeSO_4.7H_2O$
Fe4 = $FeSO_4.4H_2O$
Fe2 = $FeSO_4.2H_2O$
Fe1 = $FeSO_4.H_2O$

The author also gives a review of the literature pertaining to the properties of ferrous sulfate, especially its solubility in presence of other salts.

SOLUBILITY OF FERRIC SULFATE AND OF FERROUS SULFATE IN AQ. SOLUTIONS OF SULFURIC ACID AT 25°. (Wirth, 1912–13.)

Results for Ferric Sulfate.

Normality of used Acid.	Gms. per 100 Gms. Sat. Sol. Fe_2O_3	= $Fe_2(SO_4)_3$.
2.25	9.99	25.02
6.685	5.82	14.58
19.84	0.02	0.05

Results for Ferrous Sulfate.

Normality of used Acid.	Gms. per 100 Gms. Sat. Sol. Fe_2O_3	= $FeSO_4$.	Solid Phase.
2.25	10	19.03	$FeSO_4.7H_2O$
10.2	5.414	10.30	"
12.46	3.816	7.26	$FeSO_4.H_2O$
15.15	2.11	4.015	"
19.84	0.08	0.1522	"

EQUILIBRIUM IN THE SYSTEM FERRIC OXIDE, SULFURIC ACID AND WATER AT 25°. (Cameron and Robinson, 1907.)

(Excess of freshly precipitated ferric hydroxide was added to ferric sulfate solutions of varying concentrations and the mixtures constantly shaken for 4 months.)

d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat. Sol. Fe_2O_3.	SO_3.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. Fe_2O_3.	SO_3.	Solid Phase.
1.001	0.07	0.11	Solid Solution	20.48	26.18	$Fe_2O_3.3SO_3.10H_2O$
1.011	0.62	0.94	"	19.77	28.93	"
1.045	2.03	2.65	"	10.87	31.35	$Fe_2O_3.4SO_3 10H_2O$
1.131	6.18	7.40	"	0.16	35.96	"
1.217	10.03	11.84	"	0.07	41.19	"
1.440	15.90	20.70	"	1.05	42.43	"

SO

EQUILIBRIUM IN THE SYSTEM FERRIC OXIDE, SULFURIC ACID AND WATER. (Koerner and Calderwood, 1938.)

Weighed samples were agitated in sealed glass bottles for various lengths of time and allowed to settle. The liquid and solid were separated by filtration using a fritted glass filter. This required considerable time and the operation was conducted in the constant temperature bath. Both the filtrates and the moist solids were analyzed.

Gms. per 100 gms. sat. sol. Fe_2O_3	SO_3	Solid Phase
Results at 10°		
2.76	4.12	SS
7.32	12.59	"
16.30	25.88	"
2.23	16.19	$Fe_2O_3 + 2.44SO_3 + 8.65H_2O$
6.70	31.27	
0.0	37.23	SS
0.4	45.00	"
0.27	48.40	"
0.41	50.10	"
0.04	74.50	"
Results at 15°		
12.46	16.60	SS
14.61	21.23	"
15.70	23.05	"
16.63	24.00	"
17.61	26.45	"
16.10	25.40	$Fe_2O_3 \cdot 3SO_3 \cdot 18H_2O$
15.86	24.98	"
14.47	26.15	"
Results at 15° (con.)		
14.20	28.25	$Fe_2O_3 \cdot 3SO_3 \cdot 18H_2O$
17.11	31.01*	"
18.75	31.94*	"
17.75	31.85*	"
10.30	30.90	$Fe_2O_3 \cdot 4.46SO_3 \cdot 19.2H_2O$
7.25	32.31	"
2.48	35.23	"
0.80	36.40	"
0.01	37.20	"
3.59	30.60	$Fe_2O_3 \cdot 5.84SO_3 \cdot 30H_2O$?
0.77	34.80	"
0.01	37.20	"
7.02	29.39*	"
0.98	30.32*	"
13.18	32.84	$Fe_2O_3 \cdot 3.3SO_3 \cdot 10.3H_2O$
10.04	33.21	"
2.48	35.23	"
0.80	36.40	"
0.01	9.33	"
14.09	33.80*	"
15.65	42.27*	"

* Supersaturated, SS = Solid Solution

EQUILIBRIUM IN THE SYSTEM FERRIC OXIDE, SULFURIC ACID AND WATER

(Appleby and Wilkes, 1922.)

Results at 18°.

Gms. per 100 gms sat. sol.		Solid Phase.
Fe_2O_3.	SO_3.	
0.21	40.64	$Fe_2O_3.4SO_3.9H_2O$
0.91	36.45	»
6.48	32.43	»
8.00	31.85	»
9.63	31.88	» + $Fe_2O_3.3SO_3.7H_2O$
11.69	30.80	$Fe_2O_3.3SO_3.7H_2O$
13.88	29.71	»
17.48	29.73	»
18.68	29.64	» + Basic solid solut.
17.96	25.42	Basic solid solutions
14.00	17.71	»
11.60	13.85	»
6.81	7.60	»

Results at 25°.

Gms. per 100 gms. sat. sol.		Solid Phase.
F_2O_3.	SO_3.	
0.27	39.77	$Fe_2O_3.4SO_3.9H_2O$
0.71	37.22	»
2.38	34.99	»
3.88	33.20	»
8.04	32.06	$Fe_2O_3.3SO_3.7H_2O$
10.55	30.77	»
13.80	30.02	»
17.52	29.85	$.5(Fe_2O_3.3SO_3).2Fe_2O_3$
18.56	29.98	»
19.98	29.19	Basic solid solutions
19.78	27.90	»
19.55	25.99	»
15.53	17.62	»
13.51	14.58	»
7.91	8.19	»

EQUILIBRIUM IN THE SYSTEM FERRIC OXIDE, SULFURIC ACID AND WATER AT 50° TO 200°.

(Posnjak and Merwin, 1922.)

SO

The authors give a critical discussion of previous work on this system. Their own determinations were made with the greatest possible accuracy. The identification of the solid phases was made both microscopically and analytically. Sealed tubes were used and at temperatures above 50° the tubes were heated by means of a resistance furnace within a steel bomb. The time required for equilibrium varied from 2 months at 50° to only a week or 10 days at the higher temperatures.

Results for the Isotherm at 50°.

Gms. per 100 gms. sat. sol		Solid Phase
Fe_2O_3.	SO_3.	
0.14	0.39	$Fe_2O_3.H_2O$
0.39	0.79	»
0.90	1.53	»
1.44	2.30	» + $3Fe_2O_3.4SO_3.9H_2O$
2.55	4.08	$3Fe_2O_3.4SO_3.9H_2O$
5.71	9.09	»
7.19	11.19	»
15.43	20.08	»
16.09	20.81	»
17.96	22.96	» + $Fe_2O_3.2SO_3.5H_2O$
20.13	27.18	$Fe_2O_3.2SO_3.5H_2O$

Gms. per 100 gms. sat. sol.		Solid Phase
Fe_2O_3	SO_3	
20.70	28.40	$2Fe_2O_3.5SO_3.17H_2O$
16.78	30.72	» + $Fe_2O_3.3SO_3.7H_2O$
10.26	31.91	$Fe_2O_3.3SO_3.7H_2O$
8.56	32.52	»
5.55	33.96	$Fe_2O_3.4SO_3.9H_2O$
0.34	41.18	»
0.10	48.44	»
0.09	55.34	»
0.07	59.20	$Fe_2O_3.4SO_3.3H_2O$
0.08	62.34	»
0.07	75.37	»

Similar data for the 75°, 110°, 140° and 200° isotherms are given and also several determinations at 130°, 150° and 300°.

The following supplementary determinations upon this system at 50° are given by Tunell and Posnjak, 1931.

Gms. per 100 gms. sat. sol.			Solid Phase
Fe_2O_3	SO_3	H_2O	
0.01	0.10	99.89	$Fe_2O_3.H_2O$
1.95	2.94	95.11	" + $3Fe_2O_3.4SO_3.9H_2O$
2.54	3.57	93.89	" "

EQUILIBRIUM IN THE SYSTEM FERRIC OXIDE, SULFUR SULFUR TRIOXIDE AND WATER AT 25°.

(Baskerville and Cameron, 1935.)

Many series of determinations were made upon mixtures prepared in different ways and agitated for various lengths of time, for periods of as long as a year. The limiting members of the solid solutions appeared to be ferric oxide on the one hand and on the other a compound approaching the composition $Fe_2O_3.2.5SO_3.7H_2O$.

d of sat. sol.	Gms. per 100 gms. sat. sol. Fe_2O_3	SO_3	Solid Phase	Gms. per 100 gms. sat. sol. Fe_2O_3	SO_3	Solid Phase	Gms. per 100 gms. sat. sol. Fe_2O_3	SO_3	Solid Phase
1.052	2.45	3.55	SS	15.10	29.14	1.22.7	6.96	32.06	1.4.9
1.104	4.86	6.83	"	15.94	28.88	"	4.70	32.08	"
1.229	9.86	12.55	"	16.70	28.00	"	2.03	34.33	"
1.242	10.19	12.98	"	17.31	27.45	"	0.26	38.72	"
1.328	12.33	18.17	"	18.21	26.85	"	0.03	56.79	"
1.397	15.52	19.21	"	19.06	26.77	"	8.4	31.8*	" + 1.3.8
1.500	17.19	23.96	"	16.4	28.2	" +1.3.9	10.34	30.96	1.3.8
1.471	16.67	24.67	"	14.49	28.28	1.3.9	8.94	31.54	"
1.550	19.08	25.22	"	12.18	28.88	"	14.7	30.3*	"+ 1.2.5.7
1.590	17.95	28.95	"	11.06	28.92	"	8.11	31.88	1.4.9
—	20.5	26.4	"+ 1.22.7	9.31	29.64	"	7.96	31.86	"
				7.2	32.1	"+1.4.9			

* Metastable

1.22.7 = $Fe_2O_3.2.5SO_3.7H_2O$; 1.3.9 = $Fe_2O_3.3SO_3.9H_2O$; 1.4.9 = $Fe_2O_3.4SO_3.9H_2O$; 1.3.8 = $Fe_2O_3.3SO_3.8H_2O$; SS = Solid Solution

EQUILIBRIUM IN THE SYSTEM FERRIC OXIDE-SULFUR TRIOXIDE-WATER AT 25°.

(Wirth and Bakke, 1914.)

(The mixtures were shaken for 3-4 weeks.)

Gms. per 100 Gms. Sat. Sol. Fe_2O	SO_3	Solid Phase.	Gms. per 100 Gms. Sat. Sol. Fe_2O_3.	SO_3.	Solid Phase.
...	71.23	not det.	14.49	31.45	unstable
0.24	56.84	"	15.71	31.88	"
3.53	34	prob. $Fe_2(SO_4)_3.H_2SO_4\,9H_2O$ + $Fe_2(SO_4)_3.H_2SO_4\,3H_2O$	20.21	31.30	"
6.65	32.15	$Fe_2(SO_4)_3.H_2SO_4\,8H_2O$	9.39	31.54	$Fe_2(SO_4)_3\,H_2SO_4\,8H_2O$ + $Fe_2(SO_4)_3\,9H_2O$
9.39	31.54	" + $Fe(SO_4)_3\,H_2SO_4\,3H_2O$	11.06	29.43	$Fe_2(SO_4)_3.9H_2O$
12.03	31.51	$Fe(SO_4)_3.H_2SO_4.8H_2O$	13.88	28.33	"
13.27	31.84	"	15.23	27.92	"
13.68	31.78	unstable	16.07	27.98	"

Results are also given for the two forms of yellow ferric sulfate (α copiapite and β copiapite) also for ferric hydroxide and sulfate solutions.

It was found that a saturated solution of $Fe_2(SO_4)_3.H_2SO_4.8H_2O$ in abs. alcohol at 25° contained 8 gms. Fe_2O_3 + 17.18 gms. SO_3 (Ratio, 1:4.235) per 100 gms. sat. sol.

The yellow ferric sulfate $Fe_2(SO_4)_3.9H_2O$ is less soluble in alcohol. After 4 weeks shaking at 25°, 100 gms. of the sat. solution in abs. alcohol contained 4.497 gms. Fe_2O_3 and 6.779 gms. SO_3 (Ratio, 1:3.006). Thus the alcoholic solution, just as the aqueous, is considerably more acid than the solid phase with which it is in equilibrium.

100 grams sat. solution in glycol contain 6 gms. $FeSO_4$ at ordinary temperature. (de Coninck.)

100 gms. anhydrous hydrazine dissolve 1 gm. ferrous sulfate at room temp. with decomposition. (Welsh and Broderson, 1915.)

FERROUS SULFATE

Freezing-point data for mixtures of ferrous sulfate and 100 per cent sulfuric acid are given by Kendall and Davidson, 1921.

FERRIC SULFATE

SOLUBILITY OF FERRIC SULFATE IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE AT 25° AND VICE VERSA.

(Cameron, 1936.)

Gms. per 100 gms. sat. sol. K_2SO_4	Gms. per 100 gms. sat. sol. $Fe_2(SO_4)_3$	Solid Phase	Gms. per 100 gms. sat. sol. K_2SO_4	Gms. per 100 gms. sat. sol. $Fe_2(SO_4)_3$	Solid Phase
2.83	27.8	1.2.14	11.7	0.85	1.2.14 + K_2SO_4
2.94	24.3	"	12.2	1.25*	" "
3.34	21.8	"	12.5	1.53*	" "
3.38	20.8	"	13.1	1.68*	" "
4.56	13.1	"	13.7	1.88*	" "
5.43	11.2	"	11.9	0.63	K_2SO_4
5.32	9.02	"	11.8	0.31	"
6.21	6.04	"	11.5	0.10	"
8.0	2.35	"	11.3	0.02	"

* Probably points on a boundary curve of a four component system.

1.2.14 = $Fe_2(SO_4)_3.2K_2SO_4.14H_2O$

The solutions contained a variable small excess of SO_4

SO **FERROUS** Potassium **SULFATE** $FeSO_4.K_2SO_4.6H_2O$.

SOLUBILITY IN WATER. (Tobler, 1855.)

t°.	Gms. $K_2Fe(SO_4)_2$ per 100 Gms. H_2O.	t°.	Gms. $K_2Fe(SO_4)_2$ per 100 Gms. H_2O.
0	19.6	35	41
10	24.5	40	45
14.5	29.1	55	56
16.	30.9	65	57.3
25	36.5	70	64.2

FERROUS Potassium **SULFATE** $FeK_2(SO_4)_2.6H_2O$.

SOLUBILITY OF MIXED CRYSTALS OF IRON POTASSIUM SULFATE AND ZINC POTASSIUM SULFATE IN WATER AT 6°.8. (Haber-Chuwis, 1936.)

d of sat. sol.	Gms. per 1000 cc. sat. sol. $FeK_2(SO_4)_2.6H_2O$.	Gms. per 1000 cc. sat. sol. $ZnK_2(SO_4)_2.6H_2O$.	Mol. per cent $FeK_2(SO_4)_2.6H_2O$ in Solid Phase.
1.2067	329.15	0.00	100.0
1.1859	275.03	19.39	93.55
1.1758	246.80	28.82	90.08
1.1606	203.22	47.62	81.98
1.1474	173.59	53.07	76.98
1.1339	142.76	63.87	69.45
1.1204	119.46	67.83	64.29
1.1085	87.69	72.46	55.30
1.0993	68.10	77.78	47.22
1.0795	0.00	113.62	0.00

SOLUBILITY OF FERROUS SULFATE IN AQ. SOLUTIONS OF LITHIUM SULFATE AT 30°. AND VICE VERSA. (Schreinemakers, 1910)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
$FeSO_4$.	Li_2SO_4.		$FeSO_4$.	Li_2SO_4.	
24.87	0	$FeSO_4.7H_2O$	15.39	16.80	$Li_2SO_4.H_2O$
24.45	4	"	12.68	18.31	"
21.15	5.58	"	5.32	22.15	"
18.79	11.16	"	3.74	23.15	"
16.51	15.81	"	0	25.1	"
16.11	16.50	" $+Li_2SO_4.H_2O$			

SOLUBILITY OF FERROUS SULFATE IN AQUEOUS SOLUTIONS OF MANGANESE SULFATE AND VICE VERSA.

(White, 1933.)

Results at 0°			Results at 25°		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$MnSO_4$	$FeSO_4$		$MnSO_4$	$FeSO_4$	
3.07	12.55	$Fe.7H_2OSS$	0.09	23.09	$Fe.7H_2OSS$
5.83	11.44	"	2.55	21.41	"
10.66	9.26	"	6.82	18.94	"
16.52	6.84	"	10.33	16.62	"
19.18	5.69	"	13.57	14.39	"
29.30	1.25	"	24.96	7.78	"
31.28	0.34	"	36.95	1.82	"
31.84	0.14	"	37.83	1.33	" + $Mn.5H_2OSS$
			38.29	0.85	$Mn.5H_2OSS$
			39.39	0.33	- "

SO

$Fe.7H_2OSS$ = $FeSO_4$ Hepta hydrate Solid Solution; $Mn.5H_2OSS$ = $MnSO_4$ Penta hydrate Solid Solution.

FERRIC Ammonium **SULFATE** (Alum) $(NH_4)_2Fe_2(SO_4)_4\ 24H_2O$

100 cc. H_2O dissolve 44.15 gms. anhydrous or 124.40 gms. hydrated salt at 25°. Sp. gr. of saturated solution at 15° = 1.203. (Locke, 1901)

FERROUS Ammonium **SULFATE** $(NH_4)_2Fe(SO_4)_2.6H_2O$

SOLUBILITY IN WATER.

(Tobler; at 25°, Locke — Am. Ch. J 2kk, 159, '01)

t°.	G. $(NH_4)_2Fe(SO_4)_2$ per 100 g H_2O.	t°	G. $(NH_4)_2Fe(SO_4)_2$ per 100 g H_2O	t°.	G. $(NH_4)_2Fe(SO_4)_2$ per 100 g H_2O.
0	12 5	25	25 0 (T)	50	40
15	20.0	25	35.1 (L)	70	52
		40	33.0		

SOLUBILITY OF AMMONIUM SULFATE IN AQUEOUS SOLUTIONS OF FERROUS SULFATE AT 30° AND VICE VERSA.

(Schreinemakers, 1910 a)

Gms. per 100 Gms. Sat. Solution		Solid Phase.	Gms. per 100 Gms Sat. Solution		Solid Phase.
$(NH_4)_2SO_4$.	$FeSO_4$.		$(NH_4)_2SO_4$.	$FeSO_4$	
44.27	0	$(NH_4)_2SO_4$	8.90	17.64	1.1.6
43.88	0.79	(NH)SO+1.1.6	6.44	23.59	"
34.24	1.72	1.1.6	5.91	25.24	$1.1.6+FeSO_4.7H_2O$
19.64	5.70	"	5.24	25.24	$FeSO_4.7H_2O$
16.29	7.95	"	0	24.90	"
11.45	13.13	"			

1.1.6 = $(NH_4)_2SO_4.FeSO_4.6H_2O$.

Data for the quaternary system $(NH_4)_2SO_4 + FeSO_4 + Li_2SO_4 + H_2O$ at 30° are also given.

IRON Ammonium **SULFATE** (Ferrous) $Fe(NH_4)_2(SO_4)_2.6H_2O$.

SOLUBILITY OF MIXED CRYSTALS OF IRON AMMONIUM SULFATE AND ZINC AMMONIUM SULFATE IN WATER. (Ostersetzer, 1926.)

The two salts mix in all proportions. The influence of temperature upon the solubility is insignificant, in that the relation between the solubilities of the two salts does not change with increase of temperature.

Results at 7°.

	Gms. per 1000 cc. sat. sol.		Wt. per cent $Fe(NH_4)_2(SO_4)_2.6H_2O$ in Solid Phase.
d of sat. sol.	$Fe(NH_4)_2(SO_4)_2.6H_2O$.	$Zn(NH_4)_2(SO_4)_2.6H_2O$.	
1.1541	279.49	0.00	100.0
1.1454	236.84	18.99	85.17
1.1392	220.24	22.47	76.57
1.1377	181.49	40.10	59.99
1.1203	158.60	46.88	49.52
1.1115	125.20	62.89	37.74
1.1031	101.64	70.93	29.51
1.0965	73.58	82.46	18.19
1.0912	54.36	92.10	13.18
1.0794	0.00	125.50	0.00

Results at 8°.5.

	Gms. per 1000 cc. sat. sol.		Wt. per cent $Fe(NH_4)_2(SO_4)_2.6H_2O$ in Solid Phase.
d of sat. sol.	$Fe(NH_4)_2(SO_4)_2.6H_2O$.	$Zn(NH_4)_2(SO_4)_2.6H_2O$.	
1.1578	286.52	0.00	100.0
1.1452	243.71	24.00	87.12
1.1366	212.66	34.99	71.40
1.1304	183.13	45.93	56.76
1.1184	157.54	54.60	49.51
1.1121	133.70	63.35	38.42
1.1035	103.70	72.95	27.46
1.0963	78.82	81.59	18.63
1.0891	53.45	95.04	11.56
1.0875	27.65	112.25	5.78
1.0798	0.00	128.30	0.00

FERRIC SULFATE

SO

SOLUBILITY OF FERRIC SULFATE IN AQUEOUS SOLUTIONS OF AMMONIUM SULFATE AT 25°.

(Cameron, 1936.)

Gms. per 100 gms. sat. sol.		Solid Phase
$(NH_4)_2SO_4$	$Fe_2(SO_4)_3$	
1.4	44.5	?
1.5	44.2	?
1.7	44.4	1.1.24 + ?
1.9	43.1	1.1.24
2.2	39.2	"
3.3	32.8	"
4.8	28.7	"
11.7	20.6	1.1.24
14.8	18.0	"
17.3	16.3	" + $(NH_4)_2SO_4$
26.6	9.0	$(NH_4)_2SO_4$
40.8	1.4	"
44.2	0.5	"

1.1.24 = $Fe_2(SO_4)_3.(NH_4)_2SO_4.24H_2O$

The Solutions contained a variable small excess of SO_4.

FERROUS SULFATE

SOLUBILITY OF FERROUS SULFATE IN AQUEOUS SOLUTIONS SODIUM SULFATE AT 97° AND VICE VERSA.

(Benrath and Benrath, 1929.)

Gms. per 100 gms. sat. sol.		Solid Phase
Na_2SO_4	$FeSO_4$	
0.0	19.57	$FeSO_4.H_2O$
1.92	18.47	"
5.69	16.12	"
14.15	11.50	"
16.60	10.48	"
19.22	11.20	" + 1.1.2
19.72	10.33	1.1.2
22.87	7.32	"
23.30	6.68	1.1.2
24.91	6.51	" + 1.3
25.99	4.93	1.3
27.17	3.94	"
28.81	2.32	"
28.11	2.35	" + Na_2SO_4
29.09	1.46	Na_2SO_4
30.50	0.0	"

1.1.2 = $FeSO_4.Na_2SO_4.2H_2O$; 1.3 = $FeSO_4.3Na_2SO_4$

SOLUBILITY OF MIXTURES OF FERROUS SULPHATE $FeSO_4.7H_2O$ AND SODIUM SULPHATE $Na_2SO_4.10H_2O$ IN WATER.

(Koppel — Z. physik. Chem. 52, 405, '05.)

t°.	Gms. per 100 Gms Solution.		Gms. per 100 Gms. H_2O.		Solid Phase.	
	$FeSO_4$.	Na_2SO_4.	$FeSO_4$.	Na_2SO_4.		
0	14.54	4.93	18.06	6.11	$FeSO_4.7H_2O$ +	$Na_2SO_4.10H_2O$
15.5	17.76	11.32	25.05	15.97	"	"
21.8	16.57	15.32	24.34	22.51	$FeNa_2(SO_4)_2.4H_2O$	
24.92	16.21	15.13	23.62	22.04	"	
35	16.35	14.98	23.91	21.83	"	
40	16.37	15.42	24.01	22.62	"	
18.8	18.13	13.8	26.63	20.28	$FeNa_2(SO_4)_2.4H_2O$ +	$FeSO_4.7H_2O$
23	19.58	12.5	28.82	18.4	"	"
27	20.97	11.3	30.95	16.64	"	"
31	22.91	9.71	33.99	14.41	"	"
35	23.85	9.26	35.66	13.85	"	"
40	26.32	7.85	39.98	11.92	"	"
18.8	18.23	14.83	27.23	22.16	$FeNa_2(SO_4)_2.4H_2O$ +	$Na_2SO_4.10H_2O$
23	13.83	18.04	20.31	26.48	"	"
28	7.66	24.41	11.28	35.94	"	"
31	4.58	29.50	6.95	44.75	"	"
35	4.04	30.49	6.16	46.58	$FeNa_2SO_4.4H_2O$ +	Na_2SO_4
40	4.10	30.60	6.27	46.99	"	"

GALLIUM HYDROXIDE $Ga(OH)_3$.

OH

SOLUBILITY OF GALLIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE AT 18-20°.

(Fricke and Blencke, 1925.)

Normality of aq. NaOH	Gms Ga_2O_3 per 100 cc. sat. sol.	Normality of aq. NaOH	Gms Ga_2O_3 per 100 cc. sat. sol.
1.39	0.77	11.01	7.12
3.65	2.01	11.49	5.98
7.57	4.24	12.68	4.28
9.61	7.01	12.75	4.65
10.34	9.02	15.24	2.94
10.37	8.83	15.37	2.26

GALLIUM SELENATE $Ga_2(SeO_4)_3.22H_2O$.

An excess of air dried gallium selenate was added to water and the mixture kept at 25° for 6 hours. Constant shaking is not mentioned. Samples of the clear supernatant solution were weighed and their content of gallium determined by the sodium sulfite method.

100 gms. of the saturated solution contained 12.05 gms. Ga_2O_3 at 25°.

(Dennis and Bridgman, 1918.)

SO

GALLIUM Ammonium SULFATE (Alum) $GaNH_4(SO_4)_2.12H_2O$.

100 cc. sat. solution in water contain 56.84 gms $NH_4Ga(SO_4)_2.12H_2O$ at 25°.
" " " " 50% alcohol " 0.0217 " " "
" " " " 70% " " 0.00875 " " "
" " " " a mixt. of 35 cc. of H_2O + 50 cc. of C_2H_5OH + 15 cc. conc. H_2SO_4
contain 0.1613 gms. $NH_4Ga(SO_4)_2.12H_2O$ at 25°. (Dennis and Bridgman, 1918.)

GADOLINIUM BROMATE $Gd(BrO_3)_3.9H_2O$

SOLUBILITY OF GADOLINIUM BROMATE IN WATER.

(James, Fogg, McIntire, Evans and Donovan, 1927.)

BrO

t°	Gms. $Gd(BrO_3)_3.9H_2O$ per 100 gms. H_2O	Solid Phase	t°	Gms. $Gd(BrO_3)_3.9H_2O$ per 100 gms. H_2O	Solid Phase
0	50.18	$Gd(BrO_3)_3.9H_2O$	25	110.5	$Gd(BrO_3)_3.9H_2O$
5	60.01	"	30	126.1	"
10	70.11	"	35	144.5	"
15	82.64	"	40	166.0	"
20	95.58	"	45	195.6	"

GADOLINIUM ACETATE $Gd(CH_3COO)_3.4H_2O$.

100 gms. sat. sol. of gadolinium acetate in water contain 10.37 gm. Gd $(CH_3 COO)$ at 25°. (Meyer and Muller, 1920.

GADOLINIUM LACTATE $Gd(C_3H_5O_3)_3.1\frac{1}{2}H_2O$.

100 gms. sat. sol. of gadolinium lactate in water contain 0.154 gms. Gd_2O equivalent to 3.833 gms. Gd $(C_3H_5O_3)_3.1\ 1/2\ H_2O$, at 20°. (Jantsch, 1926.

GADOLINIUM GLYCOLATE $Gd_2(C_2H_3O_3)_3.2H_2O$.

1000 cc. H_2O dissolve 14.147 gms. of the salt at 20°. (Jantsch and Grünkraut, 1912–13.)

CH

GADOLINIUM SULFONATES.

SOLUBILITY IN WATER.

Salt.	Formula.	t°.	Gms. Anhydrous Salt per 100 Gms. H_2O.	Authority.
Gadolinium *m*-Nitrobenzene Sulfonate	$Gd[C_6H_4(NO_2)SO_3]_3.7H_2O$	15	43.8	(Holmberg, 1907.)
Gadolinium Bromonitrobenzene Sulfonate	$Gd[C_6H_3Br(NO_2)SO_3(1.4.2)]_3.10H_2O$	25	6.31	(Katz and James, 1913.)

GADOLINIUM CobaltiCYANIDE $Gd_2(CoC_6N_6)_2.9H_2O$.

1000 gms. aq. 10% hydrochloric acid dissolve 1.86 gms. of the salt at 25°. (James and Willard, 1916.)

GADOLINIUM OXALATE $Gd_2(C_2O_4)_3.10H_2O$

COO

SOLUBILITY OF GADOLINIUM OXALATE IN AQUEOUS 20% SOLUTIONS OF METHYLAMINE OXALATE, ETHYLAMINE OXALATE AND TRIETHYLAMINE OXALATE.

(Grant and James, 1917.)

Solvent.	Gms. $Gd_2(C_2O_4)_3$ per 100 cc. Solvent.
Aq. 20% Methylamine Oxalate	0.069
" Ethylamine "	0.360
" Triethylamine "	0.883

SOLUBILITY OF GADOLINIUM OXALATE IN AQUEOUS SOLUTIONS OF ACIDS' AT 25°.

(Sarver and Brinton, 1927.)

The determinations were made gravimetrically by evaporating large volumes of the saturated solution.

Solvent concentration in normality	Gms. $Gd_2(C_2O_4)_3$ per 100 gms. sat. sol.	Solvent concentration in normality	Gms. $Gd_2(C_2O_4)_3$ per 100 gms. sat. sol.
0.1008 HCl	0.0024	0.248 HNO_3	0.0819
0.2576 "	0.0099	1.992 "	0.2785
0.5004 "	0.0329	4.054 "	0.9032
1.018 "	0.0938	2.0 " + 0.1 $(COOH)_2$	0.0768
1.484 "	0.1563	3.03 " + " "	0.2813
2.000 "	0.2457	4.00 " + " "	0.5498
0.978 " + 0.1 $(COOH)_2$	0.0061	2.0 " + 0.5 $(COOH)_2$	0.0128
2.000 " + " "	0.0525	3.03 " + " "	0.0463
2.865 " + " "	0.1448	4.0 " + " "	0.1397
3.965 " + " "	0.3777	4.0 " + sat. "	0.0383
0.978 " + 0.5 "	0.0011	6.0 " + " "	0.1227
2.000 " + " "	0.0037	0.086 H_2SO_4	0.0086
2.865 " + " "	0.0215	0.419 "	0.0401
3.965 " + " "	0.0676	0.958 "	0.0988
1.484 " + sat. "	0.0026	1.846 "	0.2047
4.0 " + " "	0.0475	2.612 "	0.2970
6.0 " + " "	0.1921		

COO

GADOLINIUM OXALATE $Gd_2(C_2O_4)_3.10H_2O$.

SOLUBILITY IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°. (Wirth, 1912.)

Normality of Aq. H_2SO_4.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
	Gd_2O_3.	$Gd_2(C_2O_4)_3$.	
2.16	0.1883	0.3005	$Gd_2(C_2O_4)_3.10H_2O$
3.11	0.3010	0.4803	"
4.32	0.4359	0.6956	"
6.175	0.707	1.128	"

NO

GADOLINIUM Magnesium **NITRATE**, etc.

SOLUBILITY OF DOUBLE NITRATES OF GADOLINIUM AND OTHER METALS IN CONC. NITRIC ACID OF d_{16} = 1.325 (= 51.59 GM. HNO_3 PER 100 CC.) at 16°. (Jantsch, 1912.)

Salt.	Formula.	Gms. Hydrated Salt per Liter Sat. Solution.
Gadolinium Magnesium Nitrate	$[Gd(NO_3)_6]_2Mg_3.24H_2O$	352.3
" Nickel "	" Ni_3 "	400.8
" Cobalt "	" Co_3 "	451.4
" Zinc. "	" Zn_3 "	472.7

GADOLINIUM Dimethyl **PHOSPHATE** $Gd_2[(CH_3)_2PO_4]_6$.

100 gms. H_2O dissolve 23 gms. $Gd_2[(CH_3)_2PO_4]_6$ at 25° and 6.7 gms. at 95°. (Morgan and James, 1914.)

PO

SOLUBILITY OF GADOLINIUM DIMETHYL PHOSPHATE IN WATER.

(Marsh, 1939.)

t°	Gms. $Gd[(CH_3)_2PO_4]_3$ per 100 gms. H_2O	Gms. Gd_2O_3 per liter sat. sol.
0	37.0	126
25	24.2	82.3
50	15.7	53.4

The saturated solution at 0° was prepared by mechanical stirring for 3-4 hours. For the other temperatures the cold saturated solution was diluted somewhat and stirred occasionally for 3-4 hours.

GADOLINIUM SULFATE $Gd_2(SO_4)_3.8H_2O$.

SOLUBILITY IN WATER. (Benedicks, 1900.)

t°.	Gms. $Gd_2(SO_4)_3$ per 100 Gms. H_2O.	Solid Phase.
0	3.98	$Gd_2(SO_4)_3.8H_2O$
10	3.3	"
14	2.8	"
25	2.4	"
34.4	2.26	"

100 gms. H_2O dissolve 2.886 gms. $Gd_2(SO_4)_3.8H_2O$ at 20° and 2.19 gms. at 40°. (Jackson and Rienacker, 1930.)

SOLUBILITY OF GADOLINIUM SULFATE IN AQUEOUS SOLUTIONS OF:

Sodium Sulfate at 25°. (Bissell and James, 1916.)

Gms. per 100 Gms. H_2O.		Solid Phase.
Na_2SO_4.	$Gd_2(SO_4)_3$.	
0	2.15	$Gd_2(SO_4)_3.8H_2O$
0.43	2.06	"
0.47	0.76	$Gd_2(SO_4)_3.Na_2SO_4.2H_2O$
1.26	0.17	"
3.01	0.07	"
7.46	0.05	"
27.40	0.05	"

SO

Sulfuric Acid at 25°. (Wirth, 1912.,

Normality of H_2SO_4.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
	Gd_2O_3	= $Gd_2(SO_4)_3$.	
0	1.793	2.981	$Gd_2(SO_4)_3.8H_2O$
0.1	1.98	3.291	"
0.505	2.365	3.931	"
1.1	2.29	3.807	"
2.16	1.789	2.974	"
6.175	0.528	0.8777	"
12.6	0.0521	0.0867	"

GERMANIUM Tetra CHLORIDE $GeCl_4$

MISCIBILITY OF GERMANIUM TETRA CHLORIDE AND SULFUR DIOXIDE.

(Bond and Crone, 1934.)

The synthetic method was used and the temperatures of melting or disappearance of the second liquid layer determined.

t°	Gms. $GeCl_4$ per 100 gms. sat. sol.	t°	Gms. $GeCl_4$ per 100 gms. sat. sol.	t°	Gms. $GeCl_4$ per 100 gms. sat. sol.
-51.8(m.pt.)	100.	-4.9	63.98	-51.5	7.0
-75.0(-53.9)	98.80	-4.9	63.06	-55.2	6.26
-61.9(-55.0)	97.97	-4.7	59.87	-60.5(-58.0)	5.15
-53.0	97.97	-4.7	58.81	-67.1(-61.2)	4.21
-46.6	96.41	-4.9	52.37	-73.0(-64.5)	3.48
-31.0	93.72	-5.1	49.92	-76.1(-66.8)	3.07
-27.2	92.72	-5.5	45.00	-79.2(-66.8)	2.71
-24.2	91.76	-6.2	41.86	-86.0(-71.8)	2.17
-21.1	90.58	-7.4	37.78	-88.0(-72.8)	2.07
-15.0	87.42	-9.0	34.22	(-76.5)	1.55
-12.3	85.54	-10.1	31.95	(-76.5)	1.48
-9.2	82.24	-13.1	27.52	(-76.1)	0.94
-7.1	78.62	-24.6	17.52	(-75.9)	0.72
-6.1	75.36	-32.7	13.16	(-75.5)	0.00
-5.2	69.42	-36.4	11.31		
-5.2	68.78	-41.2	10.07		
-5.0	67.59				

The figures in parentheses are melting points.

SOLUBILITY OF GERMANIUM DOUBLE FLUORIDES IN WATER, EACH DETERMINED SEPARATELY.

(Müller, 1927.)

Germanium Double Fluoride of:	Formula of Salt	Gms. Salt per 100 cc sat. solution at:					
		0°	10°	25°	30°	40°	80°
Lithium	$GeLi_2F_6$	—	—	53.92	—	—	—
Sodium	$GeNa_2F_6$	1.52	1.68	—	2.25	2.83	3.36
Potassium	GeK_2F_6	0.25	0.363	0.59	0.65	0.95	—
Rubidium	$GeRb_2F_6$	0.23	0.302	—	0.74	—	—
Caesium	$GeCs_2F_6$	0.84	0.98	1.89	2.28	—	—
Tellurium	$GeTeF_8$	14.13	—	—	34.58	—	—
Silver	$GeAg_2F_6$	—	—	—	88.03	—	—

F

GERMANIUM DIOXIDE GeO_2.

100 gms. H_2O dissolve 0.405 gm. GeO_2 at 20°, and 1.07 gms. at 100°. (Winkler, 1887.)

SOLUBILITY OF GERMANIUM DIOXIDE IN WATER.

(Schwarz and Huf, 1931.)

The Germanium dioxide was prepared by distilling germanite 4-5 times in a stream of chlorine, freeing the tetrachloride thus obtained of chlorine by means of Hg and hydrolysing in distilled water. Several determinations made with such samples gave the following results at 20°.

Preliminary treatment of sample	Hours allowed for saturation	Gms. GeO_2 per 100 cc sat. sol.
Hydrolysis 6 hrs. with 30.6% H_2O	30	0.534
" with 3.7% H_2O drying over KOH 14 hrs, age 58 hrs.	35	0.596
Hydrolysis of GeO_2, heated 2 hrs. at 600°	28-51	0.430
" " " " " " " 1000°	143	0.349
Boiling in H_2O (hydrolysed, dried)	—	0.747
Melted GeO_2	32	0.572

O

The following results at different temperatures were obtained with a preparation which had been heated to 600° and was used in the ratio of 0.4 gm. per 100 cc H_2O.

t°	11°	20°	26°	36°	41°
Gms. GeO_2 per 100 cc sat. sol.	0.396	0.430	0.470	0.551	0.617

A table of results is also given showing that the variations of solubility of GeO_2 in Water depends upon the preliminary treatment of the sample as well as upon the ratio of solid to water used in the determination.

The properties of the modifications of GeO_2 obtained by various means are described by Müller and Blank, 1924; and Müller, 1926.

GERMANIUM DIOXIDE

SOLUBILITY OF GERMANIUM DIOXIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID, SULFURIC ACID AND SODIUM HYDROXIDE AT 25°.

(Pugh, 1929.)

The object of the determinations was to obtain evidence of the amphoteric character of germanium hydroxide and supply comparative values of the acid and basic dissociation constants of this compound. The GeO_2 was prepared from the pure disulfide by repeated treatment with HNO_3 and ignition to bright red heat. The oxide, which had not been allowed to fuse, was ground with water, washed until free of H_2SO_4 and finally reignited. It was found that 8-10 days agitation were necessary for attainment of equilibrium.

O Results for aq. Hydrochloric Acid | Results for aq. Sulfuric Acid | Results for aq. Sodium Hydroxide

Gm. Mols. HCl per liter	Gms. GeO_2 per 100cc sat. sol.	Gm. Mols. H_2SO_4 per liter	Gms. GeO_2 per 100cc sat. sol.	Gm. Mols. per liter sat. sol. NaOH	Gm. Mols. per liter sat. sol. GeO_2
0.0	0.4470	0.0	0.4470	0.0	0.0428
0.25	0.4115	0.50	0.3550	0.00125	0.0440
0.50	0.3810	0.98	0.2805	0.0025	0.0483
1.50	0.2600	1.50	0.2000	0.005	0.0545
2.0	0.2185	2.05	0.1600	0.010	0.0675
2.925	0.1544	2.52	0.1305	0.0125	0.0746
3.85	0.1140	3.02	0.099	0.025	0.1115
4.35	0.0920	3.50	0.074	0.050	0.1693
5.20	0.074	4.0	0.050	0.100	0.2280
5.72	0.102	4.5	0.041		
6.23	0.1820	5.85	0.019		
6.85	0.3164	7.95	0.009		
7.62	0.7660	(95%)	0.140.		

Fusion-point data for mixtures of $GeO_2 + K_2O$ and $GeO_2 + Na_2O$ are given by Schwarz and Heinrich, 1932.

GERMANIUM (Mono) **SULFIDE** GeS

S **GERMANIUM** (Di) **SULFIDE** GeS_2.

100 gms. H_2O dissolve 0.24 gm. GeS

100 gms. H_2O dissolve 0.45 gm. GeS_2. (Winkler, 1887.)

100 gms. liquid NH_3 dissolve 0.0473 gm. GeS (= 0.0031 Gm. Mol. GeS per liter) at -33°.

100 gms. liquid NH_3 dissolve 3.112 gm. GeS_2 (= 0.1551 Gm. Mol. GeS_2 per liter) at -32.9°. (Johnson and Wheatley, 1934.)

HYDROGEN H_2.

SOLUBILITY OF HYDROGEN IN WATER.

(Milligan, 1924.)

Hydrogen mixed with air was shaken for 2 minutes with distilled water previously saturated with air. The gas phase was analyzed by means of a Haldane gas analysis apparatus before and after contact with the water and the amount of hydrogen dissolved was estimated by difference. It was found that 1 cc. of H_2O at 25° dissolves 0.017 cc. hydrogen (reduced to 0°) when the pressure of the gas over the water is 760 mm.

SOLUBILITY OF HYDROGEN IN WATER.

(Winkler — Ber. 24, 99, '91; Bohr and Bock — Wied. Ann. 44, 318, '91; Timofejew — Z. physik. Chem. 6, 147, '90.)

t°.	β'.	l.		β.	q.
0	0.0214	...	...	0.0214	0.000193
5	0.0203	0.0209 —	0.0241	0.0204	0.000184
10	0.0193	0.0204 —	0.0229	0.0195	0.000176
15	0.0185	0.0200 —	0.0217	0.0188	0.000169
20	0.0178	0.0196 —	0.0205	0.0182	0.000162
25	0.0171	0.0193 —	0.0191	0.0175	0.000156
30	0.0163	...	...	0.0170	0.000147
40	0.0153	...	...	0.0164	0.000139
50	0.0141	...	...	0.0161	0.000129
60	0.0129	...	...	0.0160	0.000119
80	0.0085	...	...	0.0160	0.000079
100	0.0000	...	...	0.0160	0.000000

β = Bunsen Absorption Coefficient which is the volume of gas (reduced to 0° and 760 mm) absorbed by 1 volume of the liquid when the pressure of the gas itself without the tension of the liquid amounts to 760 mm.

β' = Solubility, or the volume of gas (reduced to 0° and 760 mm) which is absorbed by 1 volume of the liquid at barometric pressure of 760 mm.

q = the weight of gas in grams dissolved by 100 gms. of pure solvent, at the indicated temperature and a total pressure (that is, the partial pressure of the gas plus the vapor pressure of the liquid at the absorption temperature) of 760 mm.

l = the Ostwald Solubility Expression which represents the ratio of the volume (v) of gas absorbed at any pressure and temperature, to the volume (V) of the absorbing liquid, thus $l = \frac{v}{V}$. This expression differs from the Bunsen Absorption coefficient β in that the volume (v) of the dissolved gas is not reduced to 0° & 760 mm. The solubility l is therefore the volume of gas dissolved by unit volume of the solvent at the temperature of the experiment. The two expressions are related thus:

$$l = \beta(1+0.00367t), \qquad \beta = \frac{l}{(1+0.00367t)}$$

HYDROGEN H_2

SOLUBILITY OF HYDROGEN IN WATER AT VARIOUS TEMPERATURES AND AT 25 TO 1000 ATMOSPHERES PRESSURE.

(Wiebe and Gaddy, 1934.)

The authors used the same method previously employed at 25°. The hydrogen contained 0.1 percent N for which a correction proportional to its mol fraction was applied. A correction for change of vapor pressure due to the gas pressure on the liquid, was made. By a sensitive method of plotting deviations the experimental data were smoothed with respect to both pressure and temperature to obtain the following interpolated solubility values.

Pressure in Atmospheres	cc H_2 (reduced to 0^0 and 760mm) dissolved by 1.0 Gm. H_2O at:					
	0°	10°	20°	30°	40°	50°
25	0.5363	0.4870	0.4498	0.4263	0.4133	0.4067
50	1.068	0.9690	0.8945	0.8475	0.8215	0.8090
75	1.601	1.453	1.341	1.271	1.232	1.212
100	2.130	1.932	1.785	1.689	1.638	1.612
150	3.168	2.872	2,649	2.508	2.432	2.395
200	4.187	3.796	3.499	3.311	3.210	3.165
300	6.139	5.579	5.158	4.897	4.747	4.695
400	8,009	7.300	6.766	6.430	6.245	6.166
500	9.838	8.980	8.328	7.922	7.705	7.613
600	11.626	10.610	9.856	9.390	9.135	9.017
700	13.370	12.214	11.362	10.818	10.524	10.389
800	15.013	13.746	12.808	12.218	11.889	11.735
900	16.548	15.215	14.217	13.583	13.230	13.072
1000	18.001	16.623	15.592	14.928	14.569	14.404

Pressure in Atmospheres	cc H_2 (reduced to 0^0 and 760mm) dissolved by 1.0 Gm. H_2O at:				
	60°	70°	80°	90°	100°
25	0.4053	0.4093	0.4203	0.4385	0.4615
50	0.8095	0.8171	0.8385	0.8720	0.9120
75	1.211	1.224	1.254	1.298	1.355
100	1.610	1.628	1.667	1.727	1.805
150	2.393	2.422	2.485	2.576	2.681
200	3.168	3.208	3.286	3.402	3.544
300	4.692	4.746	4.866	5.042	5.220
400	6.173	6.249	6.392	6.600	6.841
500	7.625	7.717	7.885	8.129	8.429
600	9.016	9.131	9.324	9.665	9.994
700	10.405	10.527	10.757	11.093	11.512
800	11.746	11.893	12.169	12.555	12.980
900	13.084	13.233	13.533	13.946	14.394
1000	14.407	14.557	14.867	15.303	15.775

The authors extrapolated the results at 25 atmospheres to lower pressures by means of Henry's law to obtain values at one atmosphere. These results when converted to terms of the Bunsen and Ostwald coefficients agree fairly well with the data of Winkler except at the higher temperatures.

HYDROGEN H_2

SOLUBILITY OF HYDROGEN IN WATER AT 25° AND AT 25 TO 1000 ATMOSPHERES PRESSURE.

(Wiebe, Gaddy and Heins, Jr., 1932.)

The authors used a simple bubbling-type of apparatus made of a steel cylinder with pressure valves. Equilibrium was approached from both lower and higher pressures. The experimental accuracy was about 0.5 percent except at the lower pressures.

Atmospheres Pressure	cc. H_2 (reduced to 0° and 760mm) dissolved by 1.0 gm. H_2O	Atmospheres Pressure	cc H_2 (reduced to 0° and 760mm) dissolved by 1.0 gm. H_2O
25	0.436 ± 0.008	400	6.57 ± 0.04
50	0.867 ± 0.012	600	9.58 ± 0.05
100	1.728 ± 0.017	800	12.46 ± 0.06
200	3.39 ± 0.03	1000	15.20 ± 0.08

Additional data for the solubility of H_2 in water at pressures up to 10 atmospheres are given by Cassuto, 1913.

SOLUBILITY OF HYDROGEN IN WATER AT 25° AND AT PRESSURES UP TO 150 ATMOSPHERES.

(Frolich, Touch, Hogan and Peer, 1931.)

The determinations were made by shaking water and hydrogen at various pressures in a steel cylinder maintained at 25°, and, after attainment of equilibrium, withdrawing a sample of the mixture over mercury in one of three burets so designed that the volumes could be measured with the same degree of accuracy at any ratio of gas to liquid. The results are given in the form of a diagram from which the following approximate values were read.

Pressure in atmospheres	cc. H_2 (measured at 25° and 1 Atm. pressure) dissolved by 1.0 cc H_2O
50	2.0
80	3.0
120	4.5
150	5.5

SOLUBILITY OF HYDROGEN IN WATER AT HIGH PRESSURES.

(Ipatiew, Jr., Drushina,-Artemowitsch and Tichomirow, 1931, 1932.)

Mixtures of water and hydrogen under pressure were rotated in a steel cylinder at constant temperatures. Equilibrium was reached in comparatively short periods of time. Samples of the mixture were removed to a buret containing mercury and the volumes of liquid and gas accurately measured at room temperature and the gas volume reduced to 0° and 760mm.

t°	H_2 Pressure in Atmospheres	CC. H_2 (reduced to 0° & 760 mm) dissolved in 100 cc H_2O	t°	CC. H_2 (reduced to 0° and 760mm) dissolved in 100 cc H_2O at 100 Atmospheres Pressure
25	20	33.0	0.5	196.3
"	40	66.4	5.0	188.0
"	60	100.2	10.0	180.0
"	80	132.8	15.0	174.3
"	100	165.3	20.0	168.3
"	120	199.2	25.0	165.5
"	140	231.0	35.0	162.5
			45.0	158.7
			100.0	158.0

In a subsequent paper by Ipatiew, Jr., and Theodorawtch, 1934, results for the Solubility of Hydrogen in Water at temperatures up to 225° and at pressures varying between 30 and 100 atmospheres, are given.

SOLUBILITY OF A MIXTURE OF 76.42 PERCENT HYDROGEN AND 25.58 PERCENT NITROGEN IN WATER AT 25° AND AT 50 TO 1000 ATMOSPHERES PRESSURE.

(Wiebe and Gaddy, 1936.)

The approximately 3.1 mixture of hydrogen and nitrogen was prepared by burning hydrogen in air. The amount of argon introduces an uncertainty of about 0.2 percent. The same bubbling method was used as previously employed by the authors for determinations of the solubility of hydrogen in water at different temperatures and pressures. The composition of the gas in the two phases was analyzed by means of a modified form of thermal conductivity apparatus containing glass instead of the usual metal cells.

Pressure in atmospheres	cc H_2 (reduced to 0° and 760mm) dissolved in 1.0 gm. H_2O	Av. percent H_2 in the gas present in the liquid phase	Av. percent H_2 in the gas present in the gas phase
50	0.8349	80.17	76.42
100	1.643	80.89	76.42
200	3.209	82.68	76.42
400	6.068	84.33	76.42
600	8.809	84.92	76.42
800	11.327	85.32	76.42
1000	13.724	85.81	76.42

Thermodynamical calculations of the solubility of Hydrogen and Nitrogen and their mixtures in Water at pressures up to 1000 atmospheres based upon the above results are given by Krichevsky and Kasarnovsky, 1935, 1936, and by Kielland, 1936.

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF ACIDS AND BASES AT 25°.

(Geffcken — Z. physik. Chem. 49, 268, '04.)

Gram Equiv. Acids and Bases per Liter.	Solubility of H (l_{25} = Ostwald Expression) in Solutions of: HCl.	HNO$_3$.	½H$_2$SO$_4$.	CH$_3$COOH.	CH$_2$ClCOOH.	KOH.	NaOH.
0.0	0.0193	0.0193	0.0193	0.0193	0.0193	0.0193	0.0193
0.5	0.0186	0.0188	0.0185	0.0192	0.0189	0.0167	0.0165
1.0	0.0179	0.0183	0.0177	0.0191	0.0186	0.0142	0.0139
2.0	0.0168	0.0174	0.0163	0.0188	0.0180	...	0.0097
3.0	0.0159	0.0167	0.0150	0.0186	...	...	0.0072
4.0	...	0.0160	0.0141	0.0186	...	...	0.0055

The above figures for the concentrations of acids and bases were calculated to grams per liter, and these values with the corresponding l_{25} values for the solubility of hydrogen, plotted on cross-section paper. From the resulting curves, the following table was read:

Grams Acids and Bases per Liter.	Solubility of H (l_{25} = Ostwald Expression) in Solutions of: HCl.	HNO$_3$.	½H$_2$SO$_4$.	CH$_3$COOH.	CH$_2$ClCOOH.	KOH.	NaOH.
0	0.0193	0.0193	0.0193	0.0193	0.0193	0.0193	0.0193
20	0.0185	0.0189	0.0186	0.0192	0.0191	0.0172	0.0165
40	0.0179	0.0186	0.0180	0.0191	0.0190	0.0153	0.0140
60	0.0173	0.0183	0.0174	0.0190	0.0188	0.0135	0.0117
80	0.0167	0.0180	0.0168	0.0189	0.0187	...	0.0097
100	0.0160	0.0179	0.0162	0.0189	0.0185	...	0.0082
150	...	0.0171	0.0148	0.0188	0.0182	...	0.0058
200	...	0.0165	0.0140	0.0186	0.0179	...	...
250	...	0.0160	...	0.0184	...	...	...

THE SOLUBILITY OF HYDROGEN IN CONC. H$_2$SO$_4$ AT 20°.

(Christoff, 1906.)

% H$_2$SO$_4$	0	35.82	61.62	95.6
l_{20}	0.0208	0.00954	0.00708	0.01097

SOLUBILITY OF HYDROGEN IN AQUEOUS PROPIONIC ACID SOLUTIONS.

(Braun, 1900.)

Gms. C$_2$H$_5$COOH per 100 Gms. Solution.	Coefficient of Absorption of Hydrogen at: 5°.	10°.	15°.	20°.	25°.
2.63	0.02245	0.0214	0.0200	0.0188	0.0172
3.37	0.0222	0.0212	0.0199	0.0187	0.0171
5.27	0.0224	0.0212	0.0198	0.0184	0.0171
6.50	0.0218	0.0209	0.0193	0.0183	0.0169
9.91	0.0213	0.0203	0.0191	0.0178	0.0160

SOLUBILITY OF HYDROGEN IN AQUEOUS SODIUM HYDROXIDE AND OTHER SOLVENTS AT 100 ATMOSPHERES PRESSURE.

(Ipatiew, Jr., Drushina-Artemowitsch and Tichonirrow, 1931-1932.)

t°	Solvent	cc H$_2$ (reduced to 0° and 760mm) per 100 cc solvent
25	Aq. 20% NaOH Solution	41.7
25	Methyl alcohol	869.5
25	Benzene	694.4

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF AMMONIUM NITRATE AT 20°.

(Knopp — Z. physik. Chem. 48, 103, '04.)

p.	Normality (per 1000 Gms.) H_2O.	Molecular Concentration.	Absorption Coefficient of Hydrogen.	Density of Solutions.
0.00	0.00	0.00	0.0188	...
1.037	0.1308	0.002352	0.01872	1.0027
2.167	0.2765	0.004956	0.01845	1.0072
3.378	0.4363	0.007799	0.01823	1.0122
4.823	0.6333	0.011280	0.01773	1.0182
6.773	0.9069	0.016447	0.01744	1.0262
11.550	1.6308	0.028525	0.01647	1.04652

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF BARIUM CHLORIDE.

(Braun — Z. physik. Chem. 33, 735, '00.)

Gms. $BaCl_2$ per 100 Gms. Solution.	Coefficient of Absorption of Hydrogen at:				
	5°.	10°.	15°.	20°.	25°.
0.00	0.0237	0.0221	0.0206	0.0191	0.0175
3.29	0.0211	0.0198	0.0185	0.0172	0.0157
3.6	0.0209	0.0197	0.0184	0.0170	0.0156
6.45	0.0196	0.0186	0.0173	0.0161	0.0147
7.00	0.0194	0.0183	0.0172	0.0159	0.0146

H

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF CALCIUM CHLORIDE, MAGNESIUM SULPHATE, AND LITHIUM CHLORIDE AT 15°.

(Gordon — Z. physik. Chem. 18, 14, '95.)

Coefficient of Absorption of hydrogen in water at 15° = 0.01883.

In Calcium Chloride.			In Magnesium Sulphate.			In Lithium Chloride.		
Gms. $CaCl_2$ per 100 g. Sol.	G. M. $CaCl_2$ per Liter.	Absorption Coefficient of H.	Gms. $MgSO_4$ per 100 g Sol.	G. M. $MgSO_4$ per Liter.	Absorption Coefficient of H.	Gms. LiCl per 100 g. Sol.	G. M. LiCl per Liter.	Absorption Coefficient of H.
3.47	0.321	0.01619	4.97	0.433	0.01501	3.48	0.835	0.01619
6.10	0.578	0.01450	10.19	0.936	0.01159	7.34	1.800	0.01370
11.33	1.122	0.01138	23.76	2.501	0.00499	14.63	3.734	0.0099
17.52	1.1827	0.00839						
26 34	2.962	0.00519						

For definition of Coefficient of Absorption, see page 553

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF POTASSIUM CARBONATE, CHLORIDE, AND NITRATE AT 15°.

(Gordon.)

In Potassium Carbonate.			In Potassium Chloride.			In Potassium Nitrate.		
Gms. K_2CO_3 per 100 g. Sol.	G. M. K_2CO_3 per Liter.	Absorption Coefficient of H.	Gms. KCl per 100 g. Sol.	G. M. KCl per Liter.	Absorption Coefficient of H.	Gms. KNO_3 per 100 g. Sol.	G. M. KNO_3 per Liter.	Absorption Coefficient of H.
2.82	0.209	0.01628	3.83	0.526	0.01667	4.73	0.482	0.01683
8.83	0.690	0.01183	7.48	1.051	0.01489	8.44	0.879	0.01559
16.47	1.376	0.00761	12.13	1.755	0.01279	16.59	1.820	0.01311
24.13	2.156	0.00462	19.21	2.909	0.01012	21.46	2.430	0.01180
41.81	4.352	0.00160	22.92	3 554	0.00892			

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AND NITRATE AT 20°.

(Knopp — Z. physik. Chem. 48, 103, '04.)

In Potassium Chloride.

p.	Normality (per 1000 g. H_2O).	Absorption Coefficient.	Density of Solutions.
1.089	0.1475	0.01823	1.0052
2.123	0.2907	0.01757	1.0118
4.070	0.5687	0.01661	1.0243
6.375	0.9127	0.01531	1.0394
7.380	1.0682	0.01472	1.0460
13.612	2.1222	0.01255	1.0875

In Potassium Nitrate.

p.	Normality (per 1000 g. H_2O).	Absorption Coefficient.	Density of Solutions.
1.224	0.1245	0.01835	1.0059
2.094	0.2114	0.01818	1.0113
4.010	0.4127	0.01785	1.0236
5.925	0.6225	0.01743	1.0359
7.742	0.8293	0.01667	1.0477
13.510	1.5436	0.01436	1.0865

SOLUBILITY OF HYDROGEN IN AQUEOUS SODIUM CARBONATE AND SULPHATE SOLUTIONS AT 15°.

(Gordon.)

In Sodium Carbonate.

Gms. Na_2CO_3 per 100 Gms. Solution.	G. M. Na_2CO_3 per Liter.	Absorption Coefficient of H.
2.15	0.207	0.01639
8.64	0.438	0.01385
11.53	1.218	0.00839

In Sodium Sulphate.

Gms. Na_2SO_4 per 100 Gms. Solution.	G. M. Na_2SO_4 per Liter.	Absorption Coefficient of H.
4.58	0.335	0.01519
8.42	0.638	0.0154
16.69	1.364	0.00775

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE.

(Braun; Gordon.)

Gms. NaCl per 100 Gms. Solution	Coefficient of Absorption of Hydrogen at: 5°.	10°.	15°.	20°.	25°.
1.25	0.0218	0.0205	0.0191	0.0177	0.0162
3.80	0.0198	0.0188	0.0176	0.0162	0.0148
4.48	0.0192	0.0182	0.0171	0.0159	0.0143
6.00	0.0184	0.0175	0.0164	0.0153	0.0138
14.78	..	...	0.0093	...	...
23.84	...	...	0.00595	...	...

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF SODIUM NITRATE.

In Sodium Nitrate at 20°.

(Knopp.)

p.	Normality (per 1000 Gms. H_2O).	Absorption Coefficient of H.	Density of Solutions.
1.041	0.1236	0.01839	1.0052
2.192	0.2634	0.01774	1.0130
4.405	0.5416	0.01694	1.0282
6.702	0.8442	0.01518	1.04411
12.037	1.7354	0.0130	1.08667

In Sodium Nitrate at 15°.

(Gordon.)

Gms. $NaNO_3$ per 100 Gms. Solution.	G. M. $NaNO_3$ per Liter.	Absorption Coefficient of H.
5.57	0.679	0.01603
11.16	1.413	0.0137
19.77	2.656	0.01052
37.43	5.711	0.00578

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF VARIOUS SALTS AT 15°.

(Steiner, 1894.)

Salt in Aq. Solution.	Bunsen Absorption Coefficient β ($\times 10^4$) in Aq. Solution of Normality.								
	0.	1.	2.	3.	4.	5.	6.	7.	9.
LiCl	1883	1574	1325	1121	949	...	...	...	...
KNO_3	1883	1524	1276	1076	...	...	...	...	...
$\frac{1}{3}AlCl_3$	1883	1511	1221	993	810	667	550	...	...
KCl	1883	1502	1217	996	820	...	...	...	...
$NaNO_3$	1883	1496	1201	984	808	667	542	...	...
$\frac{1}{2}CaCl_2$	1883	1493	1195	958	780	635	510	...	...
NaCl	1883	1478	1144	380	699	573	...	...	...
$\frac{1}{2}MgSO_4$	1883	1451	1120	856	659	499	...	...	...
$\frac{1}{2}ZnSO_4$	1883	1446	1113	852	667	510	...	...	...
$\frac{1}{2}Na_2SO_4$	1883	1370	991	710	...	...	...	...	...
$\frac{1}{2}K_2CO_3$	1883	1338	967	700	508	372	273	206	158
$\frac{1}{2}Na_2CO_3$	1883	1340	699	...	...	...	...	...	...
Cane Sugar	1883	1280	731	...	...	...	...	...	...

SOLUBILITY OF HYDROGEN IN ALCOHOL. (Timofeiew, 1890; Bunsen-Heurich, 1892.)

t°.	Coef. of Absorption in 98.8% Alcohol.	t°.	Coef. of Absorption in 7% Alcohol.	t°.	Coef. of Absorption in Pure Alcohol (Bunsen).
0	0.0676	4	0.0749	1	0.06916
6.2	0.0693	18.8	0.0740	5	0.06847
13.4	0.0705			11.4	0.06765
				23.7	0.06633

SOLUBILITY IN AQUEOUS ALCOHOL SOLUTIONS AT 20° AND 760 MM. PRESSURE.

(Lubarsch, 1889.)

Wt. % Alcohol.	Vol. % Absorbed H.	Wt. % Alcohol.	Vol. % Absorbed H.
0	1.93	28.57	1.04
9.09	1.43	33.33	1.17
16.67	1.29	50	2.02
23.08	1.17	66.67	2.55

SOLUBILITY OF HYDROGEN IN AQ. SOLUTIONS OF CHLORAL HYDRATE.

(Müller, C. 1912–13.)

t°.	Gms. Chloral Hydrate per 100 Gms. Aq. Sol.	d_{20} of Aq. Solution.	Absorption Coefficient.	
			β_t.	β_{20}.
19.4	15.5	1.0722	0.01732	0.01724
17.4	28.3	1.143	0.01569	0.01540
18.7	46.56	1.2505	0.01388	0.01375
16.5	52	1.2870	0.01314	0.01280
17	63	1.371	0.01270	0.01243
17.9	68	1.4097	0.01286	0.01270
18.3	78.4	1.4993	0.01398	0.01380

SOLUBILITY OF HYDROGEN IN CHLORAL HYDRATE SOLUTIONS AT 20°. (Knopp, 1904.)

p.	Normality (per 1000 Gms. H_2O).	Molecular Concentration.	Absorption Coefficient of H.	Density of Solutions.
4.91	0.310	0.005594	0.01839	1.0202
7.69	0.504	0.008992	0.01802	1.0320
14.56	1.030	0.018223	0.01712	1.0669
29.50	2.530	0.043601	0.01542	1.1466
38.42	3.770	0.063647	0.01440	1.1982
49.79	6	0.097403	0.01353	1.2724
63.90	10.700	0.161660	0.01307	1.3743

For definition of Bunsen Absorption Coef., see p. 553

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF GLYCEROL.

Results at 14° and 21°. (Henkel, 1905, 1912.) Results at 25°. (Drucker and Moles, 1910.)

t°.	Wt. % Glycerol.	Absorp. Coef. β (See p. 227.)	Wt. % Glycerol.	d_{25} Sat. Sol.	l_{25} (Ostwald Expression)
14	0	0.0193	0	1	0.0196
"	2.29	0.0189	4	1.0101	0.0186
"	5.32	0.0186	10.5	1.0260	0.0178
"	8.57	0.0182	22	1.0542	0.0154
"	10.83	0.01815	49.8	1.1290	0.0099
"	15.31	0.01765	50.5	1.1300	0.0097
21	0	0.0184	52.6	1.1365	0.0090
"	2.29	0.0181	67	1.1752	0.0067
"	5.68	0.0177	80	1.2113	0.0051
"	6.46	0.0176	82	1.2159	0.0051
"	10.40	0.0171	88	1.2307	0.0044
"	18.20	0.0160	95	1.2502	0.0034

Additional data for this system are given by Müller, C. 1912–13.

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF SEVERAL COMPOUNDS.

(Hüfner, 1906–07.)

Aqueous Solution of:	Conc. of Solvent Gms. per Liter.	t.	Absorption Coef. β.
Water alone	0	20.11	0.0181
Dextrose (Grape Sugar)	41.45	20	0.0176
"	87.3	20.25	0.0166
"	174	20.28	0.0152
Urea	60	20.17	0.0170
Acetamide	59	20.11	0.0180
Alanine	89	20.08	0.0156
Glycocol	75	20.16	0.0158

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF CANE SUGAR AND OF GRAPE SUGAR.

(Müller, C. 1912–13.)

t°.	Wt % Cane Sugar.	Sp Gr Sat. Sol	Abs Coef. β_{15}.	t°.	Wt. % Grape Sugar.	Sp. Gr. Sat Sol.	Abs Coef. β_{20}.
15.2	5.04	$d_{15} = 1.019$	0.0173	19.3	0	...	0.0184
11.6	14.7	$d_{11} = 1.060$	0.0151	20.5	12.2	$d_{20} = 1.048$	0.0160
12	20.26	$d_{11} = 1.084$	0.0146	20.5	20.7	$d_{20} = 1.084$	0.0145
12.7	29.86	$d_{13} = 1.128$	0.0126	21.1	32.56	$d_{20} = 1.130$	0.0125
11.8	31.74	$d_{12} = 1.138$	0.0119	21.8	45.8	$d_{20} = 1.199$	0.0102
13.3	39.65	$d_{13.5} = 1.175$	0.0103	21.2	59	$d_{20} = 1.266$	0.0078
12.6	42.94	$d_{12.5} = 1.195$	0.0094				

SOLUBILITY OF HYDROGEN IN AQUEOUS SUGAR SOLUTIONS AT 15°. (Gordon, 1895)

Gms Sugar per 100 Gms. Solution.	Gm. Mols Sugar per Liter.	Absorption Coefficient of H.
16.67	0.520	0.01561
30.08	0.993	0.01284
47.65	1.699	0.00892

SOLUBILITY OF HYDROGEN AT 25° (Findlay and Shen, 1912) IN AQ. SOLUTIONS OF:

Dextrin.			Starch.			Gelatin.	
Gms. Dextrin per 100 cc.	Sp. Gr.	l_{25}.	Gms Starch per 100 cc.	Sp. Gr.	l_{25}.	Gms Gelatin per 100 cc	l_{25}.
3.98	1.012	0.0194	2.01	1.005	0.0194	1.53	0.0194
8.58	1.019	0.0191	3.56	1.011	0.0189	2.69	0.0189
8.12	1.028	0.0188	7.13	1.024	0.0181	4.74	0.0185
19.20	1.066	0.0174	9.29	1.032	0.0182	5.71	0.0182

COMPARATIVE SOLUBILITY OF HYDROGEN AT 38° AND ATMOSPHERIC PRESSURE IN WATER AND IN OX BLOOD SERUM AND CELLS.

(Van Slyke and Sendroy Jr., 1928.)

Solvent.	Abs. Coef. cc H_2 per 1 cc sat. sol.
Water	0.01620
Aq. 0.15 normal NaCl	0.01559
Ox Blood Serum	0.01533
Ox Blood Cells	0.01454

SOLUBILITY OF HYDROGEN IN WATER AND IN RUBBER.

(Venable and Fuwa, 1922.)

The gas dissolved by a given amount of air free rubber was pumped out with a Töpler pump and measured over mercury.

100 cc. H_2O dissolve 1.8 cc. hydrogen (reduced to 0° and 760^{mm}) at 21°.
» Rubber » less than 1.0 cc. (» . ») »

RATIO OF THE SOLUBILITY OF HYDROGEN IN WATER TO ITS SOLUBILITY IN AQUEOUS SOLUTIONS OF SUCROSE AT 15°.

(Garner and Masson, 1921.)

H

Mols. sucrose per liter............	0.292	0.585	0.877	1.169	1.460	1.755
Ratio, H_2 in H_2O ÷ H_2 in aq. sucrose.	1.11	1.23	1.39	1.61	1.87	2.17

SOLUBILITY OF A MIXTURE OF 3 VOLUMES OF HYDROGEN + 1 VOLUME OF NITROGEN IN LIQUID AMMONIA.

(Larson and Black, 1925.)

Total Pressure.	t°.	Cc. Gas (at standard temp-and pressure) dissolved by 1.0 gm. liquid Ammonia		
		H_2.	N_2.	Total.
50 atmospheres.......	−25.2	1.62	0.73	2.35
»	−18.5	1.90	0.84	2.74
»	−10.0	2.07	0.94	3.01
»	− 3.0	2.35	1.08	3.43
»	0.0	2.61	1.15	3.76
»	+ 2.5	2.70	1.19	3.89
»	19.0	3.19	1.46	4.65
100 atmospheres.......	−25.0	3.30	1.35	4.65
»	−20.0	3.66	1.46	5.12
»	−16.5	3.85	1.63	5.48
»	−10.0	4.43	1.83	6.26
»	− 5.2	4.84	2.02	6.86
»	0.0	5.28	2.28	7.56
»	+22.0	7.54	3.21	10.75
150 atmospheres.......	−22.0	4.70	1.89	6.59
»	−17.2	5.12	2.09	7.21
»	− 9.2	6.20	2.44	8.64
»	− 7.2	6.30	2.58	8.88
»	+ 5.0	8.22	3.33	11.55
»	13.3	9.42	3.61	13.03

SOLUBILITY OF HYDROGEN IN LIQUID AMMONIA AT SEVERAL TEMPERATURES AND AT PRESSURES UP TO 1000 ATMOSPHERES.

(Wiebe and Tremearne, 1934; Wiebe and Gaddy, 1937.)

The steel tube bubbling apparatus previously described for the solubility of H in Water was used. The H_2 contained 0.1% N_2 and the NH_3 contained 0.02% H_2O. No correction was made for these impurities. The values are believed to be accurate to within 2-3 parts per 1000.

Total Pressure in Atmospheres	cc H_2 (reduced to 0° and 760mm) dissolved by 1.0 gm. NH_3 at: 0°	25°	50°	75°	100°
25	—	1.695	0.85	—	—
50	3.28	4.47	5.10	3.49	—
75	—	7.20	9.33	9.95	5.80
100	6.70	9.88	13.49	16.35	15.67
150	—	15.08	21.60	29.00	36.35
200	13.11	20.08	29.39	41.41	57.10
300	18.96	29.45	44.42	65.40	98.74
400	24.33	38.13	58.33	88.34	140.60
500	29.27	46.18	71.33	110.22	182.4
600	33.99	53.71	83.48	131.0	224.0
700	38.25	60.77	94.82	150.6	264.3
800	42.33	67.63	105.4	169.2	305.2
900	46.20	73.74	115.3	186.8	346.5
1000	49.77	79.25	124.9	203.3	388.2

Ipatjew, and Theodorowitch, 1932, give results for the solubility of H_2 in liquid NH_3 at 25° and at pressures up to 250 atmospheres which are somewhat lower than the above over their whole range.

SOLUBILITY OF HYDROGEN IN RUSSIAN PETROLEUM.

(Gniewasz and Walfisz, 1887.)

Coefficient of absorption at 20° = 0.0582, at 10° = 0.0652.

SOLUBILITY OF HYDROGEN IN WATER AND IN ORGANIC SOLVENTS.

Results in terms of the Ostwald Expression, (Just, 1901.)

Solvent	l_{25}.	l_{20}.	Solvent.	l_{25}.	l_{20}.
Water	0.0199	0.0200	Amyl Acetate	0.0774	0.0743
Aniline	0.0285	0.0303	Xylene	0.0819	0.0783
Amyl Alcohol	0.0301	0.0353	Ethyl Acetate	0.0852	0.0788
Nitrobenzene	0.0371	0.0353	Toluene	0.0874	0.0838
Carbon Disulfide	0.0375	0.0336	Ethyl Alcohol (98.8%)	0.0894	0.0862
Acetic Acid	0.0633	0.0617	Methyl Alcohol	0.0945	0.0902
Benzene	0.0756	0.0707	Isobutyl Alcohol	0.0976	0.0929
Acetone	0.0764	0.0703			

SOLUBILITY OF HYDROGEN IN ETHYL ETHER.

(Christoff, 1912.)

Results in terms of the Ostwald Solubility Expression l

$l_0 = 0.1115$, $l_5 = 0.1150$, $l_{10} = 0.1195$, $l_{15} = 0.1259$.

Results for the system, Hydrogen + Nitrogen + Ammonia (gas) + Ammonia (Liquid) at temperatures from -22.5° to +18.7° and pressures from 50 to 1000 atmospheres are given by Larson and Black, 1925. A discussion of these and similar results for other systems in light of the concept that solubility effect is a change in activity of one component resulting from the presence of the other component is given by Cupples, 1929.

II **HYDROGEN**

SOLUBILITY OF HYDROGEN IN SEVERAL SOLVENTS.

(Horiuti, 1931.)

The determinations were made with great precision. The results are in terms of the Ostwald Solubility Expression, which is ℓ = the ratio of the concentration of the hydrogen in the liquid phase to its concentration in the gas phase.

Results for:

Carbon Tetrachloride

t°	ℓ
0	0.0650
20.9	0.0794
38.8	0.0928
59.0	0.1124

Benzene

t°	ℓ
7.0	0.0585
22.9	0.0700
41.3	0.0844
62.8	0.1051

Ethyl Ether

t°	ℓ
-80.6	0.0498
-59.9	0.0632
-40.0	0.0800
-21.1	0.0964
0.0	0.1188
21.1	0.1409

Acetone

t°	ℓ
-81.9	0.0273
-60.7	0.0376
-40.6	0.0498
-20.9	0.0618
0.0	0.0783
20.9	0,0968
40.0	0.1131

Chlorobenzene

t°	ℓ
-40.9	0.0303
-20.5	0.0382
0.0	0.0479
21.2	0.0595
40.0	0.0702
60.3	0.0837
80.8	0.0976

Methyl Acetate

t°	ℓ
-78.5	0.0249
-60.3	0.0338
-40.1	0.0447
-20.1	0.0578
0.0	0.0730
-20.9	0.0891
40.90	0.1051

SOLUBILITY OF HYDROGEN IN SEVERAL SOLVENTS.

(Maxted and Moon, 1936.)

Some of the determinations were made with an apparatus with a magnetically operated stirrer such as employed by Horiuti. For the others a form of apparatus which permitted stirring by rocking the mixture was employed.

Solvent	t°	d. of Solvent at Solution Temp.	Vapor Pressure (mm Hg) of Solvent at Solution Temp.	H_2 solubility expressed as Bunsen Abs. Coef.
Acetic Acid	18.6	1.0507	11.0	0.0558
" "	20.0	1.049	12.0	0.0566
" "	30.0	1.039	21.0	0.0594
" "	37.5	1.031	30.0	0.0620
" "	45.0	1.023	45.0	0.0649
" "	54.9	1.011	72.0	0.0676
" "	64.8	1.000	109.0	0.0714
" "	74.8	0.989	166.0	0.0742
Ethyl Alcohol	0.6	0.8063	12.2	0.0728
" "	10.0	0.7978	23.8	0.0737
" "	20.3	0.7890	44.0	0.0769
" "	25.0	0.7851	60.0	0.0784
" "	30.0	0.7808	78.0	0.0802
" "	40.0	0.7730	133.0	0.0840
" "	50.0	0.7633	220.0	0.0864
Ethyl Acetate	0.5	0.9244	25.0	0.0708
" "	10.0	0.9126	42.7	0.0724
" "	21.0	0.8993	76.9	0.0761
" "	30.0	0.8883	118.7	0.0808
" "	39.8	0.8762	184.0	0.0803
Chloroform	1.0	1.5260	61.0	0.0563
" "	10.0	1.5050	100.0	0.0576
" "	18.7	1.4886	149.6	0.0584
" "	25.5	1.4750	197.0	0.0614
Benzene	0.5	0.9001	25.0	0.0526
"	8.3	0.8920	43.0	0.0572
"	21.2	0.8775	79.0	0.0625
"	30.6	0.8675	123.0	0.0672
"	40.0	0.8576	181.1	0.0727

HYDROGEN

SOLUBILITY OF HYDROGEN IN SEVERAL SOLVENTS.

(Kirjeew and Romantchonk, 1936.)

Solvent	Total Gas Pressure in mm. Hg.	cc H_2 (reduced to 0 and 760mm) dissolved by 1 cc Solvent at:				
		-20°	-10°	0°	+20°	+40°
Petrol (Gasoline?)	50	0.010	0.008	0.007	0.005	0.004
" "	100	0.019	0.016	0.014	0.010	0.008
" "	200	0.038	0.034	0.028	0.021	0.017
" "	300	0.056	0.051	0.043	0.033	0.025
" "	400	0.074	0.068	0.057	0.044	0.034
" "	500	0.092	0.085	0.072	0.054	0.042
" "	600	0.111	0.102	0.087	0.065	0.050
" "	700	0.129	0.119	0.101	0.070	0.058
" "	760	0.140	0.129	0.110	0.083	0.064
Xylene	50	0.006	0.005	—	—	—
"	100	0.013	0.011	0.009	0.009	0.010
"	200	0.026	0.024	0.018	0.018	0.021
"	300	0.039	0.036	0.029	0.029	0.033
"	400	0.052	0.048	0.039	0.039	0.044
"	500	0.065	0.060	0.046	0.049	0.056
"	600	0.078	0.072	0.059	0.059	0.067
"	700	0.091	0.084	0.069	0.069	0.078
"	760	0.099	0.091	0.075	0.075	0.085
"Cracking Benzene"(?)	50	0.014	0.012	0.010	0.008	0.005
" "	100	0.028	0.022	0.018	0.016	0.010
" "	200	0.058	0.044	0.036	0.030	0.020
" "	300	0.087	0.064	0.056	0.044	0.030
" "	400	0.116	0.084	0.074	0.059	0.040
" "	500	0.146	0.105	0.094	0.074	0.051
" "	600	0.175	0.126	0.112	0.088	0.061
" "	700	0.202	0.148	0.132	0.102	0.072
" "	760	0.220	0.160	0.144	0.111	0.078

Results are also given for Dichlor Ethane and "Heavy Solvent" which are fairly near those for "Cracking Benzene" at 20°.

1 liter Cyclo hexanol ($C_6H_{11}OH$) dissolve 83.1cc H_2 at 20° and 760mm pressure (Cauquil, 1927.)

SOLUBILITY OF HYDROGEN IN SEVERAL SOLVENTS AT 25° AT HIGH PRESSURES.

(Frolich, Touch, Hogan and Peer, 1931.)

The determinations were made by shaking the solvent with various pressures of hydrogen in a steel cylinder maintained at 25°, and after attainment of equilibrium, withdrawing a sample of the saturated solution over mercury, in a buret designed so that the volumes could be measured with the same degree of accuracy at any ratio of gas to liquid. The results are presented in the form of a diagram from which the following approximated values were estimated.

Solvent	cc H_2 (measured at 25° and 760mm) dissolved by 1.0cc Solvent at:				
	40	60	80	100	150 Atmospheres Pressure
Methyl alcohol	3.3	5.0	7.0	8.5	12.5
Propane	17.3	25.0	34.0	42.5	—
iso Propanol	2.5	4.5	6.0	7.5	11.3
Pentane	9.0	13.5	18.2	22.5	—
Butane	11.0	16.5	22.0	27.0	—
Hexane	5.0	11.0	15.0	18.0	—
Octane	6.0	8.5	11.5	14.9	22.0
Cyclohexane	4.0	6.0	8.0	60.0	15.2
Heavy Naphtha	2.7	4.3	5.6	7.3	10.8.
Gas Oil	2.5	4.0	5.3	6.8	10.0

DATA FOR THE SOLUBILITY OF HYDROGEN IN THE FOLLOWING METALS HAVE BEEN DETERMINED.

Ag (Steacie and Johnson, 1928.)
Ce (von Samson-Himmelstjerna, 1930.)
Co (Sieverts, 1907; Sieverts and Hagen, 1934.)
Cr (Martin, 1929; Tamman, 1930; Luckemeyer-Hasse and Shenk, 1932.)
Cu (Sieverts, 1911.)
Fe (Sieverts, 1911; Martin, 1929; Sieverts and Hagen, 1931 Luckemeyer-Hasse and Shenk, 1932.)
(Sieverts, Zapf and Moritz, 1938.)
Ge (Hagen and Sieverts, 1930.)
In (" " " ")
La (von Samson-Himmelstjerna, 1930.)
Mn (Luckemeyer-Hasse and Schenk, 1932.)
Mo (Martin, 1929.)
Nb (Hagen and Sieverts, 1930.)
Ni (Sieverts, 1911; Luckemeyer-Hasse and Shenk, 1932.)
Pd (Sieverts, 1914; von Samson-Himmelstjerna, 1930; Sieverts and Zapf, 1935, also give results for the Solubility of Deuterium.)
Pt (Sieverts and Jurisch, 1912.)
Ti (Hagen and Sieverts, 1930; Kirschfeld and Sieverts, 1929.)
V (Kirochfeld and Sieverts, 1929; 1930.)
W (Martin, 1929.)

HYDROGEN BORATE H_3BO_3 (See Boron Oxide Hydrate)

HYDROGEN BROMIDE (Hydrobromic Acid) HBr

SOLUBILITY IN WATER.

(Rooseboom — Z. physik. Chem. 2, 454, '88; Rec. trav. chim. 4, 107, '85; 5, 358, '86; see also Pickering — Phil. Mag. [5] 36, 119, '93.)

t°.	Gms. HBr Dissolved (at 760–765mm.) per 100 Gms. Water.	Gms. HBr Dissolved (at 760–765mm.) per 100 Gms. Solution.	β.	Gms. HBr Dissolved at Lower Pressures per 100 Gms. H_2O.
− 2.5	255.0	71.83	..	175.0 (10 mm.)
−15	239.0	70.50	...	...
0	221.2	68.85	611.6	...
+10	210.3	67.76	581.4	108.5 (5 mm.)
15	204.0	67.10	...	...
25	193.0	65.88	532.1	...
50	171.5	63.16	468.6	...
75	150.5	60.08	406.7	...
100	130.0	56.52	344.6	...

β = Bunsen Absorption Coefficient which is the volume of gas (reduced to 0° and 760mm) absorbed by 1 volume of the liquid when the pressure of the gas itself, without the tension of the liquid, amounts to 760mm.

Br

EQUILIBRIUM IN THE SYSTEM HYDROBROMIC ACID, WATER AND ALCOHOLS AT 25°.

(Reburn and Shearer, 1933.)

The determinations were made by adding from a buret one of the constituents to known mixtures of the other two until appearance of permanent turbidity. The tie lines of the saturation curve thus obtained were determined by mixing suitable amounts of the three constituents to yield two liquid layers at 25° and titrating each of these for HBr content.

Results for HBr + H_2O + Iso Amyl Alcohol, $(CH_3)_2CHCH_2CH_2OH$

Gms. per 100 gms. sat. sol. H_2O	Gms. per 100 gms. sat. sol. $C_5H_{12}O$	Gms. per 100 gms. sat. sol. H_2O	Gms. per 100 gms. sat. sol. $C_5H_{12}O$
9.0	91.0	42.0	25.0
11.36	85.3	45.8	19.1
16.90	76.8	54.7	8.17
17.7	70.6	67.7	3.39
21.2	63.2	76.9	3.00
26.4	57.6	83.0	2.84
28.4	47.8	91.7	2.58
30.2	44.2	97.0	3.00

Tie Line Data

Gms. HBr per 100 gms. H_2O layer	Gms. HBr per 100 gms. $C_5H_{12}O$ layer
13.5	3.5
24.0	13.0
34.1	23.5

Results for HBr + H_2O + Iso Butyl Alcohol, $(CH_3)_2CHCH_2OH$

Gms. per 100 gms. sat. sol. H_2O	Gms. per 100 gms. sat. sol. $C_4H_{10}O$	Gms. per 100 gms. sat. sol. H_2O	Gms. per 100 gms. sat. sol. $C_4H_{10}O$
16.1	83.0	62.4	20.0
22.6	72.7	66.9	15.4
29.1	61.8	70.8	12.6
35.1	53.1	75.5	11.0
48.9	35.0	82.8	8.7
57.3	25.7	91.2	8.8

Tie Line Data

Gms. HBr per 100 gms. H_2O layer	Gms. HBr per 100 gms. $C_4H_{10}O$ layer
10.8	6.0
8.7	4.3

FREEZING-POINTS OF DILUTE AQUEOUS HYDROBROMIC ACID SOLUTIONS.

(Klein and Svanberg, 1920.)

t° of F. pt	Normality of Aq. HBr
-0.362	0.1
-0.923	0.25
-1.907	0.5

Freezing-point data are given for mixtures of HBr and each of the following compounds.

CH_3OH (1)
C_2H_5OH (1)
$CH;CH$ (2)
$CHCl_3$ (1)
$(CH_3)_2O$ (1)
CH_3Cl (1)
$(C_2H_5)_2O$ (3)
C_3H_4 (4)
CH_3COCH_3 (1)
$CH_3COOC_2H_5$ (1)
C_6H_6 (1)
$C_6H_5CH_3$ (1)(2)
$C_6H_3(CH_3)_3$(s)(2)
$C_6H_5C_2H_5$ (2)
$C_6H_5C_3H_7$ (5)
C_7H_4 (5'
$C_6H_4(CH_3)_2$ o m p (5)
C_9H_{12} (2)
H_2S (6)

(1) = Maass and McIntosh, 1912; Reid and McIntosh, 1916; (2) = Maass and Russell, 1918; (3) McIntosh, 1911; (4) Maass and Russell, 1921; (5) Maass, Boomer and Morrison, 1923; (6) Bagster, 1911.

HYDROGEN CYANIDE HCN

FREEZING-POINTS OF MIXTURES OF HYDROGEN CYANIDE AND WATER.

(Coates and Hartshorne, 1931.)

The apparatus was provided with a magnetically operated stirrer. A mercury thermometer was used and the freezing-points determined by back extrapolation of time-temperature curves over the super cooling region except near the eutectic point. Here it was necessary to employ a jet of air directed a short distance above the level of the liquid. The rapid evaporation thus induced caused crystals to form which inoculated the mixture and prevented super cooling. The mixtures of which the freezing-points were determined were analyzed by Liebig's method of silver nitrate titration. The results in the metastable region were obtained by a modified form of apparatus in which stirring was avoided and a rapid rate of cooling was employed.

t°	Gm. Mols. HCN per 100 gm. Mols. HCN + H_2O	Solid Phase	t°	Gm. Mols. HCN per 100 gm. Mols. HCN + H_2O	Solid Phase	t°	Gm. Mols. HCN per 100 gm. Mols. HCN + H O	Solid Phase
-0.9	0.81	Ice	-16.4	50.29	Ice	-15.8	95.9	HCN
-3.5	3.09	"	-17.3	59.24	"	-14.4	98.5	"
-7.7	7.76	"	-19.3	66.96	"	-13.3	100.0	"
-9.9	9.89	"	-21.1	70.4	"	-24.7	24.8*	
-12.8	14.25	"	-22.6	73.0	"	-24.0	34.4*	
-14.45	19.36	"	-23.4	74.5	" + HCN	-24.1	39.2*	
-15.5	26.29	"	-22.5	79.7	HCN	-24.5	47.9*	
-16.0	36.82	"	-19.4	88.9	"	-25.6	54.7*	
						-27.5	58.7*	

* Metastable region - consisting of two liquid phases with critical solution temp. of -24.0°.

Additional determinations in agreement with the above are given by Peiker and Coffin, 1933. These investigators also give results for the f. pts. of mixtures of HCN + HCOOH, HCN + $HCONH_2$ and HCN + C_6H_5CHO.

HYDROCYANIC ACID HCN.

DISTRIBUTION BETWEEN WATER AND BENZENE.

(Hantzsch and Sebalt, 1899; Hantzsch and Vagt, 1901.)

t°.	Mol. HCN per Liter: H₂O Layer (c).	Mol. HCN per Liter: C_6H_6 Layer (c').	$\frac{c}{c'}$.	t°.	Mol. HCN per Liter: H₂O Layer (c).	Mol. HCN per Liter: C_6H_6 Layer (c').	$\frac{c}{c'}$.
6	0.00625	0.00325	1.923	7	0.0574	0.0148	3.88
16	0.00593	0.00363	1.634	20	0.0572	0.0154	3.72
25	0.00580	0.00375	1.547				

Data for the effect of HCl and of KCl on the distribution are also given.

DISTRIBUTION OF HYDROGEN CYANIDE BETWEEN WATER AND BENZENE.

(Gross and Schwarz, 1930.)

CN

t°	Gm. Mols. HCN per 1000cc: H_2O layer	Gm. Mols. HCN per 1000cc: C_6H_6 layer	t°	Gm. Mols. HCN per 1000cc: H_2O layer	Gm. Mols. HCN per 1000cc: C_6H_6 layer	t°	Gm. Mols. HCN per 1000cc: H_2O layer	Gm. Mols. HCN per 1000cc: C_6H_6 layer
15	0.01084	0.002665	15	0.3494	0.0905	15	0.5532	0.1486
"	0.02167	0.005342	"	0.3777	0.0981	"	0.6507	0.1772
"	0.04334	0.01073	"	0.3999	0.1051	"	0.9178	0.2598
"	0.2321	0.05916	"	0.4740	0.1254	8.0	0.4123	0.1053
"	0.2905	0.0749	"	0.4830	0.1275	8.3	0.4203	0.1079
"	0.3214	0.0828	"	0.4933	0.1307	8.3	0.7789	0.2089

The authors also give results for the distribution of HCN at 15° between Benzene and aqueous solutions of KCl, KNO_3, $CsNO_3$, $NaNO_3$, $LiNO_3$, urea and glycerol. Results are given by Gross and Iser, 1930 for the distribution of HCN at 15° between Benzene and aqueous solutions of LiCl, NaCl, $NaNO_3$, K_2SO_4, $MgCl_2$, $MgSO_4$ and $La_2(SO_4)_3$. Results are given by Randall and Halford 1930, for the distribution of HCN at 25° between Benzene and aqueous solutions of Hydrogen Silver Cyanide ($HAg(CN)_2$).

HYDROGEN CYANATE (Cyanic Acid) HCNO

SOLUBILITY OF HYDROGEN CYANATE IN WATER DETERMINED BY THE FREEZING-POINT METHOD.

CNO

(Linhard, 1938.)

Although cyanic acid decomposes in presence of water it was found that mixtures of the two are stable at sufficiently low temperatures and the following results were obtained for the freezing-point curve.

t°(cor.)	Mols. HCNO per 100 Mols. HCNO + H_2O	Solid Phase	t°(cor.)	Mols. HCNO per 100 Mols. HCNO + H_2O	Solid Phase
-23.5	29.3	H_2O (Ice)	-68.8	58.5	H_2O
-28.7	33.3	"	-83.6	62.8	"
-33.7	38.3	"	-102.5 Eutec.	67.0	" + HCNO
-39.6	43.2	"	-101.0	68.1	HCNO
-42.2	45.0	"	-97.2	74.9	"
-50.0	49.8	"	-93.2	83.6	"
-62.0	55.3	"	-86.8 m. pt.	100.0	"

HYDROCHLORIC ACID HCl.

SOLUBILITY IN WATER BY THE FREEZING-POINT METHOD.

(Composite curve from results of Roloff, 1895; Pickering, 1893(a); Roozeboom, 1884, 1889 and Rupert, 1909.)

t°.	Gms. HCl per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. HCl per 100 Gms. Sat. Sol.	Solid Phase.
−1.706	1.66	Ice	−18.4	48.6	$HCl.2H_2O$
−14.97	10.02	"	−17.7 m. pt.	50.3	"
−28.84	14.51	"	−18.7	52.85	"
−40	17.40	"	−19.4	54.1	"
−60	21.30	"	−20.8	55.7	"
−80	24.20	"	−21.3	56.5	"
−86 Eutec.	24.8	" $+HCl.3H_2O$	−23.2	57.3	"
−50	30.1	$HCl.3H_2O$	−23.5 Eutec.	...	" $+HCl.H_2O$
−40	32.7	"	−21.5	58.2	$HCl.H_2O$
−30	36.5	"	−20.7	59.1	"
−24.9 m. pt.	40.3	"	−18.4	61.1	"
−27.5	44	" $+HCl.2H_2O$	−17.4	62.4	"
−23.8	45.7	$HCl.2H_2O$	−15.4	65.4	"
−21.2	45.9	"	−15.35	66.8	"

At about −15.35 two liquid layers are formed. Data for these are as follows:

Cl

HCl layer.		H₂O layer.					
t° of Saturation	Gms. H_2O per 100 Gms. Sat. Sol.	t°.	Gms. HCl per 100 Gms. Sat. Sol.	d. of Sat. Sol.	t°.	Gms. HCl per 100 Gms. Sat. Sol.	d. of Sat. Sol.
Below −50	0 008	−20	67.65	1.279	15	64.70	1.231
" −50	0 017	−15	67.29	1.269	20	64.19	1.228
Bet. −15 and 0°	0 077	−10	66.71	1.260	30	63.21	1.229
Above 45	0.021	−5	66.44	1.255	35	62.90	1.227
"	0 052	0	65.85	1.247	40	62.27	1.218
"	0.11	+5	65.48	1.245	45	61.76	1.212
"	0 13	10	65.18	1.240	50	61.65	1.219

For additional data on this system see Baume and Tykociner, 1914.

FREEZING-POINTS OF DILUTE AQUEOUS HYDROCHLORIC ACID SOLUTIONS.

(Chadwell, 1927.)

The determinations were made with the highest possible precision. A platinum thermometer and Wheatstone bridge were used for measuring the temperatures. The analyses were made upon solutions in contact with a large amount of added ice.

F. pt. lowering below 0° C	Gm. Equiv. HCl per 1000 gms. H_2O	F. pt. lowering below 0° C	Gm. Equiv. HCl per 1000 gms. H_2O
−0.2934	0.08321	−2.3664	0.0363
−0.5033	0.1427	−2.5465	0.6785
−0.7145	0.2044	−2.6114	0.6969
−0.7771	0.2198	−2.9420	0.7730
−0.8440	0.2374	−3.1219	0.8187
−1.1000	0.3080	−3.4545	0.8945
−1.1202	0.3137	−3.8192	0.9765
−1.4738	0.4082	−4.0721	1.0324
−1.9344	0.5275		

A compilation of the available data upon the partial vapor pressure of aqueous solutions of hydrochloric acid is given by Zeisberg, 1925.)

FREEZING-POINTS OF DILUTE AQUEOUS HYDROCHLORIC ACID SOLUTIONS.

(Klein and Svanberg, 1920.)

t° of F. pt.	Normality of HCl
-0.34	0.1
-0.876	0.25
-1.807	0.5

HYDROCHLORIC ACID HCl.

SOLUBILITY IN WATER AT DIFFERENT TEMPERATURES AND PRESSURES.

(Deicke; Roscoe and Dittmar — Liebig's Ann. 112, 334. 59; below 0°, Roozeboom — Rec. trav. chim. 3, 104, '84.)

	At Different Temperatures and 760 mm. Pressure.				At Different Pressures and 0°	
t°.	cc. HCl per 100 cc. H_2O.	Density.	Gms. HCl per 100 g. Sol.	Gms. HCl per 100 g. H_2O.	Pressures.*	Gms. HCl per 100 g. H_2O
0	525.2	1.2257	45.15	82.31	60	61.3
4	497.7	1.2265	44.36	79.73	100	65.7
8	480.3	1.2185	43.83	78.03	150	68.6
12	471.3	1.2148	43.28	76.30	200	70.7
14	462.4	1.2074	42.83	74.92	300	73.8
18	451.2	1.2064	42.34	73.41	400	76.3
23	435.0	1.2014	41.54	71.03	500	78.2
30	...	..	40.23	67.3	600	80.0
40	...	...	38.68	63.3	750	82.4
50	...	...	37.34	59.6	1000	85.6
60	...	...	35.94	56.1	1300	89.5

* Pressures in mm. Hg minus tension of H_2O vapor.

100 gms. sat. sol. of HCl in H_2O contain 45.44 gm. HCl at 0° and 41.2 gm. at 25°. (Cupr, 1926, 1928.)

100cc sat. sol. of HCl in H_2O contain 71.9 gm. HCl at 20°. (Knight and Hinshelwood, 1927.)

SOLUBILITY IN WATER AT TEMPERATURES BELOW 0°.

At a pressure of 760 mm.

t°.	φ.	t°.	φ.
−24	101.2	−15	93.3
−21	98.3	−10	89.8
−18.3	96	− 5	86.8
−18	95.7	0	84.2

At pressures below and above 760 mm.

t°.	mm. Pressure.	φ.
−23.8	...	84.2
−21	334	86.8
−19	580	92.6
−18	900	98.4
−17.7	1073	101.4

The eutectic is at −86° and 33 gms. HCl per 100 gms. H_2O.

φ = the weight of HCl gas in grams dissolved by 100 grams of H_2O at the indicated temperature and at a total pressure (that is the partial pressure of the gas plus the vapor pressure of the liquid at the absorption temperature) of 760mm.Hg.

Data for the solubility at 25° of HCl gas in water at low pressures are given by Dobson and Masson, 1924.

SOLUBILITY OF HYDROCHLORIC ACID GAS IN AQ. SULFURIC ACID SOLUTIONS.

(Coppadoro, 1909.)

Results at 17°.			Results at 40°.			Results at 70°.		
d of Sat. Sol.	Gms. per 100 Gms. Sat. Sol.		*d* of Sat. Sol.	Gms. per 100 Gms. Sat. Sol.		*d* of Sat. Sol.	Gms. per 100 Gms. Sat. Sol.	
	H_2SO_4.	HCl.		H_2SO_4.	HCl.		H_2SO_4.	HCl.
1.211	0	42.7	1.185	3.56	35.6	1.145	1.61	32.7
1.220	1.86	39.9	1.195	5.86	34.8	1.150	3.38	31.1
1.220	4.75	39.2	1.210	8.90	32.4	1.160	4.80	30.5
1.235	8.04	36.9	1.255	16.80	27.6	1.180	7.93	28.9
1.260	12.80	33.2	1.255	18.8	25.9	1.225	18.9	22.8
1.305	20.9	28.5	1.340	28.6	18.5	1.230	20	22.3
1.355	30.8	22.6	1.400	44.2	11.5	1.315	36.2	13.2
1.430	44.6	15	1.520	61.1	3.35	1.380	48	6.99
1.545	59.4	6.26	1.575	66.4	1.17	1.510	62.7	1.56
1.580	65.4	3.25	1.650	73.2	0.17	1.560	67.6	0.54
1.660	73.7	0.62	1.725	79.4	0.081	1.700	80.7	0.05
1.735	77.5	0.11	1.755	81.4	0.032	1.745	83	0.035
1.815	89	0.068	1.770	83.5	0.029	1.745	83.4	0.032

SOLUBILITY OF HYDROCHLORIC ACID IN CONCENTRATED SULFURIC ACID AT 25° AND 760MM.

Cl

(Cupr, 1928.)

Percent H_2SO_4	Gm. HCl per 100 gms. sat. sol.	Percent H_2SO_4	Gm. HCl per 100 gms. sat. sol.	Percent H_2SO_4	Gm. HCl per 100 gms. sat. sol.
76.43	0.3588	90.69	0.0922	97.36	0.1432
81.87	0.1420	92.20	0.0996	98.65	0.1971
86.76	0.0974	94.14	0.1082	100.00	0.4015
89.31	0.0920				

Additional determinations at other temperatures and concentrations of H_2SO_4 are given by Cupr, 1925(a), 1928.

SOLUBILITY OF HYDROCHLORIC ACID IN AQUEOUS SOLUTIONS OF ACETIC ACID.

(Cupr, 1926, 1928.)

Results at 0°			Results at 25°		
Gms. CH_3COOH per 100 gms. aq. Solvent	Gms. HCl per 100 gms. aq. Solvent	cc HCl gas per 1,0cc sat. sol. at 760mm	Gms. CH_3COOH per 100 gms. aq. Solvent	Gms. HCl per 100 gms. aq. Solvent	cc HCl gas per 1.0cc sat. sol. at 760mm
11.52	76.51	479.2	11.02	63.03	390.2
19.03	72.72	461.2	22.90	55.45	349.8
27.96	66.98	430.8	33.69	51.06	325.8
48.89	55.69	366.6	48.38	42.67	275.7
72.96	41.41	276.7	70.95	30.66	200.4
79.86	37.51	251.0	87.04	21.32	139.1
89.56	31.48	210.3	95.24	14.13	91.5
89.49	31.39	209.0	99.45	8.35	53.6

MISCIBILITY OF HYDROCHLORIC ACID WITH MIXTURES OF WATER AND PHENOL AT 12°.

(Schreinemakers and van der Horn van der Bos, 1912.)

Composition of the Reciprocally Saturated Liquid Pairs.				Composition of the Solutions in Contact with Solid Phenol.		
Water Rich Layer.		Phenol Rich Layer.				
% HCl.	% Phenol.	% HCl.	% Phenol.	% Water.	% HCl.	% Phenol.
0	7.45	0	72	11.22	0	88.78
3.1	6.6	0.09	78	84.5	10.7	4.8
6.6	5.3	0.2	80.3	80.38	15.64	3.98
8	5.1	0.36	82.6	72.43	24.37	3.2
10.7	4.8	0.52	84.5	60.25	36.25	3.5

Additional data for this system are given by Krug and Cameron, 1900.

HYDROGEN CHLORIDE

EQUILIBRIUM IN THE SYSTEMS HYDROCHLORIC ACID, WATER AND ORGANIC SOLVENTS.

(Reburn and Shearer, 1933.)

The determinations were made by adding from a buret, one of the consituents to known mixtures of the other two until appearance of a permanent turbidity. The tie lines of the saturation curve thus obtained were determined by mixing suitable amounts of the three constituents to yield two liquid layers and titrating each of these for acid content.

Results at 25° for HCl + H_2O + Iso Amyl Alcohol $((CH_3)_2CHCH_2CH_2OH)$

Gms. per 100 gms. sat. sol.	
H_2O	$C_5H_{12}O$
8.9	91.1
14.15	82.7
18.90	74.6
23.10	67.7
38.8	44.1
49.5	29.8
54.3	23.6
64.9	11.3
72.0	5.16
83.6	3.60
91.4	2.79
97.1	2.90

Tie Line Data

Gms. HCl per 100 gms.	
H_2O layer	$C_5H_{12}O$ layer
7.83	1.99
16.13	7.30
21.7	14.7

Results at 25° for HCl + H_2O + Iso Butyl Alcohol $((CH_3)_2CHCH_2OH)$

Gms. per 100 gms. sat. sol.	
H_2O	$C_4H_{10}O$
16.1	83.9
27.3	68.4
35.4	58.3
40.0	52.3
44.6	46.6
49.6	40.0
53.2	36.7
59.2	30.0
69.5	18.7
79.8	10.3
84.8	8.4
91.2	8.8

Tie Line Data

Gms. HCl per 100 gms.	
H_2O layer	$C_4H_{10}O$ layer
10.4	6.3
7.7	3.6
4.2	1.3

Results at 25° for HCl + H_2O + Cyclohexanone $\underbrace{CO(CH_2)_4CH_2}$

Gms. per 100 gms. sat. sol.	
H_2O	$C_6H_{10}O$
7.5	92.5
22.1	74.4
34.6	59.8
43.4	49.6
50.2	41.9
54.4	36.9
56.5	34.0
62.8	27.0
68.1	21.7
72.8	17.2
81.4	12.3
87.8	12.2

Tie Line Data

Gms. HCl per 100 gms.	
H_2O layer	$C_6H_{10}O$ layer
9.5	2.3
8.8	1.1

Results at 40° for HCl + H_2O + Iso Butyl Alcohol $((CH_3)_2CHCH_2OH)$

Gms. per 100 gms. sat. sol.	
H_2O	$C_4H_{10}O$
17.9	82.1
26.6	69.6
42.6	49.3
53.5	36.9
64.0	25.0
74.0	14.7
81.2	10.0
92.0	8.0

Results at 55° for HCl + H_2O + Iso Butyl Alcohol $((CH_3)_2CHCH_2OH)$

Gms. per 100 gms. sat. sol.	
H_2O	$C_4H_{10}O$
21.8	78.2
29.2	67.2
37.0	56.8
50.6	40.5
64.3	24.8
72.4	16.6
80.7	10.5
91.2	8.8

Results at 25° for HCl + H_2O + n Butyl Alcohol $(CH_3(CH_2)_2CH_2OH)$

Gms. per 100 gms. sat. sol.	
H_2O	$C_4H_{10}O$
21.9	78.1
29.2	67.1
39.7	54.3
51.9	39.4
66.4	23.3
75.4	13.9
84.9	8.5
91.7	8.3

DISTRIBUTION OF HYDROCHLORIC ACID BETWEEN WATER AND BENZENE.

Results at 20° (Knight and Hinshelwood, 1927.)						Results at 25° (Wynne-Jones, 1930.)	
Gms. HCl per 1000cc		Gms. HCl per 1000cc		Gms. HCl per 1000cc		Gm. Mols. HCl per 1000 gms.:	
H_2O layer	C_6H_6 layer	H_2O layer	C_6H_6 layer	H_2O layer	C_6H_6 layer	H_2O layer	C_6H_6 layer
718.8	18.50	420.2	2.47	212.0	0.252	9.603	0.00213
604.0	17.7	379.8	1.818	165.9	0.100	10.215	0.00340
549.3	17.4	343.3	1.264	134.0	0.056	10.508	0.00423
509.0	15.7	312.0	0.929	94.8	0.028	11.43	0.00768
504.6	15.62	289.3	0.706	43.3	0.0036	11.99	0.0110
492.5	8.92	259.0	0.532	19.5	0.0002	12.93	0.0216
448.5	3.72	236.1	0.382	12.3	0.0001		

1000cc pure benzene dissolve 16.8 gm. HCl at 20° and 760mm pressure.

1000cc benzene previously saturated with H_2O dissolve 18.31 gms. HCl at 20° and 760mm.

1000cc benzene simultaneously saturated with H_2O and HCl dissolve 18.50 gms. HCl at 20° and 760mm. (Knight and Hinshelwood, 1927.)

DISTRIBUTION OF HYDROCHLORIC ACID BETWEEN WATER AND NITRO BENZENE AT 25°.

(Wynne-Jones, 1930.)

Gm. Mols. HCl per 1000 gms.		Gm. Mols. HCl per 1000 gms.		Gm. Mols. HCl per 1000 gms.	
H_2O layer	$C_6H_5NO_3$ layer	H_2O layer	$C_6H_5NO_3$ layer	H_2O layer	$C_6H_5NO_3$ layer
9.635	0.0027	14.84	0.0707	18.05	0.335
11.147	0.0080	15.21	0.0833	18.38	0.394
11.61	0.0109	16.46	0.164	19.33	0.556
12.84	0.0229	17.19	0.223	19.52	0.603
13.34	0.0396	17.76	0.292	20.42	0.833

Data have also been determined for the Distribution of HCl between H_2O and each of the following compounds at 25°: Amyl Alcohol, Tertiary Amyl Alcohol, n Butyl Alcohol and Methyl Ethyl Ketone (Archibald, 1932.)

Results for the distribution of HCl between H_2O and Phenol are given by Wosnessensky and Astachow, 1925.

SOLUBILITY OF HYDROCHLORIC ACID GAS IN METHYL ALCOHOL, ETHYL ALCOHOL, AND IN ETHER AT 760 MM. PRESSURE.

(de Bruyn — Rec. trav. chim. 11, 129, '92; Schuncke — Z. physik. Chem. 14, 336, '94.)

t°.	Grams HCl gas per 100 Grams Solution in:		
	CH_3OH.	C_2H_5OH.	$(C_2H_5)_2O$.
−10	54.6	...	37.51 (−9.2°)
− 5	...	...	37.0
0	51.3	45.4	35.6
+ 5	...	44.2 (6.5°)	33.1
10	...	42.7 (11.5°)	30.35
15	...	...	27.62
20	47.0 (18°)	41.0	24.9
25	...	40.2 (23.5°)	22.18
30	43.0 (31.7°)	38.1 (32°)	19.47

FREEZING-POINTS OF MIXTURES OF ETHYL ETHER AND HYDROCHLORIC ACID.

(Hirai, 1926.)

t°.	Mol. $(C_2H_5)_2O$ per 100 mols. sat. sol.	Solid Phase.	t°.	Mols. $(C_2H_5)_2O$ per 100 mols. sat. sol.	Solid Phase.
—117.7	100.0	$(C_2H_5)_2O$	— 87.4	36.29	$(C_2H_5)_2O:(HCl)_2$
—118.8	89.16	"	— 87.3 m. pt.	33.33	"
—119.3	86.93	"	— 89.0	31.70	"
—124.2	79.68	"	— 93.5	27.39	"
—127.8	77.33	"	—100.4	21.06	"
—126.5	68.04	$(C_2H_3)_2O.(HCl)_2$	—104.0	18.76	"
—115.4	63.66	"	—113.5	11.20	"
—110.9	59.55	"	—115.5	10.55	"
—100.4	52.13	"	—123.6	6.08	"
—100.9	50.97	"	—123.7	5.70	HCl
—107.3	47.18	"	—120.8	4.65	"
— 94.5	44.84	"	—120.5	3.87	"
— 89.3	38.24	"	—112.5	0.00	"

The following determinations by McIntosh, 1928, differing from the abov were made in a specially constructed freezing-point apparatus provided with a magnetically operated stirrer and a very accurate platinum quartz thermometer.

Cl

t°	Mol. Percent HCl	Solid Phase	t°	Mol. Percent HCl	Solid Phase
-102.9	42.5	$(C_2H_5)_2O.HCl$	-84.8	70.0	$(C_2H_5)_2O.2HCl$
-100.	47.3	"	-97.6	71.6	"
-98.6	50.0	"	-99.6	80.5	$(C_2H_5)_2O.5HCl$
-97.9	54.2	"	-96.2	81.5	"
-100.4	56.5	"	-92.9	83.6	"
-82.0	65.6	$(C_2H_5)_2O.2HCl$	-94.2	85.0	"
-83.2	67.6	"			

FREEZING-POINTS OF MIXTURES OF HYDROCHLORIC ACID AND ACETONE.

(Hirai, 1926; McIntosh, 1928.)

t°	Mol Percent HCl	Solid Phase	t°	Mol. Percent HCl	Solid Phase
-94.5	0.0	$(CH_3)_2CO$	-84.6	57.7	$(CH_3)_2CO.HCl$
-107.0	14.43	$(CH_3)_2CO.HCl$	-82.7	55.56	"
-114.6	27.29	"	-86.6	57.26	"
-91.5	36.5	"	-92.8	60.39	"
-85.7	42.99	"	-81.2	69.7	$2(CH_3)_2CO.5HCl$
-76.9	47.1	"	-80.8	71.7	"
-78.0	54.0	"	-85.3	74.3	"
-80	52.91	"			

Data for the reciprocal solubility of HCl (also of CO_2, SO_2 and NH_3) and the vapors of Ether, Acetone, Methyl Alcohol and Chloroform, as determined by measuring at 25° the change in pressure produced by adding weighed amounts of the volatile liquid to a given volume of HCl gas, are given by MacFarlane and Wright, 1934.

SOLUBILITY OF DRY HYDROGEN CHLORIDE IN SEVERAL SOLVENTS AT 20° AND 760mm.

(Fairbrother and Balkin, 1931.)

Solvent	Gms. HCl per 1000cc sat. solution
Benzene (C_6H_6)	16.91
Carbon Tetrachloride (CCl_4)	6.19
Cyclo Hexane (C_6H_{12})	4.94 (17-18°)
Cyclo Hexene $(\underline{CH_2CH_2CH_2CH_2CH:CH})$	12.29 (17-18.6°)

SOLUBILITY OF HYDROGEN CHLORIDE IN SEVERAL SOLVENTS AT 20° AND 760mm.

(Bell, 1931.)

The solvents were saturated by bubbling HCl through them for about 3 hours, using some 8-10 times as much gas as required for saturation. The dissolved gas was determined by displacing it with a current of CO_2 free air and absorbing the HCl in H_2O and titrating it with normal NaOH.

Solvent	s	x	Solvent	s	x
Hexane	3.64	0.0197	Bromoform	4.78	0.0306
Octane	4.50	0.0296	Ethyl bromide	10.3	0.0348
Dodecane	3.42	0.0314	Chloroform	13.80	0.0444
Cetane	2.28	0.0270	Bromobenzene	7.13	0.0305
Cyclo Hexane	3.42	0.0154	Chlorobenzene	7.63	0.0315
Carbon tetrachloride	4.54	0.0181	Benzyl chloride	9.75	0.0448
Benzene	11.05	0.0425	Benzo tri chloride	4.77	0.0275
Toluene	11.90	0.0507	Tetra brom ethane(s)	3.93	0.0236
Tetra chlor ethylene	3.88	0.0163	Tetra chlor ethane(s)	6.20	0.0265
Tri chlor ethylene	5.79	0.0206	Ethyl bromide	35.15	0.1019
Penta chlor ethane	3.86	0.0214	Ethylene chloride	14.74	0.0457

S = the partition coefficient of HCl between the liquid and the vapor; that is s = C (the gm. equiv. HCl per liter) ÷ 0.0417, since s/c = 22.4 x 293/273; x = the mole fraction solubility calculated on the assumption that the densities of the solutions obey the ideal mixture law.

One liter sat. solution of HCl in C_6H_6 contains 3.13 gm. HCl at 20°. (Knight and Hinshelwood, 1927.)

One liter sat. solution of HCl in $CHCl_3$ contains 1.83 gm. HCl at 10°. (Williams, 1921.)

SOLUBILITY OF HYDROGEN CHLORIDE IN SEVERAL SOLVENTS.

(Hamai, 1935.)

A U shaped gas buret was used for absorbing the HCl in the several solvents. From the volume change in the gas buret, the initial and final pressures and the volume of the system, the volume of HCl actually absorbed at various pressures by the liquids was calculated. The results for 20cc volumes of solvent at the observed pressures were plotted and the value for 760mm pressure was found by extrapolation. The final results were calculated to Mol. fraction of HCl absorbed at 760mm.

Solvent	Formula	b. pt. of solvent	Mol. Fraction HCl absorbed at 760mm at: 15°	20°	25°
Tetra Chlor Ethane	$C_2H_2Cl_4$ 1.1.2.2	143.5°	0.03006	0.02744	0.02481
Carbon Tetra Chloride	CCl_4	76.0°	0.01826	0.01550	0.01277
Ethylene Chloride	$C_2H_4Cl_2$	83.0°	0.04377	0.03993	0.03576
Ethylene Bromide	$C_2H_4Br_2$	129.0°	0.03754	0.03441	0.03116
Tri chlor Ethane	$C_2H_3Cl_3$ 1.1.2	112.5°	0.03463	0.03101	—
Penta chlor Ethane	C_2HCl_5	159.0°	0.02396	0.02350	—

Freezing-point data are given for the following mixtures:

HCl + Chloroform	(Baume and Borowski, 1914.)
" + Methyl Alcohol	" " " " ; Baume and Pamfil, 1911, 1914; Maass and McIntosh, 1913.)
" + Methyl Chloride	(Baume and Tybociner, 1914.)
" + Methyl Ether	(Maass and McIntosh, 1912; Baume, 1911, 1914.)
" + Propionic Acid	(Baume and Georgitses, 1912, 1914.)
" + Hydrogen Sulfide	" " " " "
" + Magnesium Chloride	(Dernby, 1918.)
" + Sodium Chloride	" "
" + Sulfur Chloride	(Terrey and Spong, 1932.)
" + Sulfur Dioxide	(Baume and Pamfil, 1911, 1914.)

PERCHLORIC ACID $HClO_4$.

SOLUBILITY IN WATER. (van Wyk, 1902, 1905.)

C10 Mixtures of $HClO_4$ and water were cooled until crystals appeared and then very gradually warmed and constantly stirred while an observation was made of the exact temperature at which the last crystal disappeared. At certain concentrations and temperatures unstable solid phases were obtained, also, curves for two series of mix crystals were encountered. The methods for detecting these phases consisted in seeding the saturated solutions with the several different crystalline forms, and observing the change in rate of cooling during the solidification of the mixture. The data for the mix-crystal curves I and II are not given in the following table:

t°.	Mols. $HClO_4$ per 100 Mols. $HClO_4+H_2O$.	Solid Phase.	t°.	Mols. $HClO_4$ per 100 Mols. $HClO_4+H_2O$.	Solid Phase.
0	0	Ice	−32	26	$HClO_4.2\frac{1}{2}H_2O$
−10	5	"	−29.8	28.57	"
−21	7	"	−44	27	$HClO_4.2H_2O$
−34.5	9	"	−41	27.25	"
−54	11	"	−34	28	"
−50.5	19	$HClO_4.3\frac{1}{2}H_2O$	−24	29.9	"
−45	20	"	−17.8 m pt	33.3	"
−42.3	21	"	−21.5	36	"
−41.4	22.22	"	−23.6	36.5	" $+HClO_4.H_2O$
−43	23.5	"	−12.5	37	$HClO_4.H_2O$
−40.5	22.5	$HClO_4.3H_2O\,\alpha$	+3	38	"
−39.5	22.75	"	28	40.8	"
−37.6	24	"	40	43.7	"
−37.5	26	"	50 m. pt.	50	"
−38.8	27	"	45	59.9	"
−47.8	22.5	$HClO_4.3H_2O\,\beta$	27.5	71.5	"
−44	24	"	17	77.2	"
−43.5	24.5	"	+2.2	83.3	"
−43.2	25	"	−21.5	90.7	"
−44.5	26	"	−40	94	"
−37.2	25	$HClO_4.3H_2O\,\alpha+HClO_4.2\frac{1}{2}H_2O$	−102	100	"

FREEZING-POINTS OF MIXTURES OF HYDROGEN FLUORIDE AND WATER.

(Cady and Hildebrand, 1930.)

The mixtures were contained in a gold cup provided with a gold plated stirrer. The temperatures were measured with a thermo couple encased in a platinum tube. To about 100cc of solution in the gold cup enough liquid air was added to partially freeze the solution. After stirring for 15 minutes the temperature was read and immediately afterwards a sample was removed for analysis. This was weighed in a paraffine lined bottle, diluted with water and titrated with NaOH using phenolphthaleine as indicator. In some cases it was necessary to determine warming curves and take the final sudden change in slope as the freezing-point. The authors give the observed freezing-points as °K but in the following table they have been converted to the ordinary scale by deducting each one from -273°.

t°	Gm. Mols. HF per 100 gm. Mols. HF + H_2O	Solid Phase
-0.9	0.777	Ice
-6.3	5.64	"
-9.8	8.09	"
-23.0	15.65	"
-41.4	21.6	"
-60.0	26.5	"
-70.1	27.6	" + $HF.H_2O$
-62.7	30.7	$HF.H_2O$
-59.4	32.1	"
-48.9	37.1	"
-43.5	40.3	"
-36.1	47.8	"
-35.3	50.0	"
-35.8	51.5	"
-41.5	57.5	"
-51.0	62.7	"
-68.3	67.5	"
-75.1	68.5	" + $2HF.H_2O$
-75.4	69.8	$2HF.H_2O$
-75.7	71.0	"
-81.7	74.3	"
-91.1	76.2	"
-101.3	77.6	" + $4HF.H_2O$
-100.7	78.6	$4HF.H_2O$
-100.3	79.6	"
-100.2	80.0	"
-100.6	81.7	"
-105.4	86.4	"
-110.8	88.3	" + HF
-106.9	89.4	HF
-99.7	91.3	"
-93.6	93.9	"
-88.9	96.1	"
-86.9	97.4	"
-85.4	98.2	"
-82.9	100.0	"

SOLUBILITY OF HYDROGEN FLUORIDE IN BENZENE.

(Simons, 1931.)

Vessels made entirely of copper were used. The vapor of HF at its b. pt. or that carried over by nitrogen from liquid HF maintained at other temperatures, was conducted into benzene until the saturation point was reached at selected temperatures. These results were plotted and the following values obtained from the curves.

t° of the Liquid HF from which its vapor was conducted	Gm. Mols. HF dissolved per 100 gm. mols. HF + C_6H_6 at:				
	20°	30°	40°	50°	60°
-77	2.48	2.03	1.58	1.12	0.71
-18	3.85	3.15	2.44	1.73	1.02
0	4.32	3.55	2.75	1.96	1.17
b. pt.	6.73	5.48	4.22	2.98	1.80

Vapor pressure results are also given.

Similar determinations of the solubility of HF vapor at its b. pt. in octane, gave the following results.

t° of sat. sol. in Octane	25.1°	36.0°	45.2°	51.0°	66.3°
Mols. HF per 100 mols. HF + C_8H_{18}	0.338	0.276	0.235	0.194	0.170

Freezing-point data for mixtures of HF + KF are given by Cady, 1934, and the mixtures of HF + NH_3 by Ruff and Staub, 1933.

HYDRIODIC ACID HI.

SOLUBILITY IN WATER, DETERMINED BY FREEZING-POINT METHOD.

(Pickering, 1893a.)

t°.	Gm. HI per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. HI per 100 Gms. Sat. Sol.	Solid Phase.
−10	20.3	Ice	−60	52.6	$HI.4H_2O$
−20	29.3	"	−40	59	"
−30	35.1	"	about −35.5 m. pt.	64	"
−40	39	"	−40	65.5	"
−50	42	"	−49	66.3	" $+HI.3H_2O$
−60	44.4	"	−48 m. pt.	70.3	$HI.3H_2O$
−70	46.2	"	−56	73.5	" $+HI.2H_2O$
−80	47.9	" $+HI.4H_2O$	−52	74	$HI.2H_2O$

F.-pt. data for HI + H_2S (Bagster, 1911), HI + $(CH_3)_2O$. (Maass and McIntosh, 1912)

I HYDROGEN IODIDE

EQUILIBRIUM IN THE SYSTEMS HYDROGEN IODIDE, WATER AND ALCOHOLS.

(Reburn and Shearer, 1933.)

The determinations were made by adding from a buret one of the constituents to known mixtures of the other two, until appearance of a permanent turbidity. The tie lines of the saturation curves thus obtained were determined by mixing suitable amounts of the three constituents to yield two liquid layers and titrating each of these for acid content.

Results for HI + H_2O + Iso Amyl Alcohol ($(CH_3)_2CHCH_2CH_2OH$)

Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.	
H_2O	$C_5H_{12}O$	H_2O	$C_5H_{12}O$
8.50	91.5	43.2	15.7
12.0	82.8	62.3	2.76
21.0	58.8	76.6	2.55
24.0	52.6	77.5	3.03
25.8	47.5	91.2	2.98
27.8	43.2	97.2	2.80
29.1	40.1		

Results for HI + H_2O + Iso Butyl Alcohol ($(CH_3)_2CHCH_2OH$)

Gms. per 100 gms. sat. sol.	
H_2O	$C_4H_{10}O$
16.1	88.9
24.9	67.0
32.0	54.7
37.8	46.7
39.6	44.3
61.9	19.3
91.2	8.81

Tie Line Data

Gms. HI per 100 gms.:	
H_2O layer	$C_5H_{12}O$ layer
16.84	9.45
30.0	21.1
41.1	30.5

Tie Line Data

Gms. HI per 100 gms.:	
H_2O layer	$C_4H_{10}O$ layer
11.6	8.3
4.8	4.0

FREEZING-POINTS OF DILUTE AQUEOUS SOLUTIONS OF HYDROGEN IODIDE.

(Klein and Svanberg, 1920.)

t° of F. pt.	Normality of HI
-0.35	0.1
-0.91	0.25
-1.90	0.50

HYDROGEN IODATE HIO_3

SOLUBILITY OF IODIC ACID IN WATER. (Groschuff, 1906.)

t°.	Gms. I_2O_5 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. I_2O_5 per 100 Gms. Sat. Sol.	Solid Phase.
— 0.3	1.69	Ice	16	71.7	HIO_3
— 1.01	6.81	"	40	73.7	"
— 2.38	26.22	"	60	75.9	"
— 4.72	51.42	"	80	78.3	"
— 6.32	57.61	"	85	78.7	"
—12.25	67.40	"	101	80.8	"
—14	69.10	" $+HIO_3$	110	82.1	$HIO_3+HI_3O_8$
—15	70	(unstable) Ice	125	82.7	HI_3O_8
—19	72	" "	140	83.8	"
0	70.3	HIO_3	160	85.9	"

10

SOLUBILITY OF IODIC ACID IN NITRIC ACID. (Groschuff.)

t°.	Gms. HIO_3 per 100 Gms. Aq. Solution.	Gms. HIO_3 per 100 Gms. 27.73% HNO_3 Solution.	Gms. HIO_3 per 100 Gms. 40.88% HNO_3 Solution.
0	74.1	18	9
20	75.8	21	10
40	77.7	27	14
60	80	38	18

SOLUBILITY OF HYDROGEN IODATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 25°.

(Moles and Perez-Vitoria, 1931, 1932.)

Wt. Percent HNO_3	d of the $HNO_3 + H_2O$ mixture	Gms. HIO_3 per 100 gms. sat. sol.	Wt. Percent HNO_3	d of the $HNO_3 + H\ O$ mixture	Gms. HIO_3 per 100 gms. sat. sol.
20.23	1.123	35.09	50.71	1.324	5.74
28.00	1.173	21.84	58.66	1.366	3.25
35.28	1.223	15.20	65.30	1.400	1.40
43.32	1.273	10.08			

HYDROGEN NITRATE (Nitric Acid) HNO_3

RECIPROCAL SOLUBILITY OF NITRIC ACID AND WATER, DETERMINED BY THE FREEZING-POINT METHOD.

(Küster and Kremann, 1904; see also Pickering, 1893.)

t°.	Gms. HNO_3 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. HNO_3 per 100 Gms. Sat. Sol.	Solid Phase.
−10	13.9	Ice	−40	69.7	$HNO_3.3H_2O$
−20	22.9	"	−42 Eutec.	70.5	" $+HNO_3.H_2O$
−30	27.8	"	−40	72.5	$HNO_3.H_2O$
−40	31.5	"	−38 m. pt.	77.75	"
−43 Eutec.	32.7	" $+HNO_3.3H_2O$	−40	82.4	"
−40	34.1	$HNO_3.3H_2O$	−50	86.5	"
−30	40	"	−60	88.8	"
−20	49.2	"	−66.3 Eutec.	89.95	" $+HNO_3$
−18.5 m. pt.	53.8	"	−60	91.9	HNO_3
−20	58.5	"	−50	94.8	"
−30	65.4	"	−41.2 m. pt.	100	"

NITRIC ACID.

NO

FREEZING-POINTS OF AQUEOUS NITRIC ACID SOLUTIONS.

(Klein and Svanberg, 1920.)

t° of f. pt.	Normality of aq. HNO_3.	t° of f. pt.	Normality of aq. HNO_3.	t° of f. pt.	Normality of aq. HNO_3.
—0.356......	0.10	—0.885......	0.25	—1.797......	0.50

RECIPROCAL SOLUBILITY OF NITRIC ACID AND NITROGEN PEROXIDE (N_2O_4).

(Pascal and Garnier, 1919.)

Thermic analysis was used for determination of the solubility at very low temperatures and for the detection of the internal transformations in the system.

			Solubility, in the Liquid State, of :			
			N_2O_4 in HNO_3.		HNO_3 in N_2O_4.	
t°.	Gms. HNO_3 per 100 gms. mixture.	Solid Phase.	t°.	Gms. HNO_3 per 100 gms. mixture.	t°.	Gms. HNO_3 per 100 gms. mixture.
-42.......	100.0	HNO_3	-11.......	52.0	-13.25.....	2.75
-58.5.....	90.6	»	- 0.8.....	50	- 5.0......	4.20
-70.......	85	»	+15.......	45	+ 5.0......	5.20
-73 (Eutec.)..	82	» $+N_2O_4$ (Solid)	20.......	44.3	19.5......	7.15
-58.5.....	70	N_2O_4 (solid)	35.......	37.5	40.0......	10.0
-48.5	66	»	50.......	30	55.0......	20.0
-32......	62	»				
-21.4.....	60	»				

Determinations of the compositions of the two liquid layers which are formed in the system nitric acid and nitrogen peroxide at certain temperatures, were made by Bousfield, 1919, by means of density measurements, and the following results were obtained.

	N_2O_4 in HNO_3.				HNO_3 in N_2O_4.		
t°.	Density of mixture.	Specific volume.	Per cent HNO_3.	t°.	Density of mixture.	Specific volume.	Per cent HNO_3.
4.0...	1.65432	0.60448	45.6	4.0...	1.48742	0.67231	4.90
11.0...	1.63942	0.60997	45.7	11.0...	1.47351	0.67865	6.67
18.0...	1.62501	0.61538	46.0	18.0...	1.45940	0.68521	8.05

Freezing-points of mixtures of HNO_3 + H_2SO_4 + H_2O over a wide range of composition, especially for the region of high concentration of H_2SO_4, have been determined by Holmes, 1920, Carpenter and Lehrman, 1925 and Holmes, Hutchinson and Zieber, 1931. These latter investigators give a triangular diagram constructed from all available data on this system, showing the iso thermal freezing curves for mixtures of varying percentage composition.

NITRIC ACID HNO_3.

NO

DISTRIBUTION OF NITRIC ACID BETWEEN WATER AND ETHER AT 25°.

(Bogdan, 1905, 1906.)

Mols. HNO_3 per Liter of:		Mols. HNO_3 per Liter of:	
H_2O Layer.	Ether Layer.	H_2O Layer.	Ether Layer.
0.9145	0.0855	0.09005	0.00181
0.4811	0.0278	0.04749	0.00064
0.2644	0.00894	0.02760	0.00029
0.1392	0.00278	0.02462	0.00025

Data for the distribution of HNO_3 between Water and each of the following compounds; Ether, n Butyl Alcohol, n Amyl Alcohol and Methyl Ethyl Ketone are given by Archibald, 1932.

HYDROGEN OXIDE (Water) H_2O

Note - Data for the Reciprocal Solubility of Water in Organic Solvents, in addition to those here shown, will be found in Volume 2., under the respective Organic Compounds.

O

RECIPROCAL SOLUBILITY OF WATER AND SEVERAL ORGANIC COMPOUNDS AT 20°.

(Evans, 1936.)

The author describes an improvement of the Hill, 1923, method of determining the mutual solubility of liquids, which consists in the more suitable choice of the volume ratios of the two liquids. He also describes a simplified form of apparatus to be used.

The following results were obtained with the improved technique.

Organic Solvent	Solvent, Water		Solvent, Organic Compound	
	$d\frac{20}{4}$ of sat. sol.	Gms. Org. Solvent per 100 gms. sat. sol. in H_2O	$d\frac{20}{4}$ of sat. sol.	Gms. H_2O per 100 gms. sat. sol. in Org. Solvent
Sec. Butyl Alcohol	0.971	18.5	0.880	64.4
Methyl Ethyl Ketone	0.962	26.7	0.836	87.9
Methyl tert. Butyl Ether	0.990	4.8	0.745	98.5
Methyl tert. Amyl Ether	0.995	1.25	0.771	99.3
Chloroform	1.001	0.8	1.486	99.8

SOLUBILITY OF WATER IN SEVERAL ORGANIC SOLVENTS. (Clifford, 1921.)

The saturated solutions were analyzed by volatilizing the sample and absorbing the moisture in a dehydrating agent (Ca Cl_2) which does not absorb or react with the organic solvent.

Solvent.	t°.	Gms. H_2O per 100 gms. sat. sol.	Solvent.	t°.	Gms. H_2O per 100 gms. sat. sol.
Benzene	21.0	0.046	Carbon disulfide	25.0	0.010
»	26.6	0.056	» »	26.0	0.011
»	42.0	0.088	» »	27.0	0.012
»	55.0	0.113	Carbon tetrachloride.	24.0	0.010
Chloroform	24.5	0.084	» »	28.5	0.013
»	26.7	0.107	Gasoline	25.0	0.0085-0.0100
»	27.8	0.116	»	35.0	0.0121-0.0161
			»	37.5	0.0145-0.0175

Results for the Solubility of H_2O, Blood and Oils in cyclo Propane $(\underbrace{CH_2.CH_2.CH_2})$ are given by Orcutt and Seevers, 1937.

SOLUBILITY OF WATER IN BENZENE, TOLUENE AND CARBON TETRACHLORIDE.

(Rosenbaum and Walton, 1930.)

The H_2O dissolved in the organic solvents was determined by converting it to H_2 with the aid of calcium hydride according to the reaction $2H_2O + CaH_2 = Ca(OH)_2 + 2H_2$. Very high accuracy is claimed for the method, but it cannot be employed with solvents which react with CaH_2 and the determinations require considerable time for completion of the reaction.

t°	Gms. H_2O dissolved per 100 gms.		
	C_6H_6	$C_6H_5CH_3$	CCl_4
10	0.0451	0.0335	0.00711
20	0.0573	0.0450	0.00844
30	0.0746	0.0600	0.0109
40	0.0953	0.0733	0.0152
50	0.1271	0.0953	0.0237
60	0.1637	—	—

The presence of CS_2 in CCl_4 as an impurity was found to increase the solubility of water in this solvent about 50 percent.

SOLUBILITY OF WATER IN BENZENE, TOLUENE AND CYCLO HEXANE.

(Tarassenkow and Poloshinzewa, 1931, 1932.)

The determinations were made by the synthetic method of Alexieff as improved by Rothmund.

Results for C_6H_6		Results for $C_6H_5CH_3$		Results for C_6H_{12}	
t°	Gms. H_2O per 100 gms. sat. sol.	t°	Gms. H_2O per 100 gms. sat. sol.	t°	Gms. H_2O per 100 gms. sat. sol.
5.0	0.024	-9.0	0.002	14.0	0.005
9.5	0.034	-3.5	0.005	19.0	0.010
14.5	0.041	+10.5	0.020	28.5	0.015
22.5	0.060	18.0	0.034	32.5	0.020
32.0	0.082	30.0	0.053	38.0	0.031
40.	0.102	48.0	0.097	53.0	0.050
56	0.181	60.5	0.153		
67.5	0.251	76.0	0.254		
73.0	0.300	93.0	0.413		

SOLUBILITY OF WATER IN BENZENE. (Hill, 1923.)

A new thermostatic method was employed. This is based upon the unusual solubility relations of silver perchlorate. This compound is soluble in various organic solvents and exceptionaly soluble in water. Consequently, the presence of small amount of water in an organic solvent greatly increases the solubility of silver perchlorate in that solvent. The method consists in making a reference curve for the solubility of silver perchlorate in the organic solvent containing known amounts of water. Saturated solutions of water in the organic solvent are then made at various temperatures and each of these used as solvent for silver perchlorate at the temperature of the reference curve. By comparison with the reference curve the percentage of water in the solvent becomes known. The data for the reference curve of silver perchlorate in benzene + water mixtures at 25° will be found under silver perchlorate at the bottom of page 1401. The estimated results for the solubility of water in benzene are as follows.

t	Gms. H_2O per 100 gms. sat. solution.	t°.	Gms. H_2O per 100 gms. sat. solution.	t°.	Gms. H_2O per 100 gms. sat. solution.
3.0	0.035	37.5	0.109	65.0	0.232
5.4	0.037	40.0	0.118	66.0	0.238
15.0	0.051	50.0	0.158	69.5	0.258
23.0	0.063	55.0	0.181	77.0	0.304
25.0	0.072	57.5	0.193		

Data for the effect of H_2O upon the Critical Solution Temperatures of mixtures of CH_3OH + CS_2, CH_3OH + n Hexane and CH_3OH + Cyclo Hexane are given by de Brouckere and Gillet, 1935. The authors used the results as the basis of a method for the determination of H_2O.

SOLUBILITY OF WATER IN BENZENE SOLUTIONS OF MONO, DI, AND TRI CHLOR ACETIC ACIDS AT 15°

(Bell, 1930.)

Results for solutions in C_6H_6 of:

$CH_2ClCOOH$			$CHCl_2COOH$			CCl_3COOH		
d of sat. sol.	Gm. Mols. per 1000 gms. sat. sol.		d of sat. sol.	Gm. Mols. per 1000 gms. sat. sol.		d of sat. sol.	Gm. Mols. per 1000 gms. sat. sol.	
	$CH_2ClCOOH$	H_2O		$CHCl_2COOH$	H_2O		$CH_3ClCOOH$	H_2O
0.884	0.0620	0.0329	0.880	0.035	0.0408	0.878	0.0278	0.0426
0.881	0.115	0.0423	0.880	0.071	0.055	0.878	0.0506	0.0690
0.880	0.174	0.0574	0.883	0.123	0.101	0.887	0.0950	0.115
0.885	0.217	0.0645	0.895	0.179	0.130	0.885	0.140	0.165
0.888	0.284	0.0776	0.890	0.195	0.138	0.888	0.176	0.210
0.886	0.325	0.0838				0.892	0.219	0.247
0.892	0.404	0.1000						

The author recalculated the results of Waddell, 1898, for benzene solutions of acetic acid at 25° and obtained the following values.

d of sat. sol.	Gm. Mols. per 1000 gms. sat. sol.	
	CH_3COOH	H_2O
0.874	0.077	0.011
0.876	0.215	0.033
0.878	0.52	0.083
0.882	0.87	0.140
0.880	1.17	0.190

SOLUBILITY OF WATER IN BENZENE, TOLUENE AND XYLENE SOLUTIONS OF ETHANOLAMINE OLEATE (SOAP)

(Pink, 1938.)

Gm. Mols. Ethanolamine Oleate per liter organic solvent	cc H_2O dissolved per 50cc of Ethanolamine Solution in		
	Benzene (C_6H_6)	Toluene ($C_6H_5CH_3$)	Xylene $C_6H_4(CH_3)_2$
0.05	0.18	0.17	0.18
0.10	0.38	0.34	0.36
0.20	0.70	0.68	0.69
0.30	1.06	1.05	1.08
0.40	1.40	1.32	1.36
0.50	1.70	1.68	1.68
0.60	2.08	2.03	2.07
0.70	2.35	2.34	2.36

The determinations were made by adding the water from a microburet to the mixtures until on active shaking a faint cloudiness appeared. The temperature is not stated but was probably that of the room. The quantity of water dissolved is proportional to the quantity of the Ethanolamine oleate (soap) present. It was also found that additions of small quantities of phenol greatly increased the amount of water 0 dissolved. Further quantities of phenol however caused the solutions to become cloudy again.

SOLUBILITY OF WATER IN BENZENE, PETROLEUM AND PARAFFINE OIL.

(Groschuff, 1911.)

The synthetic, sealed tube method was used and the experiments were made with very great care. The mixtures were first superheated sufficiently to bring all the water into solution and then cooled until a fine mist was formed. The temperature of appearance and disappearance of this fine mist was determined repeatedly. The benzene was of $d_{20} = 0.8799$. The petroleum was American water white, of $d = 0.792$. It was freed from H_2O by distilling 3 times from melted Na and boiled at 190-250° at atmospheric pressure. The paraffine oil was first heated to 120-130° and then distilled twice under vacuum over melted Na and once without Na. Its $d_{18} = 0.883$ and b.-pt. was 200°-300° at 10 mm. pressure.

Results for:

H_2O + Benzene.		H_2O + Petroleum.				H_2O + Paraffine Oil.	
t°.	Gms H_2O per 100 Gms. Sol.	t°.	Gms H_2O per 100 Gms. Sol.	t°.	Gms. H_2O per 100 Gms. Sol.	t°.	Gms. H_2O per 100 Gms. Sol.
+ 3	0.030	− 2	0.0012	59	0.031	+16	0.003
23	0.061	+18	0.005	61	0.035	50	0.013
40	0.114	23	0.007	66	0.043	65	0.022
55	0.184	30	0.008	79	0.063	73	0.030
66	0.255	36	0.012	85	0.075	77	0.035
77	0.337	53	0.026	94	0.097	94	0.055

Observations on the solubility of water in essential oils are given by Umney and Bunker (1912).

HYDROGEN OXIDE (Water)

SOLUBILITY OF WATER IN AVIATION GASOLINES.

(Aldrich, 1931.)

The samples of gasoline were saturated with H_2O by shaking the mixture in an evacuated bulb, provided with all the refinements for accurate removal of the saturated sample for analysis. The H_2O in this sample was determined by adding sodium-potassium alloy, free of oxide, and collecting and measuring the evolved hydrogen. The determinations were made with the greatest possible accuracy.

t°	Gm. H_2O per 100 gms. sat. solution in Gasoline No.: 10	12	13	15	19
10	0.0128	0.0051	0.0071	0.0055	0.0036
30	0.0160	0.0067	0.0086	0.0172	0.0052
50	0.0193	0.0079	0.0101	0.0208	0.0069

Gasoline sample No. 10 = Oklahoma natural gasoline, d_{15} = 0.677.
" " No. 12 = West Virginia natural gasoline, d_{15} = 0.695.
" " No. 13 = California Crude, d_{15} = 0.695.
" " No. 15 = Midcontinental crude, d_{15} = 0.718.
" " No. 19 = Oklahoma natural gasoline, d_{15} = 0.682.

Except for fuel No. 15 the change in solubility with temperature is represented by a straight line

Using the calcium chloride method, Clifford, 1921, obtained the following values for the solubility of H_2O in gasoline of d = 0.700

t°	Gms. H_2O per 100 gms. sat. solution
25	0.0085; 0.0110
35	0.0161; 0.0121
37.5	0.0175; 0.0145

The Army Air Corps, 1922, using the calcium chloride method found the solubility of water in domestic aviation gasoline at 23.9° to be 0.007 gm. H_2O per 100 gms. sat. solution.

Using the same method Uspenskii, 1929 obtained the following results:

Gasoline	Gm. H_2O per 100 gms. sat. sol. at: 10°	22°
Grozny "avis"	0.007	0.011
" grade I	0.006	0.008
" grade II	0.006	0.008
Baku grade II	0.005	0.008

WATER TOLERANCE OF MIXTURES OF GASOLINE WITH ETHYL ALCOHOL ISO PROPYL ALCOHOL AND BENZENE.

(Sayley and Hopkins, 1934.)

The mixtures contained in a test tube provided with a thermometer and a stirrer were cooled in a Dewar flask containing acetone and CO_2 snow until the cloud point was reached. The tube was then removed and the point at which the cloud just disappeared with rising temperature, was taken as the critical solution temperature. Three samples of gasoline, two of Iso propyl Alcohol and a series of samples of Ethyl Alcohol containing from 1.63 to 5.65 Volume percent H_2O were used. Numerous diagrams showing the observed c.s.t. of various mixtures of the gasolines, alcohols and water are given. From these, various tables are constructed which show the relation of H_2O content to c.s.t. in mixtures of varying composition. Thus, for example, the critical Water Content of Mixtures containing 90, 80 and 70 percent of regular grade automobile fuel (liquid phase cracked gasoline) is as follows.

Vol. Percent Composition of Mixture			Critical H_2O Content in Vol. % at:		
Gasoline	Ethyl Alcohol	Iso propyl Alcohol	0°	-20°	-40°
90	10	0	0.30	0.22	0.15
90	8	2	0.35	0.27	0.19
90	7	3	0.38	0.30	0.22
90	6	4	0.41	0.33	0.25
80	20	0	0.70	0.50	0.35
80	16	4	—	0.64	0.46
80	12	8	—	0.80	0.60
70	30	0	1.25	0.84	0.59
70	25	5	—	1.09	0.76
70	20	10	—	1.25	1.00

Iso propyl Alcohol increases the water tolerance and the critical water content of any ethyl alcohol-gasoline mixture to which it is added. Benzene may be used to increase moderately the critical water content of ethyl alcohol-gasoline mixtures by substituting benzene for part of the gasoline. Its effect, However, in increasing water tolerance appears to be too slight to be of practical value.

HYDROGEN PEROXIDE H_2O_2.

FREEZING-POINTS OF MIXTURES OF HYDROGEN PEROXIDE AND WATER.

(Maass and Herzberg, 1920.)

t° of f. pt.	Gms H_2O_2 per 100 gms. mixture.	Solid Phase.	t° of f. pt.	Gms H_2O_2 per 100 gms. mixture.	Solid Phase.
− 2.0 . . .	100	H_2O_2	−51.7	49.8	$H_2O_2.2H_2O$
−14.0 . . .	86.0	»	−50.8	47.0	»
−22.7 . . .	80.45	»	−51.8	46.21	»
−36.5 . . .	74.0	»	−46.25 . . .	42.02	H_2O
−39.5 . . .	69.2	»	−38.0	37.80	»
−45.5 . . .	65.4	»	−35.7	36.47	»
−50.0 . . .	63.05	»	−28.5	31.96	»
−52.5 . . .	61.14	»	−23.4	27.72	»
−54.5 . . .	58.8	$H_2O_2.2H_2O$	−17.0	22.50	»
−54.3 . . .	56.2	»	−11.1	15.91	»
−53.6 . . .	55.06	»	− 6.3	9.96	»
−52.5 . . .	53.7	»	− 3.4	4.9	»

HYDROGEN PEROXIDE H_2O_2.

EQUILIBRIUM IN THE SYSTEM HYDROGEN PEROXIDE, UREA AND WATER.

(Jänecke, 1932.)

To aqueous hydrogen peroxide solutions of known concentrations weighed amounts of urea were added and the mixtures warmed until clear. Upon cooling the temperature was determined at which crystals separated. The Solid Phases were ice, urea or the double compound $CO(NH_2)_2.H_2O_2$.

Wt. % H_2O_2 in Aqueous Solvent	Temp. of Saturation of Solution containing:					
	10 Wt.% $CO(NH_2)_2$	20 Wt.% $CO(NH_2)_2$	30 Wt. % $CO(NH_2)_2$	40 Wt. % $CO(NH_2)_2$	50 Wt. % $CO(NH_2)_2$	60 Wt. % $CO(NH_2)_2$
3.0	-5.0	-6.5	-9.7	-0.8	+16.5	+35.0
6.0	-6.0	-7.5	-2.0	+6.0	+12.2	+20.3
10.0	-8.0	-2.0	+3.3	+5.5	+14.0	+34.5
15.0	-3.0	+6.0	+11.6	+13.5	+15.2	+32.0
20.0	+2.7	+12.2	+19.2	+21.0	+22.5	+31.5
30.0	+7.0	+20.3	+27.5	+32.0	+34.5	+34.4

Wt % H_2O_2 in Aqueous Solvent	Temp. of Saturation of Solution containing:						
	5 Wt. % $CO(NH_2)_2$	10 Wt. % $CO(NH_2)_2$	15 Wt. % $CO(NH_2)_2$	20 Wt. % $CO(NH_2)_2$	25 Wt. % $CO(NH_2)_2$	33.7 Wt. % $CO(NH_2)_2$	43.7 Wt. % $CO(NH_2)_2$
36.0	-1.0	+12.0	+20.0	+25.0	+30.5	+36.0	+40.5
47.7	0.0	+15.0	+25.0	+31.0	+38.0	—	—
59.9	+2.0	+11.0	+22.5	+33.0	—	—	—
79.1	-8.0	+12.5	+26.0	+35.5	+47.5	—	—
91.8	-20.0	+4.0	+20.0	+31.5	+45.0	—	—

FREEZING-POINTS OF MIXTURES OF HYDROGEN PEROXIDE AND METHYL ALCOHOL.

(Matheson and Maass, 1929.)

t°	Gm. Mol. CH_3OH per 100 gm. mols. $CH_3OH + H_2O_2$	Solid Phase	t°	Gm. Mol. CH_3OH per 100 gm. mols. $CH_3OH + H_2O_2$	Solid Phase
-1.7	5.6	H_2O_2	-18.6	28.3	H_2O_2
-6.4	13.2	"	-22.2	33.2	"
-10.2	18.4	"	-37.8	43.8	"
-15.3	25.2	"	-49.3	51.5	"

The authors also give results for the freezing-points of mixtures of hydrogen peroxide and each of the following compounds: Ethyl Ether, Piperidine, Di ethyl amine, Mono n Butylamine, Tertiary mono Butylamine, Di iso Butylamine, Tripropylamine and Di methyl amine.

DISTRIBUTION OF HYDROGEN PEROXIDE BETWEEN WATER AND ETHYL ETHER AT 18°. (de Kolossovsky, 1919, 1925.)

The mixtures of equal volumes of water and ether, to which different amounts of redistilled « Perhydrol » were added, were vigorously shaken during 20 minutes, by periods of 2 minutes each, and allowed to stand in the thermostat between the agitations and for 1 hour after the last. Aliquot portions of each layer were titrated with aqueous K Mn O_4 solution in presence of sulfuric acid. The determinations were plotted and the following results were obtained from the curve.

Gms. H_2O_2 per 100 cc.		$\frac{p}{p_1}$.	Gms. H_2O_2 per 100 cc.		$\frac{p}{p_1}$.
H_2O layer (p).	$(C_2H_5)_2O$ layer (p_1).		H_2O layer (p).	$(C_2H_5)_2O$ layer (p_1).	
0.935	0.065	14.4	17.908	2.092	8.6
2.795	0.205	13.6	19.590	2.410	8.1
4.640	0.360	12.9	21.251	2.749	7.7
6.470	0.530	12.2	23.707	3.293	7.2
9.182	0.818	11.2	25.324	3.676	6.9
10.968	1.034	10.6	26.929	4.071	6.6
12.734	1.266	10.1	28.522	4.478	6.4
14.479	1.521	9.5	30.119	4.881	6.2
16.204	1.796	9.0	31.714	5.286	6.0

O

DISTRIBUTION OF HYDROGEN PEROXIDE BETWEEN WATER AND ORGANIC SOLVENTS.

(Walton and Lewis, 1916.)

Different amounts of perhydrol (30% H_2O_2 solution) were added to various mixtures of water and organic solvents and, after constant agitation for about 1 hour, the H_2O_2 in each layer was determined.

Solvent	t°.	Ratio, $\frac{\text{Conc. aq.}}{\text{Conc. org. solvent}}$.	Solvent.	t°.	Ratio, $\frac{\text{Conc. aq.}}{\text{Conc. org. solvent}}$.
Ethyl Acetate	25	3.92– 4.11	Methyl Iodide	25	Approx. 200
Isobutyl Alcohol	25	2.58– 2.63	*m* Toluidine	25	Approx. 5
Amyl Acetate	25	13 –13.2	Phenol	25	4.35 –5.55
Acetophenone	25	5.82– 6.06	Quinoline	0	0.276–0.391
Ether	25	8.28– 9.11	"	25	0.365–0.642
Ether	0	5.72– 5.85	"	40	0.516–0.602
Aniline	25	4.08– 4.10			

The following approximate values, determined at room temp., are quoted from the dissertation of A. Braun, Univ., Wisconsin, 1914.

Solvent.	Ratio, $\frac{\text{Conc. aq.}}{\text{Conc. org. solvent}}$.	Solvent.	Ratio, $\frac{\text{Conc. aq.}}{\text{Conc. org. solvent}}$.	Solvent.	Ratio, $\frac{\text{Conc. aq.}}{\text{Conc. org. solvent}}$.
Ethyl Acetate	$\frac{2}{5}$	Ethylisovalerianate	$\frac{1}{10}$	Isobutyl Alcohol	$\frac{1}{3}$
Nitrobenzene	$\frac{1}{200}$	Isoamyl Propionate	$\frac{1}{12}$	Propyl Formate	$\frac{1}{8}$
Acetophenone	$\frac{1}{4}$	Chloroform	$\frac{1}{600}$	Isobutyl Butyrate	$\frac{1}{50}$
Amyl Acetate	$\frac{1}{3}$	Benzene	$\frac{1}{200}$	Propyl Butyrate	$\frac{1}{30}$

The distribution ratio of hydrogen peroxide between water and ether at 17.5° varies with concentration from 13.9 to 17.4. (Osipoff and Popoff, 1903.)

DISTRIBUTION OF HYDROGEN PEROXIDE BETWEEN WATER AND AMYL ALCOHOL AT 0° AND AT 25°.

(Calvert, 1901; Joyner, 1912.)

Results at 0°. (Calvert, Joyner.)			Results at 25°. (Calvert.)		
Mols. H_2O_2 per Liter.			Mols. H_2O_2 per Liter.		
H_2O layer (W).	Alcohol Layer (A).	$\frac{W}{A}$.	H_2O Layer (W).	Alcohol Layer (A).	$\frac{W}{A}$.
0.146	0.0216	6.76	0.094	0.013	7.01
0.200	0.030	6.66	0.194	0.028	6.91
0.407	0.061	6.63	0.297	0.042	7.08
0.749	0.113	6.66	0.670	0.095	7.09
1.970	0.293	6.71	0.913	0.130	7.01

Data are also given for the distribution of hydrogen peroxide between aqueous sodium hydroxide solutions and amyl alcohol at 0° and at 25°.

The following results for the distribution of hydrogen peroxide between water and Iso amyl alcohol (b.pt. 128°- 130°) at 0° are given by Husain, 1927, but the terms in which the concentrations are expressed are not stated.

Conc. of H_2O_2 in H_2O(W)	Conc. of H_2O_2 in Alcohol(A)	$\frac{W}{A}$
26.90	4.10	6.56
32.12	4.93	6.53

0

This author also gives results for the distribution of H_2O between Iso Amyl alcohol and aqueous solutions of sodium and potassium phosphates at 0°.

DISTRIBUTION OF HYDROGEN PEROXIDE BETWEEN WATER AND AMYL ALCOHOL AT 0°. (Menzel, 1923.)

Cc. 0.05n Thiosulfate solution required for 10cc of			Cc. 0.05n Thiosulfate solution required for 10cc of		
Aq. layer (W).	Alcoholic layer (A).	$\frac{W}{A}$.	Aq. layer (W).	Alcoholic layer (A)	$\frac{W}{A}$.
32.05	4.60	6.97	52.95	7.70	6.88
36.50	5.27	6.96	59.15	8.60	6.88
43.83	6.36	6.89	68.00	10.05	6.80
46.50	6.70	6.94	76.25	11.23	6.79
52.85	7.73	6.85			

Data are also given for the distribution of hydrogen peroxide between aqueous solutions of potassium metaborate and tetraborate, and amyl alcohol at 0°.

Freezing-point Data have been determined for Mixtures of :

H_2O_2 + KCl (Matheson and Maass, 1929.)
" + K_2SO_4 " " " "
" + NaF " " " "
" + H_2SO_4 " " " "
" + NH_3 (Maass and Hatcher, 1922.)
" + NaCl " " " "
" + $NaNO_3$ " " " "

HYDROGEN PHOSPHIDE (Phosphine) H_3P

One liter of Cyclo Hexanol ($C_6H_{11}OH$) dissolves 2.856cc H_3P at 26° and 766mm. Hg pressure. ((Cauquil, 1927.)

HYDROGEN PHOSPHITE (Phosphorus Acid) H_3PO_3

Freezing-point data are given by Redfield and King, 1936, for each of the following mixtures.

H_3PO_3 + CH_3COOH (Acetic acid)
" + CCl_3COOH (Trichlor Acetic Acid)
" + $CH_3COCOOH$ (Pyruvic acid)
" + C_6H_5COOH (Phenol)

H_3PO_3 + $C_6H_5COCH_3$ (Acetophenone)
" + (CH_2O_2) C_6H_3CHO (Piperonal)
" + $C_6H_4CH:CH.OCO$ (Coumarin)

HYDROGEN PHOSPHATE (Phosphoric Acid)

PO

PHOSPHORIC ACID (ortho) H_3PO_4.

SOLUBILITY IN WATER. (Smith and Menzies, 1909.)

(The sat. solutions were analyzed by titration. The mixtures were constantly stirred for at least two hours.)

t°.	Gms. H_3PO_4 per 100 Gms. Sat. Sol.	Solid Phase.
−81*	62.9	Ice+$2H_3PO_4.H_2O$
−16.3	76.7	$2H_3PO_4.H_2O$
+ 0.5	78.7	"
14.95	81.7	"
24.03	85.7	"
27	87.7	"
29.15	90.5	"
29.35†	91.6	"
28.5	92.5	"
27	93.4	"
25.4	94.1	"
23.5*	...	" +$10H_3PO_4.H_2O$
24.11	94.78	$10H_3PO_4.H_2O$
24.38	94.80	$10H_3PO_4.H_2O$
24.40	94.84	"
24.81	94.95	"
25.41	95.26	"
25.85	95.54	"
26.2*	...	" +H_3PO_4
26.23	95.90	H_3PO_4
27.02	95.98	"
29.42	96.15	"
29.77	96.11	"
37.65	97.80	"
39.35	98.48	"
42.30†	100	"

* Eutec. † M. pt.

NOTE. — The results of Giran (1908), determined by the freezing-point method, are shown to be erroneous, due to supercooling which would result from failure to induce crystallization by inoculation.

F.-pt. data for mixtures of phosphoric and phosphorus acids are given by Rosenheim, Stadler and Jakobsohn (1906).

SOLUBILITY OF ORTHO PHOSPHORIC ACID IN WATER. (Ross and Jones, 1925.)

The mixtures were stirred at constant temperature for at least three days. The analysis was made by titrating with standard Na OH solution, using phenolphthalein as indicator.

t°.	Gms. H_3PO_4 per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. H_3PO_4 per 100 gms. sat. sol.	Solid Phase.
—85 (Eutec.)...	62.5	Ice + $2H_3PO_4.H_2O$	28.28......	92.72	$2H_3PO_4.H_2O$
—57........	67.0	$2H_3PO_4.H_2O$	27.36......	93.33	»
—43........	70.0	»	26.08......	93.74	»
—29.0......	72.5	»	23.50 (Eutec.).	94.75	» + H_3PO_4
—17.5......	75.0	»	25.88......	95.22	H_3PO_4
0.0......	78.75	»	27.30......	95.56	»
18.92.....	84.07	»	28.38......	95.86	»
23.41.....	85.93	»	29.90......	96.18	»
25.24.....	87.05	»	31.96......	96.80	»
27.30.....	88.51	»	34.06......	97.40	»
28.75.....	90.00	»	36.15	98.00	»
29.32 m. pt.	91.60	»	40.02......	99.27	»
28.80.....	92.30	»	42.35 m pt...	100.00	»

The authors failed to find the decihydrate reported by Smith and Menzies, 1909

100 gms. sat. solution of $2H_3PO_4.H_2O$ in water contain 85.95 gms. H_3PO_4 at 25°. (Grube and Staesche, 1927.)

PO

FREEZING-POINTS OF AQUEOUS SOLUTIONS OF PHOSPHORIC ACID. (Ross and Jones, 1925.)

t°.	Gms. H_3PO_4 per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. H_3PO_4 per 100 gms. sat. sol.	Solid Phase.
— 5............	17.5	Ice	—35.........	47.5	Ice
—10............	27.0	»	—45.........	51.0	»
—15............	34.0	»	—60.........	55.0	»
—20............	38.0	»	—75.........	59.5	»
—25............	42.0	»	—85 (eutec.)....	62.5	» + $2H_3PO_4.H_2O$

SOLUBILITY OF ORTHO PHOSPHORIC ACID IN ETHYL ETHER.

(Rabinowitsch and Jakubsohn, 1923.)

t°	Gms. H_3PO_4 per 100 gms. sat. sol.	Solid Phase	t°	Gms. H_3PO_4 per 100 gms. sat. sol.	Solid Phase
14.0	82.50	$4H_3PO_4(C_2H_5)_2O$	25.5	89.10	$6H_3PO_4(C_2H_5)_2O$
17.2	83.48	" "	22.1	89.50	" "
29.3(m.pt.)	84.20	" "	17.5	89.85	"
30.0	84.38	"	16.0(Eutec.)	90.10	" + H_3PO_4
28.4	84.96	"	16.9	91.7	H_3PO_4
27.5	87.00	"	17.7	92.5	"
25.2	87.48	"	21.0	95.10	"
23.9	87.70	"	23.4	96.17	"
22.0(Eutec.)	—	" + $6H_3PO_4(C_2H_5)_2O$	26.5	97.20	"
24.5	88.05	$6H_3PO_4(C_2H_5)_2O$	28.3	97.85	"
25.2	88.10	"	28.7	97.93	"
28.2(m.pt.)	88.80	"	30.1	98.50	"
27.5	88.94	"	38.4	100.00	"

Freezing-point data are given by King and Walton, 1931, for each of the following mixtures

H_3PO_4 + CH_3COOH (acetic acid)
" + C_2H_5COOH (Propionic acid)
" + C_3H_7COOH (n Butyric acid)
" + $CH_3(CH_2)_4COOH$ (n Caproic acid)
" + C_6H_5COOH (Benzoic acid)
" + $CH_3COCOOH$ (Pyruvic acid)
" + $CH_2ClCOOH$ (Monochlor acetic acid)
" + $CH_2C_6H_5COOH$ (Phenylaacetic acid)

H_3PO_4 + C_6H_5CHO (Benzaldehyde)
" + $CH_3OC_6H_4CHO$ (Anisaldehyde)
" + $C_6H_5COCH_3$ (Acetophenone)
" + $C_6H_5COC_6H_5$ (Benzo aceto
" phenone)
" + C_6H_5OH (Phenol)
" + $C_6H_4OH.OCH_3$ (Guaicol)
" + $C_6H_4CH:CH.OCO$ (Cumarin)

PO PyroPHOSPHORIC ACID $H_4P_2O_7$.

SOLUBILITY IN WATER. (Giran, 1908; see note on preceding page.)

t°.	Gms. $H_4P_2O_7$ per 100 Gms. Sat. Sol.	Solid Phase.
−75	59	Ice + $H_4P_2O_7.1\frac{1}{2}H_2O$
+26 m. pt.	86.8	$H_4P_2O_7.1\frac{1}{2}H_2O$
23	88.8	" + $H_4P_2O_7$
61 m. pt.	100	$H_4P_2O_7$

HypoPHOSPHORIC ACID $H_3PO_3.H_2O$.

100 gms. sat. solution in water contain 81.8 gms. H_3PO_3 at the m. pt., 62°, of the hydrated compound, $H_3PO_3.H_2O$. (Rosenheim and Pritze, 1908.)

HYDROGEN SULFIDE H_2S.

S

SOLUBILITY IN WATER.
(Winkler, 1906, 1912.)

t°.	Abs. Coef. β.	q.	t°.	Abs. Coef. β.	q.	t°.	Abs. Coef. β.	q.
0	4.621	0.699	25	2.257	0.334	60	1.176	0.146
5	3.935	0.593	30	2.014	0.295	70	1.010	0.109
10	3.362	0.505	35	1.811	0.262	80	0.906	0.076
15	2.913	0.436	40	1.642	0.233	90	0.835	0.041
20	2.554	0.380	50	1.376	0.186	100	0.800	0

Abs. Coef β shows the vol. of H_2S (reduced to 0° & 760mm) absorbed by 1 vol. of H_2O when the pressure of the gas without the tension of the liquid amounts to 760mm.

q is the weight of H_2S in grams which is taken up by 100 grams of H_2O at the given temperature and total pressure (partial pressure of gas + vapor pressure of the liquid) is 760mm.

THE SOLUBILITY OF HYDROGEN SULFIDE IN WATER AS MEASURED BY THE VAPOR PRESSURES OF THE SOLUTIONS.

(Wright and Maass, 1932.)

A new type of glass diaphragm manometer was used for determination of the equilibrium pressures of known mixtures of $H_2S + H_2O$, confined in an all glass cell. This obviated stray reactions between the gas and Hg or stopcock grease. The results show that Henry's Law is not strictly obeyed.

t°	Pressure in mm. Hg		Gm. Mols. H_2S per liter of		Partition Coef.
	Total	Partial	Vapor Phase(v)	Aq. Solution(s)	s/v
5	274.5	268.0	0.0155	0.0635	4.09
"	560.0	553.0	0.0321	0.1302	4.06
"	838.0	831.0	0.0484	0.1910	3.94
"	1176.0	1169.0	0.0685	0.2682	3.92
10	303.8	294.7	0.0168	0.0597	3.56
"	615	606	0.0346	0.1220	3.52
"	914	905	0.0518	0.1801	3.47
"	1279	1270	0.0731	0.2511	3.44
"	1567	1558	0.0900	0.3060	3.40
"	2112	2103	0.1221	0.4099	3.36
20	362.8	345.4	0.0190	0.0528	2.78
"	724	707	0.0390	0.1074	2.76
"	1067	1050	0.0581	0.1594	2.74
"	1483	1466	0.0816	0.2188	2.68
"	1817	1800	0.1005	0.2696	2.68
"	2454	2437	0.1371	0.3642	2.66
30	422.8	391.3	0.0208	0.0470	2.26
"	830	798	0.0425	0.0955	2.25
"	1219	1187	0.0636	0.1413	2.22
"	1674	1640	0.0882	0.1932	2.19
"	2052	2020	0.1091	0.2398	2.20
"	2785	2753	0.1498	0.3247	2.17
40	486.5	431.6	0.0222	0.0426	1.92
"	934	879	0.0454	0.0858	1.89
"	1370	1315	0.0682	0.1260	1.85
"	1853	1798	0.0937	0.1722	1.84
"	2278	2223	0.1162	0.2149	1.85
"	3095	3040	0.1603	0.2921	1.82
60	652.2	503.3	0.0243	0.0359	1.48
"	1162	1013	0.0492	0.0730	1.48
"	1681	1532	0.0747	0.1045	1.40
"	2213	2064	0.1010	0.1440	1.42
"	2731	2582	0.1269	0.1777	1.40
"	3707	3558	0.1762	0.2426	1.38

The PT and the Px curves for the system $H_2S + H_2O$ are given by Sheffer, 1911.

SOLUBILITY OF HYDROGEN SULFIDE IN WATER AND IN RUBBER.

(Venable and Fuwa, 1922.)

The gas dissolved by a given amount of air free rubber was pumped out with a Töpler pump and measured over mercury.

100 cc. H_2O dissolve 243 cc. (at 0° and 760 mm) H_2S at 21°
» Rubber » 273 cc. (») »

SOLUBILITY OF HYDROGEN SULFIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 25°. (Kendall and Anderson, 1921.)

Normality of aq. HCl solutions.	Gm. mols. H_2S per liter sat. sol.	Cc. H_2S (at 0° and 760 mm.) dissolved by 1 cc. sat. sol. (at 760 mm. pressure).	Normality of aq. HCl solutions.	Gm. mols. H_2S per liter sat. sol.	Cc. H_2S (at 0° and 760 mm.) dissolved by 1 cc. sat. sol. (at 760 mm. pressure).
0.0 (= H_2O).	0.1023	2.266	2.498......	0.1030	2.281
0.1348......	0.1018	2.253	3.040......	0.1034	2.291
0.2828	0.1015	2.247	3.308......	0.1039	2.301
0.6308	0.1016	2.250	4.410......	0.1076	2.384
1.180.......	0.1020	2.260	4.874......	0.1090	2.413
1.848.......	0.1026	2.272			

SOLUBILITY OF HYDROGEN SULFIDE IN AQUEOUS SOLUTIONS OF HYDRIODIC ACID AT 25° AND 760 MM. TOTAL PRESSURE.

(Pollitzer, 1909.)

Mols. per Liter			Gms. per Liter		Mols. per Liter.			Gms. per Liter.	
[H'].	[HI].	[H_2S].	HI.	H_2S.	[H'].	[HI].	[H_2S].	HI.	H_2S.
0.20	0	0.1040	0	3.54	4.71	4.38	0.163	560.4	5.55
1.23	1.01	0.111	129.2	3.78	5.33	5.005	0.165	640.3	5.62
1.74	1.51	0.113	193.2	3.85	6.06	5.695	0.181	728.6	6.17
2.18	1.93	0.125	246.9	4.26	7.33	6.935	0.197	887.2	6.71
2.92	2.64	0.138	337.8	4.70	9.75	9.21	0.267	1179	9.10
3.71	3.42,	0.142	437.5	4.84					

Data for the solubility of hydrogen sulfide in liquid sulfur are given by Pelabon, 1897.

Freezing-point lowering data for mixtures of H_2S and CH_3OH and H_2S and $(CH_3)_2O$ are given by Baume and Perrot, 1911, 1914.

SOLUBILITY OF HYDROGEN SULFIDE IN AQUEOUS SALT SOLUTIONS AT 25°.

(McLauchlan, 1903.)

NOTE. — The original results are given in terms of $\frac{l}{l_0}$ which is the iodine titer (l) of the H_2S dissolved in the salt solution, divided by the titer (l_0), of the H_2S dissolved in pure water. These figures were multiplied by 2.61 (see 25° result in last table on page 322) and the products recorded in the following table as volumes of H_2S absorbed by 1 vol. of aqueous solution.

Solution.	Grams Salt per Liter.	$\frac{l}{l_0}$.	Vols. H_2S per 1 Vol. Sol.	Solution.	Gms. Salt per Liter.	$\frac{l}{l_0}$.	Vols. H_2S per 1 Vol. Sol.
n NH_4Br	98	1	2.61	*n* KBr	119	0.945	2.47
n NH_4Cl	53.4	0.96	2.40	*n* KCl	74.5	0.853	2.22
n NH_4NO_3	80	0.99	2.58	*n* KNO_3	101	0.913	2.38
$\frac{1}{2}$ *n* $(NH_4)_2SO_4$	33	0.82	2.14	$\frac{1}{2}$ *n* K_2SO_4	43.5	0.78	2.04
$\frac{1}{4}$ *n* $(NH_4)_2SO_4$	16.5	0.91	2.37	$\frac{1}{4}$ *n* K_2SO_4	21.7	0.89	2.32
n $NH_4C_2H_3O_2$	77.1	1.09	2.84	*n* KI	166	0.98	2.56
n $(NH_2)_2CO$	60.1	1.02	2.66	*n* NaBr	103	0.035	2.44
$\frac{1}{2}$ *n* HCl	18.22	0.975	2.54	*n* NaCl	58.5	0.847	2.21
$\frac{1}{2}$ *n* H_2SO_4	24.52	0.905	2.36	$\frac{1}{2}$ *n* NaCl	29.2	0.93	2.42
n $C_4H_6O_6$	150	0.944	2.46	*n* $NaNO_3$	85	0.893	2.32
3 *n* $C_4H_6O_6$	450	0.858	2.24	$\frac{1}{2}$ *n* Na_2SO_4	35.5	0.73	1.90
Pure $C_3H_5(OH)_3$	1000	0.863	2.26	$\frac{1}{4}$ *n* Na_2SO_4	17.8	0.855	2.23

Similar data are also given for the solubility of H_2S in aq. C_2H_5OH solutions and in aq. CH_3COOH solutions at 25°.

Solubility in Water and in Alcohol at t° and 760 mm. Pressure.

(Bunsen and Carius; Fauser, 1888.)

	In Water.			In Alcohol.
t°.	1 Vol. H_2O Absorbs.	β.	q.	1 Vol Alcohol Absorbs.
0	4.37 Vols. H_2S (at 0° and 760 mm.)	4.686	0.710	17.80 Vols. H_2S (at 0° and 760 mm.)
5	3.97 "	4.063	0.615	14.78 "
10	3.59 "	3.520	0.530	11.99 "
15	3.23 "	3.056	0.458	9.54 "
20	2.91 "	2.672	0.398	7.42 "
25	2.61 "	...	...	5.96 (24°) "
30	2.33 "	...	...	...
35	2.08 "	...	...	...
40	1.86 "	...	...	...

For definition of β and q see Solubility of Hydrogen Sulfide in Water.

Solubility of Hydrogen Sulfide in Several Solvents at 20° and 760mm.

(Bell, 1931.)

The solvents were saturated by bubbling H_2S through them for about 3 hours, using some 8-10 times as much gas as required for saturation. The dissolved gas was determined by displacing it with a current of CO_2 free air and absorbing the H_2S in a known volume of normal NaOH containing an excess of 30% H_2O_2 above that required for oxidation to sulfate. After absorption the excess of H_2O_2 was removed by heating to 60-70° and the excess of alkali was titrated with normal HCl.

Solvent	S	X	Solvent	S	X
Hexane	6.30	0.0341	Penta chlor Ethane	10.63	0.0514
Octane	6.80	0.0440	Bromoform	16.76	0.0581
Dodecane	5.71	0.0513	Ethyl bromide	17.80	0.0608
Cetane	5.05	0.0578	Chloroform	32.8	0.103
Cyclo Hexane	7.50	0.0338	Bromo Benzene	12.92	0.0376
Carbon tetrachloride	10.79	0.0419	Chloro Benzene	13.80	0.0388
Benzene	15.68	0.0563	Tetrabrom Ethane(s)	9.49	0.0446
Toluene	16.90	0.0672	Tetra chlor Ethane(s)	16.66	0.0702
Tetra chlor Ethylene	8.90	0.0372	Ethyl bromide	43.3	0.126
Tri chlor Ethylene	13.16	0.0482	Ethylene chloride	23.0	0.0719

S = the partition coefficient of H_2S between the liquid and the vapor; that is S = C (the gm. equiv. per liter) ÷ 0.0417, since S/C = 22.4 x 293/273.

X = the Mol. Fraction Solubility calculated on the assumption that the densities obey the ideal mixture law.

At pressures between 0 and 15 Atmospheres, the Solubility of H_2S in Gas Oil (d = 0.8319 and vapor pressure of 2mm at 25°) is expressed by the equation y = 4.17 (x + 1.7).

At pressures between 0 and 9 Atmospheres, the Solubility of H_2S in Heavy Naphtha (d = 0.8003 and vapor pressure of 80mm at 25°) is expressed by the equation y = 5.5(x).

In these equations y = Volume of H_2S at 25° and 1 atm. dissolved per 1 vol. of liquid.

x = Absolute pressure in atmospheres. (Frolich, Touch, Hogan and Peer, 1931.)

HYDROGEN SULFIDE

Freezing-point Data have been determined for the following mixtures:

$H_2S + CCl_4$	(Biltz and Brautigam, 1927.)
" $+ CS_2$	" " " "
" $+ SO_2$	" " " "
" $+ NH_3$	(Sheflan and McCrosky, 1932.)
" $+ CH_3OH$	(Baume & Perrot, 1914; Baume et al, 1914.)
" $+(CH_3)_2O$	(Baume & Perrot, 1914.)

HYDROGEN Di and TriSULFIDES H_2S_2 and H_2S_3.

Freezing-point Data for mixtures of H_2S_3 + S are given by Butler and Maass, 1930, and for H_2S_3 + S by Walton and Whitford, 1930.)

HYDROGEN SULFATE (Sulfuric Acid) H_2SO_4

SO

FREEZING-POINTS OF MIXTURES OF SULFURIC ACID AND WATER.

(Hülsmann and Biltz, 1934.)

The many difficulties which interfere with the accuracy of determination are described. The temperatures were measured with a thermoelement. The authors' original results were plotted and the following values read from the curves.

t°	Gms. H_2SO_4 per 100 gms. sat. sol.	Solid Phase	t°	Gms. H_2SO_4 per 100 gms. sat. sol.	Solid Phase
-4.0	10.0	Ice	-47.2(Eutec)	68.0	$H_2SO_4.4H_2O + H_2SO_4.2H_2O$
-15.0	20.0	"	-45	69.0	$H_2SO_4.2H_2O$
-35.0	30.0	"	-42	70.0	"
-55.0	35.0	"	-40	71.5	"
-72.4(Eutec)	36.5	" $+H_2SO_4.8H_2O$	-39 (m.pt.)	73.1	"
-67.5	37.2	$H_2SO_4.8H_2O$	-39.5(Eutec)	73.5	" $+ H_2SO_4H_2O$
-63.7	37.8	"	-30	74.5	$H_2SO_4.H_2O$
-62.0	38.2	" $+H_2SO_4.6H_2O$	-20	76.0	"
-60	38.5	$H_2SO_4.6H_2O$	-10	78.3	"
-58	39.0	"	0	81.0	"
-55	40.5	"	+8.5(m.pt.)	84.5	"
-54	42.0	" $+H_2SO_4.4H_2O$	0	88.5	"
-50	43.5	$H_2SO_4.4H_2O$	-10	91.0	"
-40	48.0	"	-20	92.5	"
-30	55.0	"	-35.5(Eutec)	93.5	" $+ H_2SO_4$
-28.5(m.pt.)	57.65	"	-20	95.5	H_2SO_4
-30.0	60.0	"	-10	97.0	"
-35.0	64.0	"	0	98.5	"
-40.0	66.0	"	+10.49	100.0	"

SOLUBILITY OF SULFURIC ACID IN WATER, DETERMINED BY THE FREEZING-POINT METHOD.

t°.	Gms. H_2SO_4 per 100 Gms. Sat. Sol.	Gms. SO_3 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. H_2SO_4 per 100 Gms. Sat. Sol.	Gms. SO_3 per 100 Gms. Sat. Sol.	Solid Phase.
−10	16.25	13.25 (1)(5)	Ice	−10	77.75	63.5 (3)	$SO_3.2H_2O$
−20	24	19.5 (1)(2)(3)	"	0	80.25	65.5 (2)	"
−30	28.5	23.25 (2)	"	+ 8.35*	84.5	68.98 (2)	"
−40	31.25	25.5 (2)	"	8.81	84.5	68.98 (1)	"
−50	33.5	27.25 (1) (2)	"	0	88.25	72 (2)	"
−60	35.25	28.75 (1)	"	−20	91.5	74.75 (1)	"
−70	36.75	30 (2)	"	−30	92.5	75.5 (1)	"
−75	38	31 (2)	" $+SO_3.5H_2O$	−38	93	76 (2)	" $+SO_3.H_2O$
−70	39	31.75 (2)	$SO_3.5H_2O$	−30	93.75	76.5 (4)	$SO_3.H_2O$
−60	41.5	33.75 (2)	"	−20	95.25	77.75 (4)	"
−50	44	36 (2)	"	−10	96.25	78.5 (1)(4)	"
−40	47.75	39 (2)	"	0	97.75	79.75 (4)	"
−30	53.25	43.25 (2)	"	+10	99.75	81 (4)	"
−25*	57.65	47.06 (2)	"	10.35	100	81.62 (1)(3)(7)(4)	
−30	61	49.75 (2)	"	10	...	82 (4)	"
−40	65.25	53.25 (2)	"	0	...	83.25 (4)	"
−60	70.75	57.75 (3)	" (unstable)	−10	...	84.5 (4)	"
−70	73.25	59.75 (3)	" " $+SO_3.2H_2O$	−12	...	85 (4)	" $+SO_3.\frac{1}{2}H_2O$
−60	73.50	60 (3)	$SO_3.2H_2O$ (unstable)	−10	...	85.25 (4)	$SO_3.\frac{1}{2}H_2O$
−50	74.25	60.5 (3)	"	0	...	86 (4)	"
−50	68	55.5 (2)	$SO_3.5H_2O+SO_3.3H_2O$	+10	...	86.75 (4)	"
−45	68.5	56 (6)	$SO_3.3H_2O$	20	...	87.5 (4)	"
−40	71	58 (6)	"	30	...	88.5 (4)	"
−38.9*	73.14	59.69 (6)	"	36*	...	89.89 (4)	"
−40	74.25	60.5 (6)	"	30	...	90.5 (4)	"
−41	74.75	61 (6)	" $+SO_3.2H_2O$	20	...	91.5 (4)	"
−40	74.75	61 (4)	$SO_3.2H_2O$	10	...	92.25 (4)	"
−30	75.25	61.5 (4)	"	6.5	...	93 (4)	" +(?)
−20	76.5	62.5 (3)	"				

SO

* m. pt.

(1) = Pfaundler and Schnegg (1875); (2) = Pickering (1890); (3) = Thilo (1892); Pictet (1894); (4) = Knietsch (1901); (5) = Rüdorff (1862); (6) = Biron (1899); (7) = Marignac (1853). See also Pickering (1890–91); Lespieau (1894) and Giran (1913).

SOLUBILITY OF SULFURIC ACID IN BENZENE SOLUTIONS OF VALERIC ACID AT 18°.

(Gurwitsch, 1914.)

The mixtures were shaken with excess of 95.8% H_2SO_4 at 0° and then brought to equilibrium at 18°.

Gms. Valeric Acid per 100 Gms Valeric Acid + Benzene.	Gms. H_2SO_4 per 100 Gms. of the Sat. Solution.
0 = Pure benzene	0
0.584	0.052
1.62	0.104
3.64	0.226
7.60	0.378
17.5	0.454

EQUILIBRIUM IN THE SYSTEM SULFURIC ACID, NITROBENZENE AND WATER AT 17°.

(Bailey and Hilton, 1936.)

Weighed quantities of two of the components were mixed and the third (usually water) added until opalescence appeared. A perfectly sharp end point was usually obtained.

Gm. Mols. per 100 gm. Mols. of the three constituents			Gm. Mols. per 100 gm. Mols. of the three constituents			Gm. Mols. per 100 gm. Mols. of the three constituents		
$C_6H_5NO_2$	H_2O	H_2SO_4	$C_6H_5NO_2$	H_2O	H_2SO_4	$C_6H_5NO_2$	H_2O	H_2SO_4
0.054	84.9	15.0	6.52	44.6	48.9	46.3	17.1	36.6
0.084	80 7	19.2	8.9	42.1	49.0	48.4	16.7	34.9
0.32	66.2	33.5	15.1	36.0	48.9	64.1	10.2	25.7
0.88	57.4	41.7	17.1	34.5	48.4	76.6	5.5	17.9
1.59	53.7	44.7	19.2	32.5	48.3	86.4	3.0	10.6
2.34	51.3	46.4	26.3	27.5	46.2	97.6	0.41	2.02
4.24	48.0	47.8	32.7	23.5	43.8	*98.6	1.4	—
						*0.03	99.99	—

SO

* These two results by Davis, 1916

Experimental determinations by the method of Alexieff of Equilibrium in the System Sulfuric Acid, Phenol and Water are given by Svecova, 1938.

Results for the distribution of H_2SO_4 between Water and Phenol, at 17° are given by Wosnessersky and Astachow, 1925.

Freezing-point data have been determined for the following mixtures:

H_2SO_4 + $ZnSO_4$ and other sulfates	(Kendall and Davidson, 1921.)
" + Phenol	(Kendall and Carpenter, 1914; Kendall and Landon, 1920; Kendall and Davidson, 1921.).
" + Nitrobenzene	(Masson, 1931.)
" + Amyl alcohol	(Archibald, 1932.)
" + Tertiary Amyl Alcohol	" "
" + n Butyl Alcohol	" "
" + Acetic acid and long series of Organic Compounds	(Kendall and Carpenter, 1914; Atsuki and Isshi, 1931.)

HYDROGEN SELENIDE H_2Se

SOLUBILITY IN WATER.

(de Forcrand and Fonzes-Diacon, 1902.)

t°.	4°	9.65	13.2	22.5
Vol. H_2Se (at 0° and 760 mm.) dissolved per 1 vol. H_2O	3.77	3.45	3.31	2.70

SeO

SOLUBILITY OF HYDROGEN SELENIDE IN WATER AND IN AQUEOUS SOLUTIONS OF HYDRIODIC ACID AT A PARTIAL PRESSURE OF H_2Se OF 760 MM.

(Mc Amis and Felsing, 1925.)

Solubility in Water.			Solubility in Aq. HI Solut. at 25°.		
t°.	Mols. H_2Se per liter sat sol.	Cc. H_2Se (at 0° and 760 mm.) per liter sat. sol.	Mols. HI per liter.	Mols. H_2Se per liter sat. sol.	Cc. H_2Se (at 0° and 760 mm. per liter sat. sol.
14.6. . .	0.09789	2194	0.20	0.08478	1900
15.0. . . .	0.09611	2154	0.40	0.08634	1935
25.0. . . .	0.08415	1886	2.73	0.11012	2468
25.6. . . .	0.08277	1855			
35.0. . . .	0.07317	1640			

HYDROGEN SELENITE (Selenious Acid) H_2SeO_3.

SOLUBILITY IN WATER.

(Etard, 1894.)

t°.	Gms. H_2SeO_3 per 100 Gms. Solution.	t°.	Gms. H_2SeO_3 per 100 Gms. Solution.	t°.	Gms. H_2SeO_3 per 100 Gms. Solution.
−10	42.2	25	67	60	79.3
0	47.4	30	70.2	70	79.3
+10	55	40	77.5	80	79.3
20	62.5	50	79.2	90	79.4

HYDROGEN SELENATE (Selenic Acid) H_2SeO_4.

SeO

SOLUBILITY IN WATER, DETERMINED BY FREEZING-POINT METHOD.

(Kremann and Hofmeier, 1908.)

t°.	Gms. H_2SeO_4 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. H_2SeO_4 per 100 Gms. Sat. Sol.	Solid Phase.
0	0	Ice	−55	71.5	$H_2SeO_4.4H_2O$
−10	21	"	−65 Eutec.	74	" $+H_2SeO_4.H_2O$
−20	30	"	−50	75.5	$H_2SeO_4.H_2O$
−30	36	"	−20	79	"
−40	40	"	0	81	"
−50	42.5	"	+20	85	"
−60	45	"	26 m. pt.	88	"
−80	48	"	20	91	"
−95 Eutec.	50	" $+H_2SeO_4.4H_2O$	16 Eutec.	91.5	" $+H_2SeO_4$
−80	52	$H_2SeO_4.4H_2O$	30	93	H_2SeO_4
−70	54	"	40	94.5	"
−60	58	"	50	96.5	"
−51 m. pt.	67	"	60	100	"

FREEZING-POINTS OF MIXTURES OF SELENIC ACID AND SULFUR TRIOXIDE.

(Meyer and Stateczny, 1922.)

A diagram is given and the following numerical data for the principal points of the diagram.

t°.	Gms. SO_3 per 100 gms. mixture.	Solid Phase.	t°.	Gms. SO_3 per 100 gms. mixture.	Solid Phase.
58......	0.0	H_2SeO_4	− 8.0 Eutec.	40.4	$H_2SeSO_7 + H_2SeS_2O_{10}$
−12 Eutec..	23.0	» $+ H_2SeSO_7$	19.0 m. pt.	53.0	$H_2SeS_2O_{10}$
+ 6.6 m. pt.	35.0	H_2SeSO_7	− 7.0 Eutec.	63.9	» $+ SO_3$

HYDROGEN SILICIDE HSi

One liter of Cyclo Hexanol ($C_6H_{11}OH$) dissolves 97cc. HSi at 26° and 765mm. (Cauquil, 1927.)

Si

HELIUM He.

SOLUBILITY OF HELIUM IN WATER. (von Antropoff, 1925.)

New determinations made with a highly refined apparatus and with the greatest possible accuracy, gave the following values, which are expressed in terms of the Bunsen absorption coefficient, as modified by Kuenen to show the volume of gas (reduced to 0° and the 760 mm) dissolved by 1.0 gm. of H_2O..

t°..........................	0°.	10°.	20°.	30°.	40°.	50°.
Absorption coef........	0.0097	0.0099	0.0100	0.0101	0.0103	0.0108

SOLUBILITY OF HELIUM IN WATER. (Cady, Elsey and Berger, 1922.)

The following very carefully determined results are given in terms of the Ostwald solubility expression $\alpha = \frac{273.1 \times V_1}{T \times V}$, in which V = the volume of H_2O, V_1 = the volume of helium absorbed by V volumes of H_2O and T = temp. on the absolute scale.

t°.....	2°.0.	10°.	25°.	30°.
α..............	0.00937	0.00895	0.00860	0.00817

According to Venable and Fuwa, 1923, 100 cc. of H_2O dissolve 1.4 cc. He (reduced to 0° and 760 mm.) at 21°. These authors also found that 100 cc. of rubber dissolve about 1.0 cc. of helium at 21°, as determined by pumping out the gas with a Töpler pump and measuring it over mercury.

SOLUBILITY OF HELIUM IN WATER.

(Lannung, 1930.)

The results are in terms of the Bunsen Absorp. Coef. β and the Ostwald Solubility Expression l. $\beta = \frac{(W + w)\ P_o}{W_L \times P}$, where W and w are the volumes of He originally introduced and remaining after absorption (reduced to 0° and 760mm). W_L is the volume of H_2O at the temp. of saturation. P is the partial pressure of He in mm Hg and P_0 is 760 mm. l = the equilibrium distribution ratio of the volume concentration of He in the solution and in the vapor phase.

He

t°	β	l
15	0.0089	0.0094
20	0.0088	0.0095
25	0.0087	0.0095
30	0.0086	0.0095
37	0.0084	0.0095

The older results of Estreicher, 1899, are considered to be too high due to inaccuracies in the method of determination.

SOLUBILITY OF HELIUM IN WATER AT PRESSURES UP TO 1000 ATMOSPHERES.

(Wiebe and Gaddy, 1935.)

The authors used a simple bubbling-type of apparatus made of a steel cylinder with pressure valves. Equilibrium was approached from both lower and higher pressures. The helium was 99.95% pure. It was found that 1% N impurity had a very decided effect upon raising the solubility, but 0.05% was negligible.

Partial Pressure of He in Atmospheres	cc He_2 (reduced to 0^0 and 760mm) dissolved per 1.0 gm. H_2O at: 0°	25°	50°	75°
25	0.2322	0.2156	0.2225	0.2442
50	0.4674	0.4332	0.4445	0.4892
100	0.9240	0.8491	0.8827	0.9699
200	1.807	1.688	1.734	1.907
400	3.436	3.241	3.358	3.666
600	4.916	4.681	4.844	5.277
800	6.228	6.015	6.248	6.787
1000	7.421	7.263	7.536	8.251

The averages of the 25 and 50 atm. values were used to compute the Bunsen and Ostwald coefficients. The values thus obtained were found to be in good agreement with the results of Cady, Elsey and Berger, 1922, and Lannung, 1930.)

Solubility of Helium in Water and in Whole Blood at 38°.

(Hawkins and Shilling, 1936.)

The blood of oxen or dogs was oxalated with 0.02 percent oxalate and used immediately or chilled to nearly 0° and used the next day. The time allowance for saturation was 30 minutes. The O capacity of the blood samples varied from 18 to 21.5 vol. percent. The H_2O content from 0.77 to 0.89 gm. per cc.

Results for H_2O		Results for Ox and Dog Blood	
He pressure in mm. Hg	He content in Vol. Percent	He Pressure in mm. Hg	He Content in Vol. Percent
723	0.80	699	0.83
1495	1.68	1466	1.70
3025	3.41	3028	3.54
4620	5.20	4556	5.59

The solubility coefficient for He in Water is 0.085 and that for dog blood was found to vary from 0.083 to 0.089 and that for ox blood to vary from 0.080 to 0.091. The amount of helium dissolved by whole blood under helium pressures varying from 1 to 6 atmospheres (absolute) was found to be directly proportional to the helium pressure in accordance with Henry's law.

Solubility of Helium in Aqueous Solutions of Salts at 25°.

(Eserlof, 1935.)

Aqueous Solutions of:	Gm. mols. Salt per 1000 gm. H_2O	cc He_2 (at 0° and 760mm.) in an amt. of solution containing 1.0 gm. H_2O
Potassium Chloride	4.72	0.0048
Sodium Chloride	5.81	0.0043
Lithium Chloride	6.18	0.0136
Lithium Iodide	2.40	0.0109
Sodium Nitrate	6.95	0.0039
Perchloric Acid	6.89	0.0187
Water alone	0.0	0.0086

Solubility of a Mixture of 30 Percent Helium and 70 Percent Neon in Water.

(Valentiner, 1927.)

t°	l (Ostwald Solubility Expression)
0	0.021
17	0.015
45	0.010

The author has collected and recalculated all previous determinations of the solubility of the rare gases in water.

Solubility of Helium in Liquid Ammonia.

(Ipatjew and Teodorowitsch, 1932.)

t°	He Pressure in Atm.	cc He_2 (at 0° and 760mm) dissolved in 1.0cc NH_3	t°	He Pressure in Atm.	cc He_2 (at 0° and 760mm) dissolved in 1.0cc NH_3
-16	35.5	0.554	+20	23.3	0.405
-10	34.55	0.521	"	38.7	0.719
+20	5.35	0.126	25	37.7	0.750
"	12.6	0.273	30	36.6	0.824

SOLUBILITY OF HELIUM IN SEVERAL ORGANIC SOLVENTS.

(Lannung, 1930.)

The results are expressed in terms of the Bunsen Absorp. Coef. and the Ostwald Solubility Expression (See results for the Solubility of Helium in Water by Lannung, 1930.)

Results for the Solubility in:

t°	Methyl Alcohol		Ethyl Alcohol		Acetone	
	β	l	β	l	β	l
15	0.0298	0.0314	0.0268	0.0283	0.0284	0.0300
18	0.0307	0.0327	0.0275	0.0293	0.0299	0.0319
20	0.0313	0.0336	0.0281	0.0302	0.0309	0.0332
25	0.0328	0.0358	0.0294	0.0321	0.0331	0.0361
30	0.0343	0.0381	0.0306	0.0340	—	—
37	0.0364	0.0413	0.0325	0.0369	—	—

t°	Benzene		Cyclohexane		Cyclohexanol	
	β	l	β	l	β	l
15	0.0165	0.0174	0.0220	0.0232	—	—
18	0.0174	0.0186	0.0227	0.0242	—	—
20	0.0180	0.0193	0.0236	0.0253	—	—
25	0.0192	0.0210	0.0252	0.0275	0.0100	0.0109
30	0.0202	0.0224	0.0268	0.0297	0.0107	0.0119
37	0.0221	0.0251	0.0293	0.0333	0.0119	0.0135

HAFNIUM Oxy **BROMIDE** $HfOBr_2$

SOLUBILITY IN AQUEOUS SOLUTIONS OF HYDRO BROMIC ACID AT 25°.

(v. Hevesy and Wagner, 1930.)

$d\frac{25}{4}$ of sat. sol.	Normality of Aq. HBr	Gms. HfO_2 per liter sat. sol.	$d\frac{25}{4}$ of sat. sol.	Normality of Aq. HBr	Gms. HfO_2 per liter sat. sol.
2.0838	0.354	694.5	1.4984	8.77	10.60
1.6989	3.620	314.5	1.7157	13.36	0.80
1.4348	6.568	48.90			

HAFNIUM Acid Oxy **FLUORIDE** $HfOF_2 \cdot H_2F_2 \cdot 2H_2O$.

SOLUBILITY IN AQUEOUS SOLUTIONS OF HYDROFLUORIC ACID AT 25°.

(v. Hevesy and Wagner, 1930.)

$d\frac{25}{4}$ of sat. sol.	Normality of Aq. HBr	Gms. HfO_2 per liter sat. sol.	$d\frac{25}{4}$ of sat. sol.	Normality of Aq. HBr	Gms. HfO_2 per liter sat. sol.
1.577	0.0	413.6	2.050	10.05	903.9
1.537	0.0	475.6	1.899	15.05	733.6
1.650	1.06	568.3	1.902	15.03	741.8
1.655	1.06	571.2	1.394	20.09	250.6
2.036	6.03	892.1	1.404	20.09	258.9
2.040	6.03	897.1			

HAFNIUM Oxy CHLORIDE $HfOCl_2$.

SOLUBILITY OF HAFNIUM OXYCHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 20°. (von Hevesy, 1925.)

The hafnium contained 5 per cent ZrO_2.

Normality aq. HCl.	d of sat. sol.	Gm. mols. $HfOCl_2$ per liter sat. sol.	Normality aq. HCl.	d of sat. sol.	Gm. mols. $HfOCl_2$ per liter sat. sol.
5.64	–	0.167	10.56	1.180	0.0801
6.48	1.127	0.103	11.28	–	0.1509
9.02	1.154	0.053	11.40	–	0.0619
10.33	–	0.0668			

HAFNIUM Ammonium FLUORIDES, $Hf(NH_4)_2F_6$ and $Hf(NH_4)_3F_7$.

SOLUBILITY IN WATER AND AQ. NH_4F SOLUTIONS.

(von Hevesy, 1925; von Hevesy, Christiansen and Berglund, 1925.)

Compound.	Solvent.	t°.	Mols. per liter	
			NH_3.	Hf.
$Hf(NH_4)_2F_6$	Water	0	1.807	0.890
»	»	20	2.832	1.425
$Hf(NH_4)_3F_7$	»	0	1.230	0.425
»	»	20	1.756	0.538
»	0.922 n NH_4F	20	–	0.261
»	1.971 »	20	–	0.108
»	5.01 »	20	–	0.0258
» + $Hf(NH_4)_2F_6$	Water	20	3.038	1.439

HAFNIUM Potassium FLUORIDE HfK_2F_6.

One liter of aq. 0.125 n HF solution dissolves 0.1008 mols. HfK_2F_6 at 20°.
» 5.89 » 0.1942 »

(von Hevesy, 1925; von Hevesy, Christiansen and Berglund, 1925.)

HAFNIUM PHOSPHATE $HfO(H_2PO_4)$.

SOLUBILITY OF HAFNIUM PHOSPHATE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 20°. (von Hevesy and Kimura, 1925.)

About 0.1 gm. of the compound was shaken 3 days in a thermostat and then allowed to stand many days. 100 cc. of the solution filtered through glass wool was evaporated and residue ignited and the weighed.

Normality of aq. HCl.	Wt. of ignited residue from 100 cc. sat. sol	Gm. mols. compd. per liter.
5.94	0.0031	0.0009
10.21	0.0043	0.00012
10.48	0.0046	0.00013

HYDRARGYRUM (Mercury) Hg.

THE SOLUBILITY OF METALLIC MERCURY IN WATER.

(Stock, 1934.)

By operating with the greatest possible care to remove air from the water and the Hg, the solubility was found to be

0.02 to 0.03y Hg per cc H_2O at 30° (y = 0.001 mg.)

When the separation of the water from the Hg was made in the air the solubility rose to 0.06y or more per cc H_2O. This increase is due to oxidation. At 85° the solubility was found to be 0.3y and at 100 0.6y Hg per cc H_2O.

Experiments were also made at 30° of the solubility of Hg in H_2O in contact with air, both with and without stirring and in presence of of oxygen. In the latter case the solubility rose to 39.6y Hg per cc H_2O in 2 months. Using pure red HgO a solubility of 42.4y HgO per cc H_2O was found. Alkali hydroxide in presence of air increased the Solubility of Hg to 54y in 5% KOH and to 135y in 10% KOH. Many other experiments of a similar character are described.

HYDRARGYRUM BROMIDE (Mercurous Bromide) Hg_2Br_2

One liter sat. sol. of Hg_2Br_2 in water contains 0.000039 gm. Hg_2Br_2 at 25°. (Sherrill, 1903.)

From the measured E.M.F. of the chain Hg | Hg_2Br_2.KBr, C | KNO_3 against | C, KCl.Hg_2Cl_2 | Hg; E = 0.1318 - 0.000188t, the calculated Solubility Product of Hg_2Br_2 is $0.545.10^{-23}$ at 10°8., $1.00.10^{-23}$ at 14.9°, $3.88.10^{-23}$ at 19.2°, $5.5.10^{-23}$ at 25° and $6.95.10^{-23}$ at 26.5°.

HYDRARGYRUM BROMIDE (Mercuric Bromide) $HgBr_2$

SOLUBILITY OF MERCURIC BROMIDE IN WATER.

(Tourneux and Pernot, 1925; above 100° Benrath, Gjedebo, Schiffers and Wunderlich, 1937.)

t°	Gms. $HgBr_2$ per 100 gms. sat. sol.	t°	Gms.* $HgBr_2$ per 100 gms. sat. sol.	t°	Gms. $HgBr_2$ per 100 gms. sat. sol.
0	0.3 (?)	50	1.25	173	33.5
10	0.4 (?)	60	1.65	185	59.1
20	0.55	80	2.7	187	74.7
25	0.61	100	4.7	189	88.1
30	0.65	142	12.0	193	92.8
40	0.9	164	22.4	201	96.2

EQUILIBRIUM IN THE SYSTEM MERCURIC BROMIDE, AMMONIA, WATER AT 8°-10°.

(Gaudechon, 1910.)

The mixtures were shaken intermittently for 21-48 hrs. Both the clear sat. solution and the separated and dried solid phases were analyzed.

Br

Initial Mixture. Gms. Mols. per Liter.			Sat. Solution. Gms. Atoms. per Liter.			Solid Phase.
$HgBr_2$.	NH_3.	NH_4Br.	Hg.	Br.	N.	
0.0125	0.0250	0	trace	0.0154	0.0185	$(NHg_2Br)_4HgBr_2$
0.0166	0.0332	0	0.00032	0.0172	0.0202	36% " +64% NHg_2BrNH_4Br
0.025	0.050	0	0.00078	0.0241	0.0251	$NHg_2Br.NH_4Br$
0.050	0.100	0	0.0019	0.0525	0.0514	"
0.0125	0.025	0.0375	0.00178	0.0497	0.0497	"
0.025	0.050	0.075	0.0041	0.103	0.108	"
0.0328	0.0656	0.0984	0 0061	0.133	0.133	93% " +6% $NHgBr.3NH_4Br$
0.0365	0 073	0.1095	0.0060	0.132	0.133	36% " +64% $NHgBr.3NH_4Br$
0.050	0.100	0.150	0.007	0.170	0 169	$NHg_2Br.3NH_4Br$
0.100	0.200	0.300	0.0124	0.333	0.338	"
0.0180	0.036	0.01875	0.001	0.0315	0.0318	$NHg_2Br.NH_4Br$
0.050	0.100	0.006	0.0057	0.1172	0.1178	"
0.050	0.100	0.150	0.0071	0.169	0.168	$NHg_2Br.3NH_4Br$
0.100	0.200	0.160	0.0083	0.184	0.187	"
0.125	0.250	0.306	0.0160	0.393	...	"

SOLUBILITY OF MERCURIC BROMIDE IN AQUEOUS SALT SOLUTIONS AT 25°.

(Herz and Paul, 1913.)

(The mixtures were constantly agitated for eight days.)

In Aq. $BaBr_2$. Mols. per Liter.		In Aq. $CaBr_2$. Mols. per Liter.		In Aq. KBr. Mols. per Liter.		In Aq. NaBr. Mols. per Liter.		In Aq. $SrBr_2$. Mols. per Liter.	
$BaBr_2$.	$HgBr_2$.	$CaBr_2$.	$HgBr_2$.	KBr.	$HgBr_2$.	NaBr.	$HgBr_2$.	$SrBr_2$.	$HgBr_2$.
0	0.017	0.072	0.117	0	0.017	0.118	0.078	0.062	0.104
0.274	0.370	0.645	0.676	0.209	0.098	0.596	0.285	0.328	0.471
0.396	0.540	1.892	1.358	0.770	0.472	1.142	0.540	0.668	0.902
0.579	0.759	2.479	2.766	2.380	1.360	2.448	1.276	1.401	1.770
1.096	1.478	3.754	3.666	3.470	1.930	5.246	2.306	1.872	2.238

The following slightly higher results for KBr solutions are given by Sherrill (1903).

Mols. KBr per liter	0	0.05	0.10	0.5	0.866	2	3	4
Mols. $HgBr_2$ per liter	0.017	0.055	0.088	0.0359	0.611	1.407	2.096	2.339

Data for equilibrium in the system $HgBr_2$ + KOH + H_2O at 25° are given by Herz (1910).

SOLUBILITY OF MERCURIC BROMIDE IN AQUEOUS SOLUTIONS OF POTASSIUM BROMIDE AND VICE VERSA.

(Pernot, 1932.)

The original results are presented only in the form of a diagram from which the following approximate figures were read.

Results at 0°			Results at 34°			Results at 80°		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
KBr	$HgBr_2$		KBr	$HgBr_2$		KBr	$HgBr_2$	
0.0	0.3	$HgBr_2$	0.0	0.68	$HgBr_2$	0.0	2.7	$HgBr_2$
7.5	15.0	"	5.0	15.0	"	10.0	30.0	"
12.0	24.0	" + 1.1.1	10.0	23.0	"	15.0	50.0	"
20.0	31.5	1.1.1	15.0	38.0	"	18.5	75.0	" + 1.1.1
25.0	37.5	"	19.0	51.0	" + 1.1.1	21.5	70.0	1.1.1
30.0	43.2	"	23.0	48.5	1.1.1	25.0	65.0	"
32.5	48.2	" + KBr	28.0	48.0	"	28.0	63.0	"
32.2	40.0	KBr	33.5	55.0	" + KBr	32.0	62.0	" + KBr
31.8	30.0	"	34.0	45.0	KBr	35.0	50.	KBr
32.5	20.0	"	35.0	30.0	"	40.0	26.	"
34.0	0.0	"	40.0	15.0	"	44.0	15.	"
			42.1	0.0	"	48.7	0.0	"

Br

1.1.1 = $HgBr_2.KBr.H_2O$

HYDRARGYRUM BROMIDE (ic)

SOLUBILITY OF MERCURIC BROMIDE IN AQUEOUS SOLUTIONS OF METYHL ALCOHOL, ETHYL-ALCOHOL AND OF ETHYL ACETATE AT 25°.

(Herz and Anders, 1907.)

In Aq. Methyl Alcohol.			In Aq. Ethyl Alcohol.			In Aq. Ethyl Acetate.		
Wt. % CH_3OH in Solvent.	d_{25} of Sat. Sol.	Gms. $HgBr_2$ per 100 cc. Sat. Sol.	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $HgBr_2$ per 100 cc. Sat. Sol.	Wt. % $CH_3CO_2C_2H_5$ in Solvent.	d_{25} of Sat. Sol.	Gms. $HgBr_2$ per 100 cc. Sat. Sol.
10.6	0.9857	0.72	0	1.0022	0.60	0	1.0022	0.60
30.77	0.9588	1.29	20.18	0.9717	0.67	4.39	1.0018	0.574
47.06	0.9401	2.52	40.69	0.9435	1.59	96.76	1.1159	26.69
64	0.9386	6.85	70.01	0.9214	6.58	100	1.0113	14.13
78.05	0.9744	14.66	100	0.9873	22.81			
100	1.2275	50.25						

100 gms. sat. sol. in 95% C_2H_5OH (d_{15} = 0.8126) contain 13.2 gms. $HgBr_2$ at 0°, 16.53 gms. at 25° and 22.63 gms. at 50°. (Reinders, 1900.)

SOLUBILITY OF MERCURIC BROMIDE IN ALCOHOLS.

(Timofeiew, 1894.)

In Methyl Alcohol.		In Ethyl Alcohol.		In Propyl Alcohol.		In Isobutyl Alcohol.	
t°.	Gms. $HgBr_2$ per 100 Gms. CH_3OH.	t°.	Gms. $HgBr_2$ per 100 Gms. C_2H_5OH.	t°.	Gms. $HgBr_2$ per 100 Gms. C_3H_7OH.	t°.	Gms. $HgBr_2$ per 100 Gms. C_4H_9OH.
0	41.15	0	25.2	0	14.6	0	4.61
10	49.5	10	26.3	10	15.6	10	5.63
19	66.3	19	29.7	19	15.5	23	6.65
22	60.9	39	31.9	39	20.8	39	9.58
39	71.3	65	44.5	65	31.3	65	15.80
65	90.8	89	66.9	86.5	42.7		
97	139.1						

MERCURY BROMIDE (ic) $HgBr_2$.

SOLUBILITY OF MERCURIC BROMIDE IN WATER AND IN AQUEOUS SOLUTIONS OF GLYCEROL AT 25°. (Moles and Marquina, 1924.)

Solvent.	d_4^{25} of sat. sol.	Gms. $HgBr_2$ per 100 gms. solvent.
Water	1.0023	0.6135
Aq. 25.0 % glycerol	1.0651	0.9840
» 75.2 »	1.2204	3.456
» 99.2 »	1.4000	15.687

SOLUBILITY OF MERCURIC BROMIDE IN METHYL ALCOHOL AND IN ETHYL ALCOHOL. (Lloyd, Brown, Glynwyn, Bonnel and Jones, 1928.)

Results for Methyl Alcohol

t°	Gms. $HgBr_2$ per 100 gms. CH_3OH	Solid Phase
10	53.5	$HgBr_2.CH_3OH$
20	65.3	"
22	70.3	"
27	71.6	$HgBr_2$
30	72.1	"
40	76.0	"
50	81.9	"
60	85.1	"

Results for Ethyl Alcohol

t°	Gms. $HgBr_2$ per 100 gms. C_2H_5OH	Solid Phase
0	27.3	$HgBr_2$
10	28.2	"
20	28.6	"
30	31.6	"
40	34.0	"
50	36.2	"
60	42.3	"
70	46.3	"

SOLUBILITY OF MERCURIC BROMIDE IN METHYL ALCOHOL AND IN ETHYL ALCOHOL. (Malhotra, 1928.)

Except in a few cases the determinations were made by the synthetic method.

Results for Methyl Alcohol of d_4^{15} = 0.7961 = 99.88 Wt.% CH_3OH

t°	Gms. $HgBr_2$ per 100 gms. CH_3OH
22.1	67.62
27.4	68.81
30.8	70.25
36.1	73.31
49.8	84.43

Results for Ethyl Alcohol of 87.73 Wt.% C_2H_5OH

t°	Gms. $HgBr_2$ per 100 gms. solvent
32.9	17.22
42.13	21.44
45.20	22.91
49.07	25.35
55.85	28.61
61.60	31.84
68.97	37.11

Results for Ethyl Alcohol of d_4^{15} = 0.7943 = 99.78 Wt.% C_2H_5OH

t°	Gms. $HgBr_2$ per 100 gms. C_2H_5OH	t°	Gms. $HgBr_2$ per 100 gms. C_2H_5OH
0.0	24.04	44.80	34.55
16.15	26.25	48.60	35.87
24.95	28.40	53.20	37.80
29.15	29.28	58.00	39.80
31.35	30.05	60.15	40.63
34.30	31.29	64.80	43.10
41.60	33.53	79.25	60.15

SOLUBILITY OF MERCURIC BROMIDE IN MIXTURES OF ALCOHOLS AT 25°.

(Herz and Kuhn, 1908.)

In Mixtures of Methyl and Ethyl Alcohols.			In Mixtures of Methyl and Propyl Alcohols.			In Mixtures of Ethyl and Propyl Alcohols.		
% CH_3OH in Mixture.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. $HgBr_2$ per 100 cc. Sat. Sol.	% C_3H_7OH in Mixture.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. $HgBr_2$ per 100 cc. Sat. Sol.	% C_3H_7OH in Mixture.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. $HgBr_2$ per 100 cc. Sat. Sol.
0	0.9873	22.8	0	1.227	50.20	0	0.9873	22.80
4.37	0.9932	23.1	11.11	1.1954	47.28	8.1	0.9802	22.25
10.4	1.009	25.4	23.8	1.1524	41.53	17.85	0.9740	21.06
41.02	1.080	33.3	65.2	1.0257	25.30	56.6	0.9487	17.63
80.69	1.185	45.7	91.8	0.9437	16.35	88.6	0.9269	14.76
84.77	1.193	46.8	93.75	0.9368	15.86	91.2	0.9239	14.64
91.25	1.211	48.6	96.6	0.9275	14.66	95.2	0.9227	14.06
100	1.227	50.2	100	0.9213	13.78	100	0.9213	13.78

SOLUBILITY OF MIXTURES OF MERCURIC BROMIDE AND MERCURIC CHLORIDE IN ALCOHOL AT 25°.

(Van Pelt, Jr., and de Boer, 1934.)

Gms. per 100 gms. sat. sol.		Percent $HgBr_2$ in Solid Phase	Gms. per 100 gms. sat. sol.		Percent $HgBr_2$ in Solid Phase
$HgCl_2$	$HgBr_2$		$HgCl_2$	$HgBr_2$	
31.35	0.0	—	17.4	20.5	50
31.0	3.3	—	14.0	22.4	60
27.3	7.1	14	10.7	21.8	—
25.8	9.8	27	10.4	22.1	—
26.0	10.0	—	6.7	24.6	100
24.0	12.2	—	3.8	20.2	100
22.2	14.1	41	0.0	18.1	—

Br

The solid phase consists of a series of mixed crystals up to about 70 percent $HgBr_2$.

SOLUBILITY OF MERCURIC BROMIDE IN ETHYL ALCOHOL SOLUTIONS OF POTASSIUM BROMIDE AT 34° AND VICE VERSA.

(Pernot, 1933.)

The original results are given only in the form of diagrams from which the following approximate figures have been read.

Results for Absolute C_2H_5OH			Results for 95 Percent C_2H_5OH		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$HgBr_2$	KBr		$HgBr_2$	KBr	
25.0	0.0	$HgBr_2$	19.0	0.0	$HgBr_2$
35.0	3.0	"	30.0	3.0	"
40.0	4.5	"	40.0	6.0	"
45.0	6.0	" + 1.1.A	45.5	7.2	" + 1.1.H
40.0	6.0	1.1.A	35.0	7.2	1.1.H
25.0	6.0	"	30.0	7.5	"
20	6.0	"	25.5	8.5	"
20	7.0	" + KBr	28.0	12.0	"
15	5.5	KBr	30.5	14.5	" + KBr
10	4.0	"	20.5	10.0	KBr
5	2.0	"	10.0	5.0	"

1.1.A = $HgBr_2.KBr.C_2H_5OH$

1.1.H = $HgBr_2.KBr.H_2O$

Solubility of Mercuric Bromide in an Equimolecular Mixture of Ethyl Alcohol and Benzene. (Dukelski, 1907.)

$t°$.	0.	10.	20.	30.	40.	50.	60.
Gms. $HgBr_2$ per 100 Gms. Sat. Sol.	10.7	12	14	16	17.5	19	21

100 gms. of sat. sol. in acetone at 25° contain 34.76 gms. $HgBr_2$. (Reinders, 1900.)

Solubility of Mercuric Bromide in Aniline. (Staronka, 1910.)

$t°$.	Mol. % $HgBr_2$.	Gms. $HgBr_2$ per 100 Gms. $C_6H_5NH_2$.	Solid Phase.	$t°$.	Mol. % $HgBr_2$.	Gms. $HgBr_2$ per 100 Gms. $C_6H_5NH_2$.	Solid Phase.
60	4	16.14	$HgBr_2.2C_6H_5NH_2$	110*	33.3	193.3	$HgBr_2.2C_6H_5NH_2$
70	5.8	23.83	"	109.7†	33.5	195	" $+HgBr_2.C_6H_5NH_2$
80	8.3	35.04	"	115	37.2	229.3	$HgBr_2.C_6H_5NH_2$
90	12.2	53.80	"	120	42.3	283.8	"
100	18.8	89.64	"	124	50	387.2	"
105	23.2	116.9	"	123	55.4	480.9	"

* M. pt. † Eutec.

100 gms. ethyl acetate dissolve 13.05 gms. $HgBr_2$ at 18°. (Naumann, 1910.)
100 gms. methyl acetate dissolve 21.93 gms. $HgBr_2$ at 18° (d_{18} sat. sol. = 1.090). (Naumann, 1909.)

Solubility of Mercuric Bromide in Anhydrous Acetic Acid Determined by the Synthetic Method.

(Davidson and Chappell, 1938.)

t^o	Mols. $HgBr_2$ per 100 mols. $HgBr_2$ + CH_3COOH	Solid Phase	t^o	Mols. $HgBr_2$ per 100 mols. $HgBr_2$ + CH_3COOH	Solid Phase
16.5	0.194	CH_3COOH	75	0.707	$HgBr_2$
25	0.261	$HgBr_2$	86	0.860	"
32	0.287	"	92	0.998	"
41	0.350	"	97	1.13	"
51	0.413	"	103	1.29	"
58	0.477	"	110	1.50	"
71	0.650				

Solubility of Mercuric Bromide in Pyridine. (Staronka, 1910.)

$t°$.	Mol. % $HgBr_2$.	Gms. $HgBr_2$ per 100 Gms. C_5H_5N.	Solid Phase.	$t°$.	Mol. % $HgBr_2$.	Gms. $HgBr_2$ per 100 Gms. C_5H_5N.	Solid Phase.
10	5	24	$HgBr_2.2C_5H_5N$	107*	39	291.5	$HgBr_2.2C_5H_5N+HgBr_2.C_5H_5N$
30	8	39.64	"	110	40.4	309	$HgBr_2.C_5H_5N$
50	11.2	57.49	"	120	45.5	381.3	"
80	17.5	96.68	"	123†	50	455.8	"
100	22	128.5	"	125	51	474.4	$3HgBr_2.2C_5H_5N$
110	24.5	147.8	"	130	54.2	539.4	"
118†	33.3	227.6	"	134†	60	683.7	"
110	35.5	250.8	"	133	64	810.4	"

* Eutec. † m. pt.

Solubility of Mercuric Bromide in Quinoline. (Staronka, 1910.)

$t°$.	Mol. % $HgBr_2$.	Gms. $HgBr_2$ per 100 Gms. C_9H_7N.	Solid Phase.
88	4.4	12.85	$HgBr_2.2C_9H_7N$
111	8.9	27.28	"
127	14.3	46.58	"
134	17.6	61.16	"

Data for the solubility of mercuric bromide in nitrobenzene, in *p* nitrotoluene, in *m* nitrotoluene, in *o* nitrotoluene and in *α* nitronaphthalene, determined by the method of lowering of the freezing-point, are given by Mascarelli, 1906, and Mascarelli and Ascoli, 1907. Data for $HgBr_2$ + Se are given by Olivari, 1912.

DISTRIBUTION OF MERCURIC BROMIDE BETWEEN WATER AND BENZENE (THIOPHENE FREE) AT 25°. (Sherrill, 1903.)

Mols. per Liter.		Dist. Coef.	Mols. per Liter.		Dist. Coef.
H_2O Layer.	C_6H_6 Layer.		H_2O Layer.	C_6H_6 Layer.	
0.017	0.194	0.876	0.00634	0.0715	0.89
0.01147	0.1303	0.88	0.00394	0.0436	0.90
0.00953	0.1074	0.89	0.00320	0.0353	0.90

Data are also given for the distribution between aqueous potassium iodide solutions and thiophene free benzene at 25°.

Data for the solubility of mix crystals of $HgBr_2 + HgI_2$ in acetone at 25° and in ethyl alcohol of $d_{15} = 0.8126 = 95\%$ at 0°, 25° and 50° are given by Reinders (1900). In the case of acetone, the ratio of $HgBr_2$ in the solution increases with increase of per cent of $HgBr_2$ in the solid phase. In the case of the alcohol solutions the ratio in solution does not show such regular variations with change of per cent of $MgBr_2$ in the solid phase.

SOLUBILITY OF MERCURIC BROMIDE IN ORGANIC SOLVENTS.

Br

In Carbon Disulfide. (Arctowski, 1894.)

t°.	Gms $HgBr_2$ per 100 Gms. Solution	t°	Gms. $HgBr_2$ per 100 Gms. Solution.
−10	0.049	15	0.140
−5	0.068	20	0.187
0	0.087	25	0.232
+5	0.105	30	0.274
10	0.122		

In Other Solvents at 18°-20°. (Sulc., 1900.)

Solvent.	Formula.	Gms. $HgBr_2$ per 100 Gms. Solvent.
Chloroform	$CHCl_3$	0.126
Bromoform	$CHBr_3$	0.679
Carbon Tetrachloride	CCl_4	0.003
Ethyl Bromide	C_2H_5Br	2.31
Ethylene Dibromide	$C_2H_4Br_2$	2.34

One liter benzene dissolves 6.99 gms. $HgBr_2$ at 25°. (Abegg and Sherrill, 1903.)

100 gms. sat. solution of Mercuric Bromide in Acetone contain 33.9 gms. $HgBr_2$ at 25°. (Zapata y Zapata, 1930.)

100 gms. of liquid Sulfur Dioxide dissolve 0.074 gm. $HgBr_2$ at 0°. (Jander and Ruppolt, 1937.)

Fusion-point data have been determined for the following mixtures:

$HgBr_2 + HgCl_2$ (Losana, 1926.)
" $+ HgI_2$ " "
" + " $+ HgCl_2$ " "
" $+ HgSO_4$ (Paic, 1930, 1933.)
" $+ AgNO_3$ Bergman, 1922-24, 1926; Bergman, Genke and Isaikin,
" $+ TlNO_3$ " " " 1922-24.)
" $+ TlSO_4$ (Woskresenskaja, 1929.)
" $+ PbBr_2$ (Sandonnini, 1912, 1924.)

BrO

MERCURY BROMATE (ic) normal $Hg(BrO_3)_2$, basic $HgOHBrO_3$.

SOLUBILITY OF EACH IN AQUEOUS SOLUTIONS OF PERCHLORIC ACID AND OF NITRIC ACID AT 25°. (Smith, 1924.)

Results for $Hg(BrO_3)_2$ in Aq:

Perchloric Acid.		Nitric Acid.	
Approx Normality of $HClO_4$	Gms $Hg(BrO_3)_2$ per 100 cc sat sol	Approx Normality of HNO_3	Gms. $Hg(BrO_3)_2$ per 100 cc. sat sol
2.0	6.58	2.0	14.66
2.5	5.22	3.0	15.00
3.0	4.13	4.0	14.99
3.5	3.40	5.0	14.75
4.0	2.58		
5.0	1.55		

Results for $HgOHBrO_3$ in Aq:

Perchloric Acid.		Nitric Acid.	
Approx. Normality of $HClO_4$.	Gms. $HgOHBrO_3$ per 100 cc. sat. sol.	Approx Normality of HNO_3.	Gms. $HgOHBrO_3$ per 100 cc. sat. sol.
0.0 (=H_2O)	0.081	1.0	12.52
1.0	4.34	2.0	21.30
2.0	5.94		
2.5	6.06		
3.0	6.06		

MERCURY ACETATE (ous) $Hg_2(CH_3COO)_2$.

SOLUBILITY OF MERCUROUS ACETATE IN WATER AND IN AQUEOUS ACETIC ACID AT 21°. (Legerlotz, 1918.)

Recrystallized mercurous acetate was rubbed with water or aqueous acetic acid untill thoroughly wet and the mixture constantly shaken in a thermostat for 120 hours. The saturated solution was analyzed by adding a slight excess of Na Cl to precipitate Hg Cl and this latter filtered, dried and weighed.

Solvent.	Gms. $Hg_2(CH_3COO)_2$ per 100 cc. sat. sol.
Water	0.1024
Aq. acetic acid (conc. = 2)	0.0730
" (conc. = 4)	0.0690
" (conc. = 6)	0.0650

The amount of acetic acid corresponding to conc. 2, 4 and 6 is not stated.

100 gms. sat. solution of Mercurous Acetate in Water contain 0.75 gm. $Hg_2(CH_3COO)_2$ at 13°. (Welsh and Broderson, 1915.)

The Solubility Product of $Hg_2(CH_3COO)_2$ in Water at 25° is 2.0×10^{-15} (Bargarsky 1897, reported by Brodsky, 1929.)

100cc anhydrous Hydrazine dissolve about 2.0 gms. $Hg_2(CH_3COO)_2$ at about 20° with precipitation of Hg. (Welsh and Broderson, 1915.)

100 gms. Methyl Alcohol dissolve 1.24 gm. $Hg_2(CH_3COO)_2$ at 15° and 1.40 gm. at the b. pt. (66.3°). (Henstock, 1934.)

CH **HYDRARGYRUM ACETATE** (Mercuric Acetate) Hg $(CH_3COO)_2$

100 gms. water dissolve 25 gms. $Hg(CH_3COO)_2$ at 10°. (Welsh and Broderson, 1915.)

100 gms. Methyl Alcohol dissolve 7.54 gms. $Hg(CH_3COO)_2$ at 15° and 49.84 gms. at the b. pt.(66.7°). (Henstock, 1934.)

100 gms. Acetone dissolve 0.60 gm. $Hg(CH_3COO)_2$ at 15°. (Henstock, 1934.)

100 gms. of liquid Sulfur Dioxide dissolve 0.095 gm. Hg $(CH_3COO)_2$ at 0°. (Jander and Ruppolt, 1937.)

SOLUBILITY OF MERCURIC ACETATE IN MIXTURES OF PHENOL AND ACETIC ACID AT 15°. (Mameli and Cocconi, 1922.)

Gms per 100 gms sat sol			Gms per 100 gms sat sol		
$Hg(CH_3COO)_2$.	C_6H_5OH	CH_3COOH.	$Hg(CH_3COO)_2$	C_6H_5OH.	CH_3COOH
34.03	51.93	14.04	35.46	52.82	11.72
40.08	51.90	8.02	8.61	18.65	72.74
7.40	8.40	84.20	9.23	34.99	55.78
42.02	52.20	5.78	13.56	43.76	42.68
9.65	19.46	70.89	28.53	50.76	20.71

Data for the f. pt. of Hg $(CH_3COO)_2 + C_6H_5OH$ and other mixtures are also given by Mameli and Cocconi.

MERCUROUS TARTRATE $Hg_2C_4H_4O_6$

The Solubility Product of Mercurous Tartrate in Water at 18°, as quoted from Behrend, 1894, by Brodsky, 1929, is $(2).10^{-10}$.

MERCURY Nitroso **PHENYL** Hydroxylamine $Hg[C_6H_5.N(NO)O]_2$.

This compound is prepared by precipitating in acid solutions, salts of mercury with "Cupferron" (the ammonium salt of nitroso phenyl hydroxylamine). Its solubility in water at 18° is less than 1.3×10^{-6} gm. atoms or 0.3 mg per liter. (Pinkus and Martin, 1927.)

MERCURY BENZOATE (ic) $Hg(C_6H_5COO)_2.H_2O$.

100 cc. of sat. sol. of mercuric benzoate in water contain 0.209 gm. $Hg(C_6H_5COO)_2$ at 20°. (Ephraim and Pfister, 1925.)

100 gms. H_2O dissolve 1.2 gm. $Hg(C_6H_5COO)_2$ at 15° and 2.5 gms. at 100°. (Tarugi and Checchi, 1901.)

100 gms. Methyl Alcohol dissolve 3.67 gms. $Hg(C_6H_5COO)_2$ at 15° and 3.67 at the b. pt. (66.5°). 100 gms. Acetone dissolve 7.23 gms. $Hg(C_6H_5COO)_2$ at 15°. (Henstock, 1934.)

100 gms. Benzene (C_6H_6) dissolve 2.49 gms. $Hg(C_6H_5COO)_2$ at 15°. (Henstock, 1934.)

MERCURY CINNAMATE (ic) $(C_6H_5CH.CHCOO)_2Hg.?H_2O$.

100 gms. H_2O dissolve about 0.03 gm. mercuric cinnamate at 25°. (De Jong, 1906.)
100 gms. H_2O dissolve about 0.53 gm. Hg cinnamate at 100°. (Tarugi & Checchi, 1901.)

MERCURY DIPHENYL $Hg(C_6H_5)_2$.

Fusion-point data for mixtures of $Hg(C_6H_5)_2 + Sn(C_6H_5)_4$ and for $Hg(C_6H_5)_2 + Sb(C_6H_5)_3$ are given by Cambi, 1912.

CN

MERCURIC Diazoamino BENZENE $Hg(C_6H_5N = N-C_6H_5)_2$.

SOLUBILITY IN ALCOHOLS.
(Watt and Fernelius, 1936.)

Alcohol	t°	Gms. $Hg(C_6H_5N = N-C_6H_5)_2$ per liter sat. sol.
Methyl Alcohol	25	0.0116
Ethyl Alcohol	25	0.0052
n Propyl Alcohol	25	0.0228

MERCURIC CAMPHOR CARBONATE $Hg(C_{10}H_{15}O.CO_2)_2$

SOLUBILITY IN SEVERAL SOLVENTS.
(Picon, 1931.)

This compound is made by allowing camphoric acid and yellow oxide of mercury to react in the cold in presence of a small amount of water.

Solvent	t°	Gms. $Hg(C_{10}H_{15}O.CO_2)_2$ per liter sat. sol.
Methyl Alcohol	15	44.9
Ethyl Alcohol	10	46.0
Ethyl Ether	10	133.0
Acetone	12.5	84.7
Ethyl Acetate	12.5	82.6
Chloroform	12.5	376.2
Carbon Tetrachloride	12.5	215.9
Benzene	15.0	560.3
Carbon Disulfide	15	341.25
Petroleum Ether	10	43.4
Gasoline	10	145.2
Oil	15	50.0

HYDRARGYRUM (Mercuric Palmitate and Stearate)

SOLUBILITY OF EACH SEPARATELY IN SEVERAL SOLVENTS AT 20°.

(Dietzel and Sedlmeyer, 1928.)

Weighed amounts of compound and solvent were shaken for 30 hours. The mixture was the filtered and the excess of undissolved compound weighed and the amount dissolved found by difference.

Results for Hg Palmitate $Hg(C_{16}H_{31}O_2)_2$		Results for Hg Stearate $Hg(C_{18}H_{35}O_2)_2$	
Solvent	Gm. Mols. $Hg(C_{16}H_{31}O_2)_2$ per liter sat. sol.	Solvent	Gm. Mols. $Hg(C_{18}H_{35}O_2)_2$ per liter sat. sol.
Abs. Ethyl Alcohol	0.0005404	Abs. Ethyl Alcohol	0.0000809
Ethyl Ether	0.0005460	Ethyl Ether	0.0005061
Chloroform	0.0007027	Chloroform	0.0007279
Mixture of Alcohol Chloroform & Pyridine	0.01261	Mixture of Alcohol Chloroform & Pyridine	0.001380

MERCURY FULMINATE $C_2HgN_2O_2$.

One liter of solution in water contains 0.70 gm. $C_2HgN_2O_2$ at 12° and 1.76 gms. at 49°. (Holleman, 1896.)

CN MERCURIC CYANIDE $Hg(CN)_2$.

SOLUBILITY IN WATER.

t°.	Gms $Hg(CN)_2$ per 100 Gms. H_2O.	Gms $Hg(CN)_2$ per 100 cc. Sat. Sol.	Authority.
− 0.45 Eutec.	about 11	...	(Guthrie, 1878.)
13.5	9.3	...	(Timofeiew, 1894.)
15	12.5	...	(Marsh and Struthers, 1905.)
20	...	9.3	(Konowalow, 1898, 1899.)
25	...	11.12	(Sherrill, 1903.)
25	11.27	10.95 (d_{25} = 1.0813)	(Herz and Anders, 1907.)
101.1	53.85	..	(Griffiths.)

The Solubility Product of Mercuric Cyanide in Water at 25° is 5.0×10^{-40} as calculated from the results of Immerwahr by Brodsky, 1929. The following results for the Solubility of Mercuric Cyanide in Water at temperatures above 100° are given by Benrath, Gjedebo, Schiffers and Wunderlich, 1937.

t°	100°	125°	140°	150°	175°	200°
Gms. $Hg(CN)_2$ per 100 gms. sat. sol.	35.8	42.9	49.8	56.7	63.4	72.8

SOLUBILITY OF MERCURIC CYANIDE IN AQUEOUS POTASSIUM CYANIDE SOLUTIONS AT 25°. (Sherrill, 1903.)

Mols per Liter.		Gms. per Liter.	
KCN.	$Hg(CN)_2$.	KCN.	$Hg(CN)_2$.
0.0493	0.4855	3.21	122.6
0.0985	0.5350	6.41	135.2
0.1970	0.6270	12.83	158.4

The regularity of the increase in solubility proves that the complex $Hg(CN)_2.KCN$ is formed at the given concentrations.

Data are also given for the distribution of $Hg(CN)_2$ between aqueous solutions of KCN and ether at 25°.

HYDRARGYRUM CYANIDE (Mercuric Cyanide)

SOLUBILITY OF MERCURIC CYANIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CYANIDE AT 25° AND VICE VERSA.

(Corbet, 1926.)

Due to the difficulty of preparing KCN free from KOH the saturated solutions were prepared from double salts which were free of KOH. The solutions were kept in contact with an atmosphere of coal gas previously washed by being passed through solutions of lead acetate and NaOH.

Gms. per 100 gms. sat. sol.		Solid.	Gms. per 100 gms. sat. sol.		Solid.
KCN.	$Hg(CN)_2$.	Phase.	KCN.	$Hg(CN)_2$.	Phase.
41.7	0.00	KCN	12.81	39.96	$K_2Hg(CN)_4$
39.7	0.49	$KCN + K_2Hg(CN)_4$	11.37	41.85	$Hg(CN)_2$
29.47	2.34	$K_2Hg(CN)_4$	3.97	20.34	»
17.34	11.09	»	*1.09	18.53	»
14.54	15.54	»	*0.56	11.83	»
12.54	20.65	»	*0.28	10.89	»
12.51	31.19	»	*0.00	10.00	»

*Sherrill, *Z. Physik Chem.*, 43, 719, 1903.

MERCURY CYANIDE (ic) $Hg(CN)_2$.

SOLUBILITY OF MERCURIC CYANIDE IN AQUEOUS SOLUTIONS OF AMMONIA AT 0°.

(Brinkley, 1922).

Gms. per 100 gms. sat. sol		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
$Hg(CN)_2$.	NH_3.		$Hg(CN)_2$.	NH_3.	
6.31	0.0	$Hg(CN)_2$	24.68	9.40	$Hg(CN)_2.NH_3$
8.46	0.43	»	25.41	9.55	» $+Hg(CN)_2.2NH_3$
11.66	1.09	» $+Hg(CN)_2.NH_3$	24.04	11.23	$Hg(CN)_2.2NH_3$
9.40	2.06	$Hg(CN)_2.NH_3$	23.40	12.59	»
10.32	4.08	»	24.46	16.87	»
15.43	6.82	»	43.57	22.09	»
17.51	7.67	»	66.10	21.51	»
19.31	8.25	»	79.30	20.70	»

One liter 5.2% aqueous NH_3 solution dissolves 204.3 gms. $Hg(CN)_2$ at about 20°.

(Konowalow, 1898.)

SOLUBILITY OF MERCURIC CYANIDE IN AQUEOUS SOLUTIONS OF POTASSIUM SODIUM TARTRATE AND OF SODIUM ACETATE AT 18-20°.

(Bordeianu, 1933.)

In aqueous solutions of:

$KNaC_4H_4O_6 \cdot 4H_2O$		$NaCH_3COO$	
Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.	
$KNaC_4H_4O_6$	$Hg(CN)_2$	$NaCH_3COO$	$Hg(CN)_2$
7.5	9.65	8.84	9.11
10.0	9.69	16.57	9.40
15.0	10.38	32.52	9.69
20.0	10.73		

SOLUBILITY OF MERCURIC CYANIDE IN AQUEOUS SOLUTIONS OF METHYL ALCOHOL, ETHYL ALCOHOL AND OF ETHYL ACETATE AT 25°. (Herz and Anders, 1907.)

In Aq. Methyl Alcohol.			In Aq. Ethyl Alcohol.			In Aq. Ethyl Acetate.		
Wt. % CH_3OH in Solvent.	d_{25} of Sat. Sol.	Gms. $Hg(CN)_2$ per 100 cc. Sat. Sol.	Wt. % C_2H_5OH in Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. $Hg(CN)_2$ per 100 cc. Sat. Sol.	Wt. % $CH_3COOC_2H_5$ in Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. $Hg(CN)_2$ per 100 cc. Sat. Sol.
10.6	1.0640	11.02	0	1.0813	10.95	0	1.0810	10.95
30.77	1.0484	12.46	20.18	1.0339	8.76	4.39	1.0798	10.83
47.06	1.0426	16.37	40.69	1.0006	9.02	96.76	1.9374	2.66
64	1.0441	20.48	70.01	0.9419	9.57	100	0.9097	1.80
78.05	1.0484	24.58	100	0.8552	8.19			
100	1.0762	34.29						

SOLUBILITY OF MERCURIC CYANIDE IN ETHYL ALCOHOL, METHYL ALCOHOL AND IN MIXTURES OF THE TWO.

In Ethyl Alcohol. (Timofeiew, '94; de Bruyn, '92; Herz and Kuhn, 1908.)		In Methyl Alcohol. (Dukelski, 1907.)		In $CH_3OH + C_2H_5OH$ at 25°. (Herz and Kuhn, 1908.)		
t°.	Gms. $Hg(CN)_2$ per 100 Gms. Sat. Sol.	t°.	Gms. $Hg(CN)_2$ per 100 Gms. Sat. Sol.	% CH_3OH in Mixture.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. $Hg(CN)_2$ per 100 cc. Sat. Sol.
0	8.3	0	26.10	4.37	0.8618	9.02
10	8.8	14.17	29.17	10.4	0.8707	10.10
20	9.25	23.4	32.01	41.02	0.9267	16.70
25	9.53*	27.4	31.77	80.69	1.024	28.20
30	9.8	31.7	32.53	84.77	1.034	29.60
40	10.3	38.1	33.29	91.25	1.052	30
* $d_{\frac{25}{4}} = 0.8552$		44.5	34.05	100	1.076	34.30

100 gms. of a sat. solution of $Hg(CN)_2$ in a mixture of equimolecular amounts of CH_3OH and C_6H_6 contain 10.2 gms. $Hg(CN)_2$ at 10°, 13 gms. at 30° and 15 gms. at 50°. (Dukelski, 1907.)

100 gms. Methyl Alcohol dissolve 34.55 gms. $Hg(CN)_2$ at 15° and 59.84 gms. at the b. pt. (67°).

100 gms. Acetone dissolve 10.3 gms. $Hg(CN)_2$ at 15°. (Henstock, 1934.)

SOLUBILITY OF MERCURIC CYANIDE IN MIXTURES OF PROPYL AND METHYL ALCOHOLS AND PROPYL AND ETHYL ALCOHOLS AT 25°. (Herz and Kuhn, 1908.)

In $C_3H_7OH + CH_3OH$.				In $C_3H_7OH + C_2H_5OH$.			
% C_3H_7OH in Mixed Solvent.	$d_{\frac{25}{4}}$ of Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. $Hg(CN)_2$ per 100 cc. Sat. Sol.	% C_3H_7OH in Mixed Solvent.	$d_{\frac{25}{4}}$ of Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. $Hg(CN)_2$ per 100 cc. Sat. Sol.
0	0.7878	1.0760	34.3	0	0.7867	0.8552	8.91
11.11	0.7894	1.0327	29.52	8.1	0.7886	0.8549	7.90
23.80	0.7907	0.9891	24.48	17.85	0.7902	0.8527	7.30
65.20	0.7954	0.8800	10.48	56.6	0.7926	0.8386	5.21
91.80	0.7992	0.8376	5.04	88.6	0.7973	0.8311	3.87
93.75	0.7995	0.8335	4.23	91.2	0.7979	0.8306	3.84
96.60	0.7999	0.8322	3.98	95.2	0.7986	0.8293	3.64
100	0.8004	0.8283	3.44	100	0.8004	0.8283	3.44

100 gms. propyl alcohol dissolve 3.79 gms. $Hg(CN)_2$ at 13.5°. (Timofeiew, 1894.)

100 gms. acetonitrile (b. pt. 81.6°) dissolve 9.58 gms. $Hg(CN)_2$ at 18°. (Naumann and Schier, 1914.)

100 gms. benzonitrile (b. pt. 190–1°) dissolve 1.093 gms. $Hg(CN)_2$ at 18°. (Naumann, 1914.)

SOLUBILITY OF MERCURIC CYANIDE IN ANILINE. (Staronka, 1910.)

t° of Solidification	41°	49	58.5	65	77	83.5	84	88.5
Mol. % $Hg(CN)_2$ in sat. Solution.	3.7	5.7	7.7	9	14.2	18.2	19.7	23.4

The solid phases are the unstable $Hg(CN)_2.4C_6H_5NH_2$ and the stable $Hg(CN)_2.2C_6H_5NH_2$ (m. pt. about 90°).

CN

One liter sat. solution in ethyl ether contains 2.53 gms. $Hg(CN)_2$ at 25°. (Abegg and Sherrill, 1904.)

100 gms. glycerol dissolve 27 gms. $Hg(CN)_2$ at 15.5°.

SOLUBILITIES OF MERCURIC CYANIDE DOUBLE SALTS IN WATER AND IN ALCOHOL.

Double Salt.	t°.	Gms. per 100 Grams. Water.	Gms. per 100 Grams. Alcohol.	Observer.
$Hg(CN)_2.2KCN$	cold	22.7	...	
$Hg(CN)_2.2TlCN$	1°	12.6	...	(Fromuller — Ber. 11, 92, '78.)
$Hg(CN)_2.2TlCN$	10°	9.7	...	" "
$2Hg(CN)_2.CaBr_2.5H_2O$	cold	100.0	50.0	(Custer.)
$2Hg(CN)_2.CaBr_2.5H_2O$	boiling	400.0	100.0	"
$Hg(CN)_2.KCl.H_2O$	18°	14.81	...	(Brett.)
$Hg(CN)_2.KBr.2H_2O$	18°	7.49	...	"
$Hg(CN)_2.KBr.2H_2O$	boiling	100.0+	...	"
$Hg(CN)_2.BaI_2.4H_2O$	cold	6.42	4.42	(Custer.)
$Hg(CN)_2.BaI_2.4H_2O$	boiling	250.0	62.5 (90% Alc.)	"
$Hg(CN)_2.KI$	cold	6.2	1.04 (34° B Alc.)	(Caillot.)
$Hg(CN)_2.NaI.2H_2O$	18°	22.2	15.4 (90% Alc.)	(Custer.)
$Hg(CN)_2.SrI_2.6H_2O$	18°	14.3	25.0 (90% Alc.)	"

SOLUBILITY OF MECURIC CYANIDE IN ORGANIC SOLVENTS AT 18°–20°. (Sulc, 1900.)

Solvent.	Formula.	G. $Hg(CN)_2$ per 100 Gms. Solvent.
Bromoform	$CHBr_3$	0.005
Carbon Tetra Chloride	CCl_4	0.001
Ethyl Bromide	C_2H_5Br	0.013
Ethylene Di Bromide	$C_2H_4Br_2$	0.001

Data for the ternary system, mercuric cyanide, phenol, water are given by Timmermans, 1907.

SOLUBILITY OF MERCURIC CYANIDE IN PYRIDINE. (Staronka, 1910.)

t°.	Mols. $Hg(CN)_2$ per 100 Mols. $Hg(CN)_2$ + C_5H_5N	Solid Phase.	t°.	Mols. $Hg(CN)_2$ per 100 Mols. $Hg(CN)_2$ + C_5H_5N	Solid Phase.	t°.	Mols. $Hg(CN)_2$ per 100 Mols. $Hg(CN)_2$ + C_5H_5N	Solid Phase.
9	7.1	$Hg(CN)_2.6C_5H_5N$	22.5	17.3	$Hg(CN)_2.2C_5H_5N$	56.5	26.6	$2Hg(CN)_2.3C_5H_5N$
11	8.7	"	28.5	18.4	"	68	27.5	$Hg(CN)_2.C_5H_5N$
12.2	10.4	"	32	19.3	"	70	27.7	"
13	11.3	"	38	20.6	"	86	29	"
13.5	12.9	"	42	22.3	"	111	32	"
14.5	13.8	"	46	23.7	"	122.5	33.8	"
16.5	15.8	"	53	25.3	$2Hg(CN)_2.3C_5H_5N$	125	34.4	"
20.5	15.9	"	54.5	26	"	141	38.3	"

100 gms. pyridine dissolve 64.8 gms. $Hg(CN)_2$ at 18°. (Schroeder, 1905.)

SOLUBILITY OF MERCURIC CYANIDE IN QUINOLINE. (Staronka, 1910.)

t°.	Mols. $Hg(CN)_2$ per 100 Mols. $Hg(CN)_2$+C_9H_7N.	Solid Phase.	t°.	Mols. $Hg(CN)_2$ per 100 Mols. $Hg(CN)_2$+C_9H_7N.	Solid Phase.
45	4.2	$Hg(CN)_2.3C_9H_7N$	137	13.2	$Hg(CN)_2.2C_9H_7N$(?)
54	6	" tr. pt. 60°	161	17.4	"
89 (61°)	8.2		180	22.5	"
99 (61)	9.2		192	27.1	"

CN

100 gms. liquid Sulfur Dioxide dissolve 0.014 gm. $Hg(CN)_2$ at 0°. (Jander and Ruppolt, 1937.)

MERCURY OXY CYANIDE $HgO.Hg(CN)_2$.

SOLUBILITY OF MERCURY OXY CYANIDE IN AQUEOUS SOLUTIONS AT 18-20°.
(Bordelanu, 1933.)

In aqueous solutions of:

$KNaC_4H_4O_6.4H_2O$		$NaCH_3COO$		H_3BO_3	
Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.	
$KNaC_4H_4O_6$	$HgO.Hg(CN)_2$	$NaCH_3COO$	$HgO.Hg(CN)_2$	H_3BO_3	$HgO.Hg(CN)_2$
0.0	1.315	8.25	1.291	0.4	1.80
12.0	3.18	18.74	1.170	1.4	1.94
20.0	4.39	35.72	1.063	2.4	2.00
42.0	5.73			3.4	2.18

The author also gives results showing that the presence of $Hg(CN)_2$ has little effect upon the above solubilities.

CNS

MERCUROUS THIOCYANATE $Hg_2(SCN)_2$.

The Solubility Product of Mercurous Thiocyanate in Water at 25° is 3.0×10^{-20} as quoted by Brodsky, 1929 from Immerwahr, and 1.4×10^{-20} as quoted from Grossmann, 1905.

MERCURIC THIOCYANATE $Hg(SCN)_2$

EQUILIBRIUM IN THE SYSTEM MERCURIC THIOCYANATE, POTASSIUM THIOCYANATE AND WATER AT 25°.

(Mason and Forgeng, 1931.)

The authors determined the following triple points of the system:

Gms. per 100 gms. sat. sol. KSCN	Gms. per 100 gms. sat. sol. $Hg(SCN)_2$	Solid Phase
0.0	0.063	$Hg(SCN)_2$
2.05	4.05	" + $KHg(SCN)_3$
33.1	49.1	$K_2Hg(SCN)_4$ + "
66.4	10.4	" + KSCN
70.5	0.0	KSCN

CNS

MERCURIC THIOCYANATE

100 gms. liquid Sulfur Dioxide dissolve 0.02 gm. $Hg(SCN)_2$ at 0°. (Jander and Ruppolt, 1937.)

MERCURIC Zinc **THIOCYANATE** $HgZn(SCN)_4$.

SOLUBILITY OF MERCURIC ZINC THIOCYANATE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE.

(Cuvelier, 1935.)

Measured amounts of aqueous solutions of $HgNa_2(SCN)_4$, $Zn(NO_3)_2$, $Cu(SCN)_2$ and NH_4Cl of known concentration were mixed and the amount of zinc not precipitated as $HgZn(CNS)_2$ was determined by a colorimetric comparison. Thus the amount of $HgZN(SCN)_4$ remaining in solution at each concentration of NH_4Cl was estimated by difference.

Normality of Aq. NH_4Cl	Gms. $HgZn(SCN)_4$ per 100 gms. sat. sol.	Normality of Aq. NH_4Cl	Gms. $HgZn(SCN)_4$ per 100 gms. sat. sol.
0.022	0.0766	0.714	0.462
0.044	0.110	1.000	0.505
0.089	0.173	1.428	0.534
0.178	0.255	1.843	0.546
0.357	0.353		

MERCUROUS CARBONATE Hg_2CO_3

The Solubility Product of mercurous carbonate in water at 25° is 9.0×10^{-17} as quoted from Immerwahr by Brodsky, 1929.

COO

MERCUROUS OXALATE $Hg_2C_2O_4$

The Solubility Product of mercurous oxalate in water at 25° is $(2).x\ 10^{-13}$ as quoted from Behrend by Brodsky, 1929.

MERCURIC OXALATE HgC_2O_4.

100 gms. H_2O dissolve 0.0107 gm. HgC_2O_4 at 20°. (Trifnov, 1924, 1925.)
Data for the system. $HgC_2O_4 + K_2C_2O_4 + H_2O$ at 20° are also given. The five branches of the curve have, respectively, for solid phase: HgC_2O_4; $K_2C_2O_4.HgC_2O_4.2H_2O$, $2K_2C_2O_4.HgC_2O_4.3H_2O$, $3K_2C_2O_4.HgC_2O_4.4H_2O$ and $K_2C_2O_4$.

MERCUROUS CHLORIDE Hg_2Cl_2

Solubility of Mercurous Chloride in Water.

t°.	Gms. Hg_2Cl_2 per 100 Gms. Sat. Sol.	Authority.	t°.	Gms. Hg_2Cl_2 per 100 Gms. Sat. Sol.	Authority.
0.5	0.000140	(Conductivity, Kohlrausch, 1908.)	24.6	0.00028	(Kohlrausch, 1908.)
18	0.000075	(Indirect, Behrend, 1893.)	25	0.000047	(Sherrill, 1903.)
18	0.00021	(Conductivity, Kohlrausch, 1908.)	43	0.00070	(Kohlrausch, 1908.)
20	0.000038	(Ley and Heimbucher, 1904.)			

The solubility product of mercurous chloride, determined by a modified electrometric method, was found by Brodsky and Scherschewer, 1926, to be $2.0.10^{-19}$ at 11°, $3.4.10^{-19}$ at 15°, $5.3.10^{-19}$ at 19° and $12.2.10^{-19}$ at 26°.5.

Subsequent determinations by Brodsky, 1929, gave the following values: 2.22×10^{-19} at 10.8°, 3.31×10^{-19} at 14.9°, 5.42×10^{-19} at 19.2° and 15.1×10^{-19} at 26.5°.

HYDRARGYRUM CHLORIDE (ic) $HgCl_2$

Solubility of Mercuric Chloride in Water.

Average curve from results of Etard, 1894; Foote, 1903; Osaka, 1903–08; Herz and Paul, 1913; Greenish and Smith, 1903; Schreinemakers and Thonus, 1912; Sherrill, 1903; Morse, 1902.

Cl

t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.
0	3.5	25	6.9	80	23.1
10	4.6	30	7.7	100	38
15.5	5.3 (d_{15} = 1.047)	40	9.3	120	59
20	6.1	60	14	150	78.5

Solubility of Mercuric Chloride in Water.

t°.	d of sat. sol.	Gms. $HgCl_2$ per 100 gms. sat. sol.	t°.	d of sat. sol.	Gms. $HgCl_2$ per 100 gms. sat. sol.
18.......	–	6.24 (1)	56.......	1.109	13.7 (3)
25.......	–	6.76 (2)	80.......	1.194	23.4 (3)
34.......	1.068	8.55 (3) (4)	100	1.348	36.0 (3)

(1) Laird, 1920; (2) Moles and Marquina, 1914, 1924; (3) Tourneux, 1919; (4) Toda, 1921.

More recent determinations have given the following results:

t°	d of sat. sol.	Gms. $HgCl_2$ per 100 gms. sat. sol.	t°	Gms. $HgCl_2$ per 100 gms. sat. sol.	t°	Gms. $HgCl_2$ per 100 gms. sat. sol.
15	1.0457	5.426 (1)	105	38.9 (5)	157	80.0
20	1.0518	6.167 (1)	116	49.0	165	82.6
25	1.0560	6.806 (1)	123	55.3	175	86.5
25	—	6.584 (2)	129	61.5	182	88.8
25	—	6.732 (3)	133	65.1	195	91.4
30	—	7.55 (4)	141	70.6	206	93.0
70	—	19.12 (4)	145	73.2	235	96.0

(1) Flöttmann, 1928; (2) Benrath, 1927; (3) Benrath and Ammer, 1929; (4) Sugden, 1929; (5) above 100°, Benrath, Gjedebo, Schiffers and Wunderlich, 1937.

EQUILIBRIUM IN THE SYSTEM MERCURIC CHLORIDE, MERCURIC IODIDE AND WATER.

(Sugden, 1929.)

Suitable mixtures of the two salts in water were heated to 100° and then rapidly filtered. The solutions thus obtained, from which solids separate, were rotated up to 11 days. It was necessary to operate in this manner since equilibrium is established too slowly if solids are present from the beginning. Due to analytical difficulties great accuracy is not claimed for the results. The solid phase in the iodide region consists of two series of mixed crystals which are respectively yellow and red. They correspond to the yellow and red form of the simple iodide stable above and below 129°.

Results at 30°			Results at 70°		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$HgCl_2$	HgI_2		$HgCl_2$	HgI_2	
7.55	0.0	W	19.12	0.0	W
7.67	0.41	"	19.5	0.44	"
7.75	0.21	"	20.5	1.10	Y
7.77	0.43	" + R	19.8	1.02	"
7.72	0.54	R	17.4	0.99	"
7.69	0.46	"	16.7	1.00	"
6.75	0.31	"	12.8	0.99	"
5.32	0.28	"	12.6	0.94	"
3.39	0.33	"	10.2	0.91	" + R
2.20	0.18	"	9.9	0.84	" + R
7.82	0.52	Y	7.35	0.75	R
5.36	0.37	"	3.94	0.52	"

Cl

W = White, R = Red, Y = Yellow.

MERCUROUS CHLORIDE HgCl

SOLUBILITY OF MERCUROUS CHLORIDE (CALOMEL) IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE, BARIUM CHLORIDE, CALCIUM CHLORIDE AND OF HYDROCHLORIC ACID AT 25°.

(Richards and Archibald, 1902.)

Solid phase in each case. Calomel + about 0.1 gm. of mercury.

In Aqueous NaCl.

Sp. Gr. of Solutions.	Gms. per Liter.	
	NaCl.	HgCl.
...	5.85	0.0041
1.040	58.50	0.041
1.078	119	0.129
1.093	148.25	0.194
1.142	222.3	0.380
1.188	292.5	0.643

In Aqueous $BaCl_2$.

Sp. Gr. of Solutions.	Gms. per Liter.	
	$BaCl_2$.	HgCl.
1.088	104.15.	0.044
1.134	156.22	0.088
1.174	208.30	0.107
1.263	312.54	0.231

In Aqueous $CaCl_2$.

Sp. Gr. of Solutions.	Gms. per Liter.	
	$CaCl_2$.	HgCl.
...	39.96	0.022
...	55.5	0.033
1.064	111	0.081
1.105	138.75	0.118
1.151	195.36	0.231
1.205	257.52	0.322
1.243	324.67	0.430
1.315	432.9	0.518
1.358	499.5	0.510

In Aqueous HCl.

Sp. Gr. of Solutions.	Gms. per Liter.	
	HCl.	HgCl.
...	31.69	0.034
...	36.46	0.048
1.042	95.43	0.207
1.069	158.4	0.399
1.091	209.2	0.548
1.114	267.3	0.654
1.119	278.7	0.675
1.132	317.3	0.670
1.153	364.6	0.673

100 gms. bromoform, $CHBr_3$, dissolve 0.055 gm. HgCl at 18°-20°. (Sulc., 1900.)

Data for the system Mercurous Chloride + KOH + H_2O at 25° are given by Herz, 1911.

MERCURIC CHLORIDE $HgCl_2$

SOLUBILITY OF MERCURIC CHLORIDE IN AQUEOUS SALT SOLUTIONS AT 25°.

(Herz and Paul, 1913.)

In Aqueous Barium Chloride.		In Aqueous Calcium Chloride.		In Aqueous Lithium Chloride.		In Aqueous Magnesium Chloride.	
Mols. per Liter.		Mols. per Liter.		Mols. per Liter.		Mols. per Liter.	
$BaCl_2$.	$HgCl_2$.	$CaCl_2$.	$HgCl_2$.	LiCl.	$HgCl_2$.	$MgCl_2$.	$HgCl_2$.
0	0.265	0.190	0.364	0.414	0.351	0.168	0.374
0.385	0.697	0.402	0.766	0.835	0.666	0.415	0.719
0.572	1.167	0.656	1.108	1.271	1.021	0.570	1.131
0.776	1.620	0.964	1.811	1.738	1.678	0.997	1.864
1.336	2.645	1.429	2.645	2.265	2.214	1.320	2.569
3.030	5.348	1.723	3.304	3.091	2.896	1.728	3.206

Cl

In Aqueous Potassium Chloride.			In Aqueous Sodium Chloride.		In Aqueous Strontium Chloride.	
Mols. per Liter.			Mols. per Liter.		Mols. per Liter	
KCl.	$HgCl_2$.		NaCl.	$HgCl_2$.	$SrCl_2$.	$HgCl_2$.
0	0.265		0.201	0.372	0.164	0.315
0.1	0.381	(Sherrill, 1903.)	0.416	0.508	0.311	0.563
0.174	0.355		0.671	0.748	0.519	0.829
0.221	0.381		1.153	1.192	0.724	1.342
0.25	0.542	(Sherrill, 1903.)	1.941	2.022	1.046	1.776
0.683	0.836		3.162	3.434	1.384	2.293

SOLUBILITY OF MERCURIC CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT:

0°.					20–25° (?).	
(Engel — Ann. chim. phys. [6] 17, 362, '89.)					(Ditte — *Ibid.* [5] 22, 551, '81.)	
Mg. Mols. per 100 cc. Sol.		Gms. per 100 cc. Sol.		Sp. Gr. of Solutions.	Parts HCl per 100 Parts H_2O.	Parts $HgCl_2$ per 100 Parts Solution
HCl.	½$HgCl_2$.	HCl.	$HgCl_2$.			
4.3	9.7	1.57	13.11	1.117	0.0	6.8
9.9	19.8	3.61	18.04	1.238	5.6	46.8
17.8	35.5	6.49	32.44	1.427	10.1	73.7
26.9	55.6	9.81	49.04	1.665	13.8	87.8
32.25	68.9	11.76	58.80	1.811	21.1	127.4
34.25	72.4	12.48	62.40	1.874	31.0	141.9
41.5	85.5	15.13	75.65	2.023	50.0	148.0
48.1	88.6	17.54	87.70	2.066	68.0	154.0
70.9	95.7	25.84	129.20	2.198		

One liter of 0.1 *n* $Hg(NO_3)_2$ solution dissolves 105 gms. $HgCl_2$ at 25°. (Morse, 1902.)

This result, together with distribution experiments, show that complexes of $HgCl_2$ and $Hg(NO_3)_2$ are formed.

EQUILIBRIUM IN THE SYSTEM MERCURIC CHLORIDE, YELLOW MERCURIC OXIDE AND WATER AT 35°. (Toda, 1921.)

The various mixtures were rotated in a thermostat for about 72 hours, and both the clear solution and solid phases were analyzed.

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
$HgCl_2$	HgO.	Solid Phase.	$HgCl_2$.	HgO.	Solid Phase.
8.58	0.0	$HgCl_2$	0.61	0.02	$HgCl_2.4HgO$
8.72	0.14	» + $HgCl_2.2HgO$	0.23	0.03	»
8.68	0.07	» »	0.20	0.06	»
8.69	0.10	» »	0.13	0.04	» + HgO
8.81	0.03	» »	0.07	0.04	» »
8.70	0.11	» »	0.05	0.03	» »
8.69	0.10	» »	0.05	0.04	» »
4.39	0.09	$HgCl_2.2HgO$	0.04	0.04	HgO
3.42	0.06	»	0.01	0.03	»
0.66	0.02	»	0.00	0.001	»
0.66	0.02	» + $HgCl_2.3HgO$			

EQUILIBRIUM IN THE SYSTEM MERCURIC CHLORIDE, POTASSIUM CHLORIDE, AND WATER AT 34°. (Tourneux, 1919.)

Saturation was secured by constant stirring. Both the saturated solutions and solid phases were analyzed.

Cl

d of sat sol	Gms per 100 gms sat sol.		Solid Phase.	d of sat. sol.	Gms per 100 gms. sat. sol.		Solid Phase.
	$HgCl_2$	KCl.			$HgCl_2$.	KCl.	
1.068	8.55	0.0	$HgCl_2$	1.386	27.9	9.6	$HgCl_2.KCl.^9/_4H_2O$
1.202	19.14	2.6	»	1.368	25.5	11.4	»
–	27.2	4.2	»	1.428	26.8	14.9	»
–	34.1	5.4	»	1.561	30.8	20.0	»
1.497	37.0	6.0	»	1.620	32.6	22.0	»
1.512	37.4	6.0	» + $2HgCl_2, KCl\ 2H_2O$	1.624	33.0	21.9	» + $HgCl_2.2KCl.H_2O$
1.525	37.8	6.5	$2HgCl_2, KCl\ 2H_2O$	1.621	32.8	21.9	$HgCl_2.2KCl.H_2O$
1.533	37.7	6.7	»	–	29.0	23.0	»
1.545	37.6	7.3	»	–	24.5	24.8	»
1.549	37.8	7.45	» + $3HgCl_2, 2KCl\ ^5/_2H_2O$	1.459	20.65	26.0	» + KCl
1.534	37.4	7.8	$3HgCl_2, 2KCl\ ^5/_3H_2O$	–	17.8	26.8	KCl
1.530	37.6	8.0	»	–	12.2	27.0	»
1.524	36.8	8.2	» + $HgCl_2, KCl\ ^9/_4H_2O$		8.4	27.3	»
1.512	35.9	8.2	$HgCl_2, KCl\ ^9/_4H_2O$	–	4.5	27.5	»
1.486	34.5	8.5	»	–	0.0	27.8	»

Results similar to the above are given for 56°, 80° and 100°.

In a later paper by Tourneaux, 1934, having for its object an explanation of the variation in the solubility of $HgCl_2$ in aq. solutions of KCl and vice versa, the author calculates the equilibrium constants involved and finds that they vary with the temperature in accordance with the law of Van't Hoff.

Data for the system $HgCl_2 + KCl + NH_4Cl + H_2O$ at 25° are given by Osaka and Ando 1925, 1926.

SOLUBILITY OF MERCURIC CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT 20° AND VICE VERSA.

(Tichomirow, 1907; see also results by Foote and Levy)

Gms. per 100 Gms. H_2O		Solid Phase.	Gms. per 100 Gms. H_2O.		Solid Phase.
KCl.	$HgCl_2$.		KCl.	$HgCl_2$.	
0	7.39	$HgCl_2$	20.35	29	$HgCl_2.KCl$
1.12	11.63	"	26.31	34.83	"
2.39	15.72	"	30.32	39.10	"
4.05	22.17	"	34.12	42.82	" $+HgCl_2.2KCl$
4.84	25.16	" $+2HgCl_2.KCl$	34.18	39.34	$HgCl_2.2KCl$
5.60	25.13	$2HgCl_2.KCl$	34.34	35.16	"
6.71	25.66	"	35.54	30.63	"
7.39	26.41	" $+HgCl_2.KCl$	37.72	24.30	"
7.46	24.70	$HgCl_2.KCl$	41.33	19.33	" $+KCl$
8.95	19.93	"	39.66	15.76	KCl
15	22.87	"	37.87	10.28	"
17.57	26.12	"	35.32	21	"

SOLUBILITY OF MIXTURES OF POTASSIUM AND MERCURIC CHLORIDES IN WATER AT 25°.

(Foote and Levy.)

Cl

Composition of Solution. Grams per 100 Grams Solution.		Percentage Composition of Undissolved Residue			Solid Phase.
KCl.	$HgCl_2$.	KCl.	$HgCl_2$.	H_2O.	
26.46	none	100	none	...	KCl
26.24	15.04	...	3.63	...	KCl and $2KCl.HgCl_2.H_2O$
26.43	15.02	...	26.15	...	
26.33	15.02	...	52.01	...	
26.33	14.92	...	61.04	...	
23.74	18.91	34.61	61.66	3.73	$2KCl.HgCl_2.H_2O$ Calc. Composition 34.05% KCl, 61.84% $HgCl_2$, 4.11% H_2O
22.36	21.39	34.77	62.02	3.21	
21.39	23.88	34.80	61.84	3.35	
20.32	27.62	...	65.24	...	$2KCl.HgCl_2.H_2O$ and $KCl.HgCl_2.H_2O$
20.26	27.38	...	73.98	...	
17.85	25.34	21.89	75.10	3.01	$KCl.HgCl_2.H_2O$ Calc. Composition 20.52% KCl, 74.53% $HgCl_2$, 4.95% H_2O
9.26	18.95	21.02	73.36	5.62	
7.80	19.56	20.76	73.06	6.18	
6.84	22.81	20.75	74.54	4.71	
6.66	24.32	20.54	73.99	5.47	
6.52	25.13	...	76.46	...	$KCl.HgCl_2.H_2O$ and $KCl.2HgCl_2.2H_2O$
6.64	25.16	...	80.60	...	
6.27	25.11	12.09	83.20	4.71	$KCl.2HgCl_2.2H_2O$ Calc. Composition 11.43% KCl, 83.05% $HgCl_2$, 5.52% H_2O
5.77	24.73	11.87	83.18	4.95	
4.68	24.75	...	84.46	...	$KCl.2HgCl_2.2H_2O$ and $HgCl_2$
4.66	25.17	...	93.68	...	
4.69	24.82	...	98.50	...	
none	6.90	none	100.00	none	$HgCl_2$

Data for the quaternary system Ammonium Chloride + Mercuric Chloride + Potassium Chloride + Water at 25° are given by Osaka and Ando, 1924.

The results of these authors have been further interpreted in a paper by Jänecke, 1938.

Data for equilibrium in the system $HgCl_2 + KOH + H_2O$ at 25° are given by Herz, 1910.

SOLUBILITY OF MERCURIC CHLORIDE IN AQUEOUS SOLUTIONS OF MAGNESIUM CHLORIDE AT 25° AND VICE VERSA.

(Bassett, Barton, Foster and Pateman, 1933.)

Cl

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$HgCl_2$	$MgCl_2$		$HgCl_2$	$MgCl_2$		$HgCl_2$	$MgCl_2$	
6.90	0.0	$HgCl_2$	53.15	16.30	B	44.93	21.12	C
33.47	5.4	"	51.88	17.27	"	43.20	21.95	" + D
47.72	8.28	"	50.08	18.77	" + C	41.66	22.43	D
56.03	9.86	"	49.85	19.23	B	31.92	25.29	"
57.46	10.68	"	49.47	19.07	C	24.29	27.64	"
59.23	12.48	" + B	48.95	19.22	"	11.76	31.72	"
55.90	14.44*	B	48.78	19.45	"	0.58	35.48	"
55.78	14.38	"	47.32	20.01	"	0.0	35.70	"
54.53	15.24	"	45.45	20.90	"			

* Metastable

$B = [Mg(H_2O)_6][Hg_3Cl_8]$; $C = [Mg(H_2O)_6][HgCl_4]$; $D = [Mg(H_2O)_6]Cl_2$.

SOLUBILITY OF MERCURIC CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE.

(Homeyer and Ritsert — Pharm. Ztg. 33, 738, '88)

Per cent Concentration of NaCl Solutions.	Gms. $HgCl_2$ per 100 Gms. NaCl Solution at:		
	15°	65°	100°
0.5	10	13	44
1.0	14	18	48
5.0	30	36	64
10.0	58	68	110
25.0	120	142	196
26.0 (saturated)	128	152	208

100 gms. of aqueous 1.0 normal NaCl solution dissolve 25.08 gms. $HgCl_2$ at 25°. (Osaka, 1903-08.)

EQUILIBRIUM IN THE SYSTEM AMMONIUM CHLORIDE, MERCURIC CHLORIDE, WATER AT 30°.

(Meerburg, 1908.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
$HgCl_2$	NH_4Cl.		$HgCl_2$.	NH_4Cl.	
0	29.50	NH_4Cl	57.05	9.92	3.2.1
22.80	26.91	"	58.65	9.20	" +9.2
42.45	25.05	"	*51.83	8.76	9.2
50.05	24.79	" 1.2.1	*46	7.52	"
53.08	22.77	1.2.1	*35.60	5.26	"
58.90	20.02	" +1.1.1	*32.90	5.06	"
56.38	18.50	1.1.1	29.65	3.62	" $+HgCl_2$
55.58	16.82	"	40.12	5.13	$HgCl_2$
57.01	14.12	" +3.2.1	21	2.29	"
56.26	13.04	3.2.1	7.67	0	"

1.2.1 = $HgCl_2.2NH_4Cl.H_2O$; 1.1.1 = $HgCl_2.NH_4Cl.H_2O$;
3.2.1 = $3HgCl_2.2NH_4Cl.H_2O$; 9.2 = $9HgCl_2.2NH_4Cl$.

* In these solutions 2 to 3 weeks were required for attainment of equilibrium.

Cl

SOLUBILITY OF MIXTURES OF SODIUM AND MERCURIC CHLORIDE IN WATER AT 25°.

(Foote and Levy — Am. Ch. J. 35, 239, '06.)

Gms. per 100 Gms. Solution.		Gms. per 100 Gms. Undissolved Residue.			Solid Phase.
NaCl.	$HgCl_2$.	NaCl.	$HgCl_2$	H_2O	
26.5	none	100	none	none	NaCl
18.66	51.35	...	16.39	...	NaCl and $NaCl.HgCl_2.2H_2O$
18.71	51.32	...	21.98	...	
18.64	51.42	...	65.42	...	
18.87	51.26	...	71.25	...	
14.97	57.74	16.38	74.18	9.44	Double Salt $NaCl.HgCl_2.2H_2O$ Calc. Comp. 16.01% NaCl 74.14% HgCl 9.85% H_2O
14.03	59.69	16.36	74.21	9.43	
13.25	62.16	16.16	74.70	9.14	
13.17	62.59	15.96	74.76	9.28	
12.97	62.50		78.20	...	$NaCl.HgCl_2.2H_2O$ and $HgCl_2$
13.14	62.48	.	88.64	.	
13.15	62.55	.	90.83	.	
Two determinations made at 10.3° gave					
19.46	46.49	67.46	29.19	3.35	
19.48	46.50	22.83	68.85	8.32	

SOLUBILITY OF MIXTURES OF MERCURIC AND RUBIDIUM CHLORIDES IN WATER AT 25°.

(Foote and Levy, 1906.)

Composition of Solution. Gms per 100 Gms. Solution.		Percentage Composition of Undissolved Residue.			Solid Phase.
RbCl.	$HgCl_2$	RbCl.	$HgCl_2$.	H_2O.	
48.57	none	100	none	none	RbCl
46.76	9.18	88.04	11.24	0.72	RbCl and $2RbCl.HgCl_2.H_2O$
47.54	9.49	60.33	37.51	2.16	
47.55	9.39	56.59	40.75	2.66	
47.3	9.47	46.73	49.38	3.88	
47.65	10.35	46.50	50.92	2.58	$2RbCl.HgCl_2.H_2O$ Calc. Composition 45.55% RbCl, 51.05% $HgCl_2$, 3.4% H_2O
35.16	19.58	45.98	50.80	3.22	
34.77	19.94	43.07	52.44	4.49	$2RbCl.HgCl_2.H_2O$ and $3RbCl.2HgCl_2.2H_2O$
34.76	20.10	41.10	55.36	3.54	
30.27	20.17	39.07	57.34	3.59	$3RbCl.2HgCl_2.2H_2O$ Calc. Composition 38.55% RbCl, 57.62% $HgCl_2$, 3.82% H_2O
29.20	20.55	39.10	57.47	3.43	
27.38	20.63	38.67	57.40	3.93	
26.83	20.87	38.48	57.36	4.16	$3RbCl.2HgCl_2.2H_2O$ and $RbCl.HgCl_2.H_2O$
27.09	20.97	31.40	64.35	4.25	
26.15	20.58	30.34	65.48	4.18	$RbCl.HgCl_2.H_2O$ Calc. Composition 29.49% RbCl, 66.11% $HgCl_2$, 4.40% H_2O
23.81	18.71	30.87	65.10	4.03	
18.10	14.25	29.87	65.28	4.85	
10.87	10.42	29.33	66.15	4.52	
10.68	10.56	28.59	67.99	3.42	$RbCl.HgCl_2.H_2O$ and $3RbCl.4HgCl_2.H_2O$
10.50	10.05	26.22	72.20	1.58	
10.06	9.86	25.28	73.38	0.84	$3RbCl.4HgCl_2.H_2O$ Calc. Composition 24.76% RbCl, 74.01% $HgCl_2$, 1.23% H_2O
8.48	8.71	25.30	73.15	1.55	
8.46	8.80	25.44	73.67	0.89	
5.68	8.70	25.09	73.46	1.45	
5.10	8.33	24.92	73.93	1.15	
3.43	8.25	22.79	75.72	1.49	$3RbCl.4HgCl_2.H_2O$ and $RbCl.5HgCl_2$
3.38	8	12.68	86.74	0.58	
2.98	7.71	8.40	91.24	..	$RbCl.5HgCl_2$ Calc. Composition 8.20% RbCl, 91.8% $HgCl_2$
1.89	7.64	8.38	91.78	...	
1.50	7.55	8.30	91.81	...	
1.10	7.21	8.07	91.58	..	
0.79	7.16	6.91	93.15	. .	$RbCl.5HgCl_2$ and $HgCl_2$
0.84	7.42	2.27	97.09	...	
none	6.90	none	100	...	$HgCl_2$

Cl

MERCURIC CHLORIDE $HgCl_2$

SOLUBILITY OF MERCURIC CHLORIDE IN AQUEOUS SOLUTIONS OF STRONTIUM CHLORIDE AT 25° AND VICE VERSA.

(Bassett, Barton, Foster and Pateman, 1933.)

Gms. per 100 gms. sat. sol. $HgCl_2$	$SrCl_2$	Solid Phase	Gms. per 100 gms. sat. sol. $HgCl_2$	$SrCl_2$	Solid Phase	Gms. per 100 gms. sat. sol. $HgCl_2$	$SrCl_2$	Solid Phase
6.90	0.0	$HgCl_2$	56.20	19.20	B - S	0.0	40.0*	D
34.70	9.30	"	55.45	19.82	"	48.20	23.60	E
48.21	13.93	"	54.33	20.88	"	46.25	24.02	"
56.62	16.65	"	52.70	21.90	"	45.32	24.26	"
57.17	17.34	"	51.20	22.50	"	34.52	26.78	"
58.38	18.02	" +B+S	50.87	22.98	"	31.02	27.50	"
58.68	18.47*	" + C	48.90	23.69	" + E	18.82	30.50	"
58.49	19.42*	C	48.81	24.01	"	8.55	33.42	"
59.49	19.66*	"	48.77	23.90*	"	0.0	35.84	"
58.13	18.00	B + S						

* = Metastable

B = $[Sr(H_2O)_8]$ $[(HgCl_2)_2Cl_2]$; C = $[Sr(H_2O)_6]$ $[(HgCl_2)_6Cl_2]$; D = $SrCl_2.2H_2O$; E = $SrCl_2.6H_2O$; S = solid solution.

C1

SOLUBILITY OF MERCURIC CHLORIDE IN AQUEOUS ETHYL ALCOHOL AT 25°.

(Abe, 1912.)

Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	$HgCl_2$.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	$HgCl_2$.	Solid Phase.
0	6.80*	$HgCl_2$	45.84	15.36	$HgCl_2$
5.08	6.65	"	49.86	18.18	"
14.49	6.41	"	53.61	21.40	"
21	6.55	"	57.26	24.51	"
26.25	7.31	"	60.55	27.67	"
31.53	8.51	"	63.95	29.86	"
36.85	10.32	"	67.39	32.40	"
41.36	12.64	"			

SOLUBILITY OF MERCURIC CHLORIDE IN AQ. ETHYL ALCOHOL AT 25°.

(Herz and Anders, 1907.)

Wt. % C_2H_5OH in Solvent.	d_{25} of Solvent.	d_{25} of Sat. Sol.	Gms. $HgCl_2$ per 100 cc. Sat. Sol.
0	0.9971	1.0565	7.22
20.18	0.9665	1.0214	6.76
40.69	0.9302	1.0180	10.69
70.01	0.8632	1.0616	23.60
100	0.7856	1.1067	36.86

The solid phase in contact with solutions of Mercuric Chloride plus Potassium Chloride in 95% or absolute ethyl alcohol at 34° was found to be $6HgCl_2.5KCl.2C_2H_5OH$. (Pernot, 1934.)

SOLUBILITY OF MERCURIC CHLORIDE IN AQUEOUS METHYL ALCOHOL AT 25°.

(Herz and Anders, 1907.)

Wt. % CH_3OH in Solvent.	$d_{\frac{25}{4}}$ of Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. $HgCl_2$ per 100 cc. Sat. Sol.
10.60	0.9792	1.0441	7.90
30.77	0.9481	1.0420	11.31
37.21	0.9369	1.0507	13.43
47.06	0.9186	1.0809	19.71
64	0.8800	1.2015	38.44
78.05	0.8489	1.3314	57.17
100	0.7879	1.2160	48.62

100 cc. 90% ethyl alcohol dissolve 27.5 gms. $HgCl_2$ at 15.5°, d_{15} sat. sol. = 1.065. (Greenish and Smith, 1903.)

100 gms. 99.2% ethyl alcohol dissolve 33.4 gms. $HgCl_2$ at 25°. (Osaka, 1903–8.)
" abs. " " " 49.5 " " " . (de Bruyn, 1892.)
" " methyl " " 52.9 " " at 19.5° and 66.9 gms. at 25°. (de Bruyn, 1892.)
" " " " " 1.2 " " at the crit. temp. (Centnerszwer, 1910.)

SOLUBILITY OF MERCURIC CHLORIDE IN METHYL, ETHYL PROPYL, *n* BUTYL, ISO BUTYL AND ALLYL ALCOHOLS.

(Etard — Ann. chim. phys. [7] 2, 563, '94.)

NOTE. — For the solubility in Me, Et, and propyl alcohols at room temperature, see Rohland — Z. anorg. Ch. **18**, 328, '98; at 8.5°, 20° and 38.2°, see Timofejew — Compt. rend. **112**, 1224, '91; in Me and Et alcohols at 25°, see de Bruyn — Z. physik. Ch. **10**, 783, '92. The determinations of these investigators agree well with those of Etard, which are given below. Cl

t°	Grams $HgCl_2$ per 100 Grams Saturated Solution in:					
	CH_3OH.	C_2H_5OH.	C_3H_7OH.	$CH_3(CH_2)_3OH$.	$(CH_3)_2CHCH_2OH$.	$CH_2.CH.CH_2OH$
−30	...	14.5	15.0	...	...	...
−20	...	20.1	15.7	13.5	...	21.0
−10	15.2	26.5	16.5	13.7	...	25.5
0	20.1	29.8	17.4	14.0	5.2	30.0
+10	26.3	30.6	18.0	14.3	6.0	37.5
20	34.0	32.0	18.8	14.6	6.8	46.5
25	40.0	32.5	19.5	15.5	7.2	...
30	44.4	33.7	20.0	16.5	7.5	...
40	58.6	35.6	23.0	19.6	9.7	...
60	62.5	41.2	29.8	26.5	17.0	...
80	66.0	47.5	36.8	33.0	24.9	...
100	70.1	54.3	43.8	...	31.7	...
120	73.5	61.5	50.6	...	39.2	...
150	78.5	...	...	...	...	...

SOLUBILITY OF MERCURIC CHLORIDE IN AQ. ETHYL ACETATE AT 25°.

(Herz and Anders, 1907.)

Wt. % $CH_3COOC_2H_5$ in Solvent.	$d_{\frac{25}{4}}$ of Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. $HgCl_2$ per 100 cc. Sat. Sol.
0	0.9971	1.0565	7.22
4.39*	...	1.0581	7.38
96.76†	...	1.2371	41.55
100‡	0.884	1.1126	26.42

* Almost sat. with ethyl acetate. † Ethyl acetate almost sat. with H_2O. ‡ (b. pt. = 75.77°.)

SOLUBILITY OF MERCURIC CHLORIDE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 18°.

(Laird, 1920.)

Wt. % C_2H_5OH in solvent.	Gms. $HgCl_2$ per 100 gms. sat. sol.	Wt. % C_2H_5OH in solvent.	Gms. $HgCl_2$ per 100 gms. sat. sol.
0	6.24	25.0	5.08
10.0	5.63	30.0	5.86
15.0	5.43	40.0	7.58
20.0	5 15	51.0	11.30

SOLUBILITY OF MERCURIC CHLORIDE AT 25° IN AQUEOUS SOLUTIONS OF :

(Moles and Marquina, 1914, 1924.)

Citric Acid.		Tartaric Acid.		Glycerol.		Sucrose.	
Per cent Citric acid in solvent.	Gms $HgCl_2$ per 100 gms. sat. sol.	Per cent Tartaric acid in solvent.	Gms. $HgCl_2$ per 100 gms. sat. sol.	Per cent Glycerol in solvent.	Gms $HgCl_2$ per 100 gms. sat. sol.	Per cent Sucrose in solvent.	Gms. $HgCl_2$ per 100 gms. sat. sol.
0.0	6.76	10.0	6.36	5.08	7.20	10.0	7.08
10.0	6.63	20.0	5.75	15.1	8.33	25.0	8.05
25.0	5.73	25.0	5.36	25.0	9.60	30.0	8.46
50.0	3.99	35.0	4.59	35.0	11.10	35.0	8.83
		42.5	3.98	50.18	14.88	40.0	9.14
		50.0	3.28	75.08	26.53	42.5	9.16
				100.00	44.22	47.0	9.68
						55.0	10.14

Cl

Ethyl ether, saturated with mercuric chloride by repeated agitation at room temperature, and also by prolonged boiling under a reflux condenser and allowing to stand at ordinary temperature for many days, contained 6.9 gms. $HgCl_2$ per 100 gms. ether. On the basis of 0.720 as the Sp. Gr. of the ether this corresponds to 5.0 gms. $HgCl_2$ per 100 cc. of ether. (Richard, 1926.)

100 gms. glycerol of $d = 1.2326$ (= 86.5 %) dissolve 53.5 gm. $HgCl_2$ at 20°
» » » $d = 1.2645$ (= 98.5 %) » 65.5 » » »

(Holm, 1921, 1922.)

100 gms. sat. solution of mercuric chloride in selenium oxychloride ($SeOCl_2$) contain 0.89 gm. $HgCl_2$ at 25°. (Wise, 1923.)

100 gms. liquid Sulfur Dioxide dissolve 0.103 gm. $HgCl_2$ at 0°.
(Jander and Ruppolt, 1937.)

SOLUBILITY OF MERCURIC CHLORIDE IN AQUEOUS SOLUTIONS OF URETHAN AT 25°.

(Fallitsch, 1928, 1929.)

Gm. Mols. $HgCl_2$ per 1000 gms. H_2O		Solid Phase
$HgCl_2$	$NH_2COOC_2H_5$	
0.27	0.0	$HgCl_2$
0.30	1.1225	"
0.607	4.4898	"
1.552	11.326	"
0.25	51.79	" + $NH_2COOC_2H_5$

SOLUBILITY OF MERCURIC CHLORIDE IN ANHYDROUS ACETIC ACID DETERMINED BY THE SYNTHETIC METHOD.

(Davidson and Chappell, 1928.)

t^0	Mols. $HgCl_2$ per 100 mols. $HgCl_2$ + CH_3COOH	Solid Phase	t^0	Mols. $HgCl_2$ per 100 mols. $HgCl_2$ + CH_3COOH	Solid Phase
16.6	0.0	CH_3COOH	53	1.46	$HgCl_2$
16.45	0.27	"	60	1.61	"
16.35	0.477	"	66	1.81	"
17.0	0.477	$HgCl_2.2CH_3COOH$	72	2.01	"
24	0.680	"	78	2.22	"
30	0.936	"	84	2.42	"
33	1.06	"	92	2.74	"
36	1.19	"	97	3.05	"
40	1.15	$HgCl_2$	106	3.55	"
46	1.30	"	117	4.21	"

DISTRIBUTION OF MERCURIC CHLORIDE BETWEEN WATER AND BENZENE.

(Linhart, 1915.)

Results at 25°.			Results at 40°.		
Mols. $HgCl_2$ per Liter:		$\frac{\text{Conc. in } H_2O}{\text{Conc. in } C_6H_6}$	Mols. $HgCl_2$ per Liter:		$\frac{\text{Conc. in } H_2O}{\text{Conc. in } C_6H_6}$
C_6H_6 Layer.	H_2O Layer.		C_6H_6 Layer.	H_2O Layer.	
0.02100	0.2866	13.65	0.02647	0.34600	13.07
0.01224	0.15777	12.91	0.015296	0.18470	12.08
0.005244	0.064756	12.35	0.011774	0.138228	11.74
0.000618	0.007382	11.95	0.008041	0 091959	11 44
0 000310	0.003696	11.90	0.004140	0 04586	11.08
0.000155	0.001845	11.90	0.000847	0.009153	10.81

C1

DISTRIBUTION OF MERCURIC CHLORIDE BETWEEN WATER AND AMYL ALCOHOL.

(Wossnessensky and Astachow, 1927.)

Mols. $HgCl_2$ per liter		$\frac{\text{Conc. in } H_2O}{\text{Conc. in Amyl Alcohol}}$
Water	Amyl Alcohol	
0.0072	0.013	0.554
0.0378	0.072	0.525
0.0688	0.139	0.495

SOLUBILITY OF MERCURIC CHLORIDE IN ACETIC ACID.

(Etard, 1894.)

t°.	Gms. $HgCl_2$ per 100 Gms. Solution.	t°.	Gms. $HgCl_2$ per 100 Gms. Solution.	t°.	Gms. $HgCl_2$ per 100 Gms. Solution.
20	2.5	70	8.5	110	13.6
30	3.5	80	9.7	120	16.5
40	4.7	90	11	130	20.7
50	6	100	12.4	140	25.2
60	7.2			160	34.8

DISTRIBUTION OF MERCURIC CHLORIDE BETWEEN WATER AND ETHER.

(Hantzsch and Sebalt, 1899.)

50 cc. ether + 50 cc. sat. aqueous $HgCl_2$ solution were shaken together at different temperatures and after equilibrium was established the $HgCl_2$ in each layer determined.

t°.	Mols. $HgCl_2$ per Liter: H_2O Layer (c').	Mols. $HgCl_2$ per Liter: $(C_2H_5)_2O$ Layer (c^2).	$\frac{c'}{c^2}$.
0	0.0056	0.01407	0.391
10	0.0066	0.01415	0.467
17.5	0.0090	0.02150	0.419
25	0.0095	0.02076	0.429

Determinations by Skinner (1892) at room temp. using concentrations of $HgCl_2$ in the aqueous layer varying from 1.4 to 5.9 per cent, gave a distribution coefficient, $\frac{c_1}{c_2}$ = approximately 0.23.

DISTRIBUTION OF MERCURIC CHLORIDE BETWEEN AQUEOUS HCl AND ETHER AT 18°.

(Mylius, 1911.)

When 1 gm. of Hg as $HgCl_2$ is dissolved in 100 cc. of H_2O or aqueous HCl and shaken with 100 cc. of ether, the percentage of the Hg which goes into the ethereal layer is as follows:

Cl

Percentage Conc. of Aq. HCl	0 (= H_2O)	1	10	20
Per cent Hg in Ether Layer	69.4	13	0.4	0.2

DISTRIBUTION OF MERCURIC CHLORIDE BETWEEN WATER AND TOLUENE AT 24°.

(Brown, 1898.)

Gms. $HgCl_2$ per 100 cc. H_2O Layer.	Gms. $HgCl_2$ per 100 cc. $C_6H_5CH_3$ Layer.	Gms. $HgCl_2$ per 100 cc. H_2O Layer.	Gms. $HgCl_2$ per 100 cc. $C_6H_5CH_3$ Layer.
0.442	0.0270	1.816	0.130
0.732	0.0488	3.766	0.292
0.780	0.0542	3.754	0.298
1.192	0.0812	6.688*	0.528*

* This solution saturated.

Results at Dif. Temperatures.

(Hantzsch and Vagt, 1901.)

t°.	Mols. $HgCl_2$ per Liter: H_2O Layer (c_1).	Mols. $HgCl_2$ per Liter: $C_6H_5CH_3$ Layer (c_2).	$\frac{c_1}{c_2}$.
0	0.0578	0.0047	12.35
10	0.0575	0.0050	11.60
20	0.0576	0.0050	11.40
30	0.0574	0.0051	11.20
50	0.0573	0.0052	11.25

Results at 25°.

(Morse, 1902; Drucker, 1912; Hantzsch and Vagt, 1901.)

Mols. $HgCl_2$ per Liter: H_2O Layer (c_1).	Mols. $HgCl_2$ per Liter: $C_6H_5CH_3$ Layer (c_2).	$\frac{c_1}{c_2}$.
0.18410	0.01590	11.6
0.09193	0.00807	11.4
0.04593	0.00410	11.1
0.02289	0.00211	10.8
0.01142	0.00108	10.5
0.00573	0.00057	10

Data for the effect of $Hg(NO_3)_2$ upon the distribution are given by Morse (1902). Results for the effect of $ZnCl_2$ are given by Drucker (1912).

SOLUBILITY OF MERCURIC CHLORIDE IN WATER-ETHER MIXTURES AT 25°.

(Abe, 1912.)

Gms. per 100 Gms. Sat. Sol.			Solid Phase.
$HgCl_2$.	Ether.	H_2O.	
6.92	87.86	5.22*	$HgCl_2$
5.2	1.2	93.6	"
4.3	5.2	90.5	"
2.8	5.4	91.8	"
1.5	5.4	93.1	"

* (Solvent, ether sat. with H_2O.)

SOLUBILITY OF MERCURIC CHLORIDE IN MIXTURES OF ETHER AND ETHYL ALCOHOL AT 25°. (Abe, 1912.)

Gms. per 100 Gms. Sat. Sol.		Gms. per 100 Gms. Sat. Sol.	
$HgCl_2$.	C_2H_5OH.	$HgCl_2$.	C_2H_5OH.
32.43	67.57	36.29	27.16
35.50	58.59	34.08	22.48
37.39	51.02	28.55	15.20
37.96	44.79	20.67	8.97
38.24	38.69	5.49	0
37.75	32.84		

SOLUBILITY OF MERCURIC CHLORIDE IN MIXTURES OF ALCOHOLS AT 25°.

Cl

(Herz and Kuhn, 1908.)

In Mixtures of Ethyl and Methyl Alcohols.			In Mixtures of Ethyl and Propyl Alcohols.			In Mixtures of Methyl and Propyl Alcohols.		
% CH_3OH in Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. $HgCl_2$ per 100 cc. Sat. Sol.	%C_3H_7OH in Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. $HgCl_2$ per 100 cc. Sat. Sol.	% C_3H_7OH in Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. $HgCl_2$ per 100 cc. Sat. Sol.
0	1.107	36.86	0	1.1070	36.86	0	1.2160	48.62
4.37	1.130	39.43	8.1	1.0988	36.67	11.11	1.2278	50.34
10.40	1.157	42.61	17.85	1.0857	34.06	23.80	1.2848	57.14
41.02	1.294	58.37	56.6	1.0272	27.11	65.20	1.1568	42.28
80.69	1.321	61.67	88.6	0.9854	21.66	91.80	1.0090	25.09
84.77	1.288	57.82	91.2	0.9824	21.60	93.75	1.0029	23.23
91.25	1.254	53.85	95.2	0.9772	20.87	96.6	0.9851	21.52
100	1.216	48.62	100	0.9720	20.03	100	0.9720	20.03

SOLUBILITY OF MERCURIC CHLORIDE IN MIXTURES OF ETHYL ALCOHOL AND BENZENE AND OF ETHYL ALCOHOL AND CHLOROFORM AT DIFFERENT TEMPERATURES.

(Dukelski, 1907.)

In a Mixture of one mol. C_2H_5OH + one mol. C_6H_6.		In a Mixture of two mols. C_2H_5OH + one mol. C_6H_6.		In a Mixture of one mol. C_2H_5OH + one mol. CH_3Cl.		In a Mixture of two mols. C_2H_5OH + one mol. $CHCl_3$.	
t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.
−2.5	15.20	−5.2	19.45	−20.5	3.82	−20.5	6.60
0	15.40	0	20.13	−12	4.43	0	7.69
6	16.38	9.1	21.65	0	4.89	8	8.96
20.5	18.40	20.9	23.57	8	5.37	23	10.66
20.65	18.50	24.4	24.19	23	7.12	38.5	12.50
24.5	19.33	36.5	26.53	38.5	8.51	44.2	14.40
34.5	21.34	53.7	31.27	44.2	9.51		
54.4	24.84	74	38.74	45.6	9.98		
54.5	24.42						

Some of the determinations were made by the direct method of saturating the solution at a given temperature and determining the dissolved material by evaporating and weighing. Others were made by the synthetic method of Alexejew.

Solubility of Mercuric Chloride in Mixtures of Methyl Alcohol and Chloroform, Methyl Alcohol and Carbon Tetrachloride, and Methyl Alcohol and Dichlorethane at Different Temperatures.

(Dukelski, 1907.)

In a Mixture of one mol. CH_3OH + one mol. $CHCl_3$.		In a Mixture of two mols. CH_3OH + one mol. $CHCl_3$.		In a Mixture of two mols. CH_3OH + one mol. CCl_4.		In a Mixture of two mols. CH_3OH + one mol. $C_2H_4Cl_2$.	
t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.
−12	1.73	−12	3.33	0	5.20	0	13.33
0	3.51	0	6.73	7.7	6.69	12.5	21.30
8	5.63	8	8.21	24.9	14.06	20.8	29.23
23	10.15	23	16.56	30.6	19.40	25.3	34.78
24.9	10.71	24.9	18.45	35.5	20.50	30.2	36.87
30.6	11.40	30.6	19.70	36.1	21.80	37.4	37.95
38.5	12.02	38.5	20.83	48.5	21.90	45.9	39.36

Solubility of Mercuric Chloride in Mixtures of Methyl Alcohol and Benzene at Different Temperatures.

(Timofeiew, 1894.)

Cl

In a Mixture of one mol. CH_3OH + one mol. C_6H_6.		In a Mixture of one mol. CH_3OH + two mols. C_6H_6.	
t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.
0	8	0	4.8
21–25	23.9	21–25	17.1
30	27.3	30	18
37	28.1	37	18.4

Solubility of Mercuric Chloride in Benzene, in Dichlorethane and in Ethylacetate at Different Temperatures.

(Dukelski, 1907.)

In C_6H_6.		In $C_2H_4Cl_2$.		In $CH_3COOC_2H_5$.	
t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.
6.5	0.26	0	1.33	0	22.9
18	0.53	12.5	1.55	6.5	22.7
34.1	0.64	25.3	1.73	26.1	22.8
54.1	1.02	33	2.05	38.5	23.5
69	1.39	45.9	2.42	45.3	26.4

Solubility of Mercuric Chloride in Mixtures of Benzene and Ethylacetate, Chloroform and Ethyl Acetate and of Carbon Tetrachloride and Ethyl Acetate.

(Dukelski, 1907.)

In a Mixture of one mol. C_6H_6 + one mol. $CH_3COOC_2H_5$.		In a Mixture of one mol. $CHCl_3$ + one mol. $CH_3COOC_2H_5$.		In a Mixture of one mol. CCl_4 + two mols. $CH_3COOC_2H_5$.	
t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.
0	9.62	0	3.34	0	9.24
6.5	9.62	26.1	4.07	10.3	9.05
25.7	9.78	36.1	4.78	25.7	9.32
27.6	9.98	46	5.38	27.6	9.50
35.5	10.81	48.5	5.10	38.5	9.89
45.3	13.69			45.3	11.70

SOLUBILITY OF MERCURIC CHLORIDE IN ETHYL ACETATE AND IN ACETONE.

(Etard, 1894; von Laszcynski, 1894; Krug and McElroy, 1892; Linebarger, 1894; Aten, 1905–06.)

NOTE. — The results obtained by the above-named investigators were calculated to a common basis and plotted on cross-section paper. The variations which were noted could not be satisfactorily harmonized, consequently all the results are included in the following table:

SOLUBILITY.

t°.	In Ethyl Acetate. Grams $HgCl_2$ per 100 Grams Solution.				In Acetone. Gms. $HgCl_2$ per 100 Gms. Solution.			
	Laszcynski.	Aten.	Linebarger.	Etard.	K and McE.	Laszcynski.	Aten.	Etard.
−10	...	23.0	...	40	...	...	44.0 *	57.0
0	22.0	23.2	32.0	40	...	49.7	43.0 *	61.7
+10	22.2	23.5	32.5	40	...	52.0	51.0 *–58.9 †	61.7
20	22.5	23.4	32.7	40	...	54	58.5 †	61.7
25	22.7	23.5	33.0	40	37.4	55.2	58.2 †	61.7
30	23.0	...	33.2	40	...	...	...	61.7
40	23.5	...	33.5	40	...	...	...	61.7
50	24.0	...	33.5	41	...	...	...	61.7
60	24.7	...	...	42.5	...	...	...	61.7
80	26.0	...	...	45.2	...	...	...	61.7
100	...	...	...	48.0	...	...	...	...
120	...	...	...	50.8	...	...	...	...
150	...	...	...	55.0	...	...	...	...

(*) Solid phase $HgCl_2(CH_3)_2CO$. (†) Solid Phase $HgCl_2$.

Cl

100 gms. absolute acetone dissolve 143 gms. $HgCl_2$ at 18°. (Naumann, 1904.)

100 gms. sat. solution of $HgCl_2$ in Acetone contain 54.9 gms. $HgCl_2$ at 25°. (Zapata y Zapata, 1930.)

100 gms. ethyl acetate ($d_{\frac{18}{4}}$ = 0.8995) dissolve 48.8 gms. $HgCl_2$ at 18°. (Naumann, 1910.)

100 gms. methyl acetate ($d_{\frac{18}{4}}$ = 0.935) dissolve 42.6 gms. $HgCl_2$ at 18°. (Naumann, 1909.)

SOLUBILITY OF MERCURIC CHLORIDE IN SEVERAL SOLVENTS.

(Arctowski, 1894; von Laszcynski, 1894; Sulc, 1900)

In Carbon Bisulphide (A.).

t°.	Gms. $HgCl_2$ per 100 Gms. Solution.
−10	0.010
0	0.018
10	0.026
15	0.032
20	0.042
25	0.053
30	0.063

In Benzene (von L.).

t°.	Gms. $HgCl_2$ per 100 Gms. Solution.
15	0.537
41	0.616
55	0.843
84	1.769

In Several Solvents at 18–20° (S.).

Solvent.	Gms. $HgCl_2$ per 100 Gms. Solvent.
$CHBr_3$	0.486
$CHCl_3$	0.106
CCl_4	0.002
C_2H_5Br	2.010
$C_2H_4Br_2$	1.530

SOLUBILITY OF MERCURIC CHLORIDE IN MIXTURES OF ACETONE AND BENZENE, ETHER AND CHLOROFORM AND OF ETHYL ACETATE AND BENZENE AT 25°.

(Marden and Dover, 1917.)

In Mixtures of $CH_3COCH_3 + C_6H_6$.		In Mixtures of $(C_2H_5)_2O + CHCl_3$.		In Mixtures of $CH_3COOC_2H_5 + C_6H_6$.	
Gms. CH_3COCH_3 per 100 Gms. Mixture.	Gms. $HgCl_2$ per 100 Gms. Mixed Solvent.	Gms. $CHCl_3$ per 100 Gms. Mixture.	Gms. $HgCl_2$ per 100 Gms. Mixed Solvent.	Gms. $CH_3COOC_2H_5$ per 100 Gms. Mixture.	Gms. $HgCl_2$ per 100 Gms. Mixed Solvent.
100	140	0	6.95	100	49.3
90	117	10	5.85	90	26
80	96.5	20	4.73	80	22.1
70	77	30	3.70	70	18.1
60	60	40	2.80	60	14.2
50	45	50	2.10	50	11
40	31.4	60	1.48	40	8
30	20	70	0.95	30	5.4
20	10.7	80	0.657	20	3.1
10	3.9	90	0.328	10	1.6
0	0.66	100	0.128	0	0.66

SOLUBILITY OF MERCURIC CHLORIDE IN BENZENE.

(Average curve from results of Linebarger, 1895; Sherrill, 1903; and Marden and Dover, 1917.)

Cl

t°.	Gms. $HgCl_2$ per 100 Gms. C_6H_6.	t°.	Gms. $HgCl_2$ per 100 Gms. C_6H_6.
0	0.20	25	0.64
10	0.39	30	0.71
20	0.56	40	0.84

SOLUBILITY OF MERCURIC CHLORIDE IN ABSOLUTE ETHYL ETHER.

(Etard, 1894; Laszcynski, 1894; Köhler, 1879.)

t°.	Gms. $HgCl_2$ per 100 Gms. Solution.	t°.	Gms. $HgCl_2$ per 100 Gms. Solution.	t°.	Gms. $HgCl_2$ per 100 Gms. Solution.
−20	6	60	6	90	7.5
0	6	70	6.4	100	8
20	6	80	7	110	8.5

SOLUBILITY OF MERCURIC CHLORIDE IN CHLORINATED HYDROCARBONS AT 25°.

(Hoffmann, Kirmreuther and Thal, 1910.)

Solvent.	Formula.	Gms. $HgCl_2$ per 100 Gms. Solvent.	Solvent.	Formula.	Gms. $HgCl_2$ per 100 Gms. Solvent.
Ethylene Chloride	$CH_2Cl.CH_2Cl$	1.229	Dichlorethylene	$CHCl.CHCl$	0.114
Tetrachlorethane	$C_2H_2Cl_4$	0.090	Trichlorethylene	$CHCl.CCl_2$	0.0274
Chloroform	$CHCl_3$	0.101	Tetrachlorethylene	$CCl_2.CCl_2$	0.0072
Pentachlorethane	C_2HCl_5	0.0193	Carbontetrachloride	CCl_4	trace

100 gms. 95% formic acid dissolve 2.1 gm. $HgCl_2$ at 19°. (Aschan, 1913.)

100 gms. 95% formic acid dissolve 0.02 gm. Hg_2Cl_2 at 16.5°. "

100 cc. anhydrous hydrazine dissolve 1 gm. $HgCl_2$ with decomp. at room temp. (Welsh and Broderson, 1915.)

100 cc. anhydrous hydrazine dissolve 1 gm. Hg_2Cl_2 with decomp. at room temp. (Welsh and Broderson, 1915.)

100 gms. glycerol dissolve 80 gms. $HgCl_2$ at 25°. (Moles and Marquina, 1914.)

100 gms. glycerol dissolve 8 gms. $HgCl_2$? Hg_2Cl_2 at 15–16°. (Ossendowski, 1907.)

100 gms. anhydrous lanolin (m. pt. about 46°) dissolve 1.55 gms. $HgCl_2$ at 45°. (Klose, 1907.)

100 gms. sat. solution of $HgCl_2$ in Ethyl Ether contain 6.494 gms. $HgCl_2$ at about 20°. (Richard, 1926.)

SOLUBILITY OF MERCURIC CHLORIDE IN PYRIDINE.

(McBride, 1910.)

The determinations at the lower temperatures were made by stirring an excess of $HgCl_2$ with pyridine and analyzing the sat. solution. Those at the higher temperatures were made by the synthetic method.

t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	Solid Phase.
−32.6	2.76	$HgCl_2.2C_5H_5N$	94.7	60.72	$HgCl_2.2C_5H_5N+3HgCl_2.2C_5H_5N$
−21.75	7.86	"	74.7	48.38	$HgCl_2.C_5H_5N$ (unstable)
0.02	13.14	"	83.5	50.53	" (stable)
12.58	17.34	"	90.4	53.41	" "
18.78	19.78	"	97	56.45	" "
27.23	22.65	"	100.5	57.84	" "
31.05	24.46	"	104.2	60.72	" "
40.90	29.29	"	107	63.06	" (unstable)
50.10	34.94	"	106.2	...	" $+3HgCl_2.2C_5H_5N$
60.03	40.36	"	95.2	60.77	$3HgCl_2.2C_5H_5N$ (unstable)
70.15	46.44	"	106.4	61.93	" (stable)
76	...	" $+HgCl_2.C_5H_5N$	109.8	62.58	" "
80.02	51.52	$HgCl_2.2C_5H_5N$ (unstable)	114	63.18	" "
89	56.45	" "	124.2	65	" "
94.1	60.09	" "	145.5	69.66	" "

Data for this system are also given by Staronka (1910).

Data for the solubility of $HgCl_2.2C_5H_5N$ and of $Hg(NO_3)_2.2C_5H_5N.2H_2O$ in aqueous solution of pyridine at 18°.1 are given by Strömholm (1908). C1

Data for the solubility of diamine mercuric chloride, $(NH_3)_2HgCl_2 - NH_2HgCl$, in aqueous solutions of ammonia at 17.5° are given by Strömholm (1908).

SOLUBILITY OF MERCURIC CHLORIDE AND OF DOUBLE MERCURIC AND TETRA METHYL AMINE CHLORIDE $(CH_3)_4NCl.6HgCl_2$ IN AQ. ETHER AT 17°.

(Strömholm — J. pr. Ch. [2] 66, 443, '02; Z. physik. Chem. 44, 64, '03.)

Molecular Concentration per Liter.			Grams per Liter of Solution.		
H_2O.	$HgCl_2$ (*).	$HgCl_2$ (†).	H_2O.	$HgCl_2$ (*).	$HgCl_2$ (†).
0.0	0.1515	0.0342	0	41.16	9.26
0.0656	0.1795	0.0428	1.18	48.64	11.60
0.1311	0.2069	0.0516	2.36	56.08	14.00
0.1956	0.2339	0.0603	3.52	63.38	16.34
0.2611	0.2489	0.0690	4.70	70.16	18.70
0.3267	0.2849	0.0779	5.88	77.20	21.10
0.3922	0.3100	0.0866	7.06	84.02	23.48

(*) Results in this column are for solutions in contact with the Solid Phase $HgCl_2$. (†) Results in this column are for solutions in contact with the Solid Phase $(CH_3)_4NCl.6HgCl_2$.

SOLUBILITY OF MERCURIC CHLORIDE AND OF DOUBLE MERCURIC AND TETRA METHYL AMINE CHLORIDE IN ALCOHOL–ETHER SOLUTIONS AT 17°.

(Strömholm.)

Grams C_2H_5OH per Liter.	Grams $HgCl_2$ (*) per Liter.	Grams $HgCl_2$ (†) per Liter.
0.0	41.16	9.26
4.58	50.00	11.87
9.16	58.76	14.38
13.74	66.96	16.90

SOLUBILITY OF DOUBLE MERCURIC CHLORIDES IN AQUEOUS AND PURE ETHER AT 16.6°.

(Strömholm, 1902, 1903.)

Mol. Conc. of $HgCl_2$ per Liter of: Pure Ether.	Aq. Ether (1).	Aq. Ether (2).	Aq. Ether (3).	Gms. $HgCl_2$ per Liter of: Pure Ether.	Aq. Ether (4).	Aq. Ether (5).	Aq. Ether (6).	Solid Phase.
0.1515	0.2387	0.2647	0.3196	41.04	64.69	71.71	86.58	$HgCl_2$
0.0673	0.1157	0.1293	0.1617	18.23	31.41	35.05	43.79	$(CH_3.CH_2C_2H_4)_2SCl.6HgCl_2$
0.0404	0.0720	0.0835	0.1034	10.95	19.51	22.61	28.01	$(CH_3.C_2H_4CH_2C_2H_4)_2SCl.6HgCl_2$
0.0342	...	0.0706	...	9.26	...	19.10	...	$(CH_3)_4NCl.6HgCl_2$
0.0264	...	0.0568	...	7.14	...	15.39	...	$(C_2H_5)_3SCl.6HgCl_2$
0.0209	0.0400	0.0460	0.0594	5.66	10.83	12.48	16.10	$(CH_3\,C_2H_5)_2SCl.6HgCl_2$
0.0063	...	0.0144	...	1.70	...	3.90	...	$(CH_3)_3.H_2NCl.2HgCl_2$

(1) containing 0.21055 mol. H_2O per liter. (2) 0.2756 mol. H_2O per liter. (3) 0.421 mol. H_2O per liter. (4) containing 3.79 gms. H_2O per liter. (5) 4.97 gms. H_2O per liter. (6) 7.59 gms. H_2O per liter.

SOLUBILITY OF MIXTURES OF MERCURIC AND POTASSIUM CHLORIDES AT 25° IN:

Absolute Alcohol. (Foote, 1910)

Gms. per 100 Gms. Sat. Solution. KCl.	$HgCl_2$.	Solid Phase.
0.21	33.69	$HgCl_2+5KCl.6HgCl_2.2C_2H_5OH$
0.28	33.80	" "
0.22	24.84	$5KCl.6HgCl_2.2C_2H_5OH$
0.28	6.21	"
0.25	1.65	$5KCl.6HgCl_2.2C_2H_5OH+KCl$
0.17	1.57	" "
0.38	1.03	" "

Cl

Acetone. (Foote, 1910.)

Gms. per 100 Gms. Sat. Solution. KCl.	$HgCl_2$.	Solid Phase.
1.27	61.87	$HgCl_2+KCl.5HgCl_2.(CH_3)_2CO$
1.39	60.68	$KCl.5HgCl_2.(CH_3)_2CO$
2.58	55.85	"
2.78	54.41	" +5.6.2
2.93	48.13	5.6.2
2.52	18.04	"
3.34	13.26	"
2.92	11	" +KCl

5.6.2 = $5KCl.6HgCl_2.2(CH_3)_2CO$.

100 gms. of sat. abs. alcohol solution of $HgCl_2$ + NaCl contain 46.85 gms. $HgCl_2$ and 3.01 gms. NaCl at 25°. (Foote, 1910.)

SOLUBILITY OF MERCURIC CHLORIDE AND SODIUM CHLORIDE IN ETHYL ACETATE AT 40°.

(Linebarger — Am. Ch. J. 16, 214, '94.)

Mols. per 100 Mols. Acetate. NaCl.	$HgCl_2$.	Gms. per 100 Gms. Acetate NaCl.	$HgCl_2$.	Gms. per 100 Gms. Solution. NaCl.	$HgCl_2$.	Solid Phase.
0.8	12.9	0.53	39.7	0.53	28.4	$HgCl_2$
2.3	12.4	1.53	38.15	1.51	27.61	"
4.3	16.4	2.85	50.44	2.78	33.54	"
9.1	22.85	6.05	86.14	5.60	46.28	"
18.5	34.9	12.29	107.4	10.95	51.76	"
20.0	40.0	13.29	123.0	11.73	55.18	$HgCl_2$+NaCl

The double salt $(HgCl_2)_2.NaCl$ is formed under proper conditions.

Freezing-point Data are given for the Following Mixtures.

Mercuric Chloride + Mercuric Iodide	(Padoa and Tibaldi, 1903; Losana, 1926; Bergmann and Gonke, 1926.)
" " + Mercuric Sulfate	(Paic, 1930, 1933.)
" " + Lead Chloride	(Van Driel, 1935.)
" " + Ammonium Chloride	(Jänecke, 1923.)
" " + Silver Nitrate	(Bergmann, 1926.)
" " + Thallium Nitrate	" "
" " + Thallium Sulfate	(Waskresenskaja, 1929.)
" " + Selenium	(Olivari, 1909.)
" " + Antimony Chloride	(Kendall, Crittenden and Miller, 1923.)
" " + Sulfur	(Olivari, 1909.)
" " + Nitrobenzene	(Mascarelli, 1906; Mascarelli and Ascoli, 1907.)
" " + *o m* and *p* Nitrotoluene	(Mascarelli, 1906, 1907, 1909.)
" " + Urethan	(Mascarelli, 1908, 1909.)
" " + " + Nitronaphthalene	(" 1906, 1907.)
" " + " + *p*Nitrotoluene	(" 1908.)
" " + α Nitronaphthalene	(" 1906, 1907.)
" " + *p* Nitranisole	(" 1906.)

MERCUROUS Per CHLORATE $Hg_2(ClO_4)_2$

C10

Solubility of Mercurous Per Chlorate in Water.

(Newbery, 1936.)

t°	Gms. $Hg_2(ClO_4)_2$ per 100 gms. H_2O	Solid Phase	t°	Gms. $Hg_2(ClO_4)_2$ per 100 gms. H_2O	Solid Phase
-20	215	$Hg_2(ClO_4)_2.4H_2O$	37	455	$Hg(ClO_4)_2.2H_2O$
0	282	"	38	455	"
+ 8	315	"	40	457	"
17	355	"	50	480	"
20 (d = 2.960)	368	"	60	500	"
30	420	"	70	516	"
35	450	"	78	536	"
36	465	" + $Hg(ClO_4)_2.2H_2O$	99	580	"

Solubility of Mercurous Per Chlorate in Aqueous Solutions of Perchloric Acid at 21°.

(Newbery, 1936.)

Mols. free $HClO_4$ per 100 gms. H_2O	Gms. $Hg_2(ClO_4)_2$ per 100 gms. H_2O	Solid Phase
0.10	375	$Hg_2(ClO_4)_2.4H_2O$
0.38	300	"
0.46	280	"
1.27	21.2	$Hg_2(ClO_4)_2.2H_2O$
1.29	13.7	"

The total gm. mols. of $HClO_4$ in the above solutions is nearly constant hence each added gm. mol. of $HClO_4$ precipitate approximately one gm. mol. equivalent of the salt.

MERCUROUS CHROMATE Hg_2CrO_4

The Solubility Product of Mercurous Chromate in Water at 25° is 2.0×10^{-9} as quoted from Immerwahr by Brodsky, 1929.

MERCUROUS Phospho FLUORIDE Hg_2PO_3F

F One liter sat. solution of Mercury Phospho Fluoride in Water contains about 0.0005 gm. mols. (= 0.025 gm.) Hg_2PO_3F at 20°. (Lange, 1929.)

MERCUROUS IODIDE Hg_2I_2

SOLUBILITY OF MERCUROUS IODIDE IN WATER AT 25°. (Sherrill, 1903.)

One liter sat. solution contains 2×10^{-7} gms. Hg_2I_2, determined by indirect method.

Data for the solubility of mercurous iodide in aq. KI solutions at 25° are also given by Sherrill.

The Solubility Product of Mercurous Iodide in Water, calculated from measurements of the E.M.F. of a chain electroded by Brodsky, 1929, is as follows:

t°	Solubility Product
10.8	2.01×10^{-20}
14.9	5.10×10^{-20}
19.2	10.5×10^{-20}
25.0	49.5×10^{-20}
26.5	74.2×10^{-20}

I MERCURIC IODIDE HgI_2

SOLUBILITY OF MERCURIC IODIDE IN WATER.

t°	Gms. HgI_2 per liter	Authority
17.5	0.040	(Bourgoin, 1884.)
22.	0.054	(Rohland, 1898.)
22,5	0.001	(Naude, 1927.)
25.	0.059	(Morse, 1902.)

SOLUBILITY OF MERCURIC IODIDE IN WATER AT TEMPERATURES ABOVE 100° DETERMINED BY THE SYNTHETIC METHOD.

(Benrath, Gjedebo, Schiffers and Wunderlich, 1937.)

At 11.5 percent concentration of HgI_2 and temperature of 241° the mixture separates into two liquid layers, composed of a yellow solution and a wine red melt. These two layers mutually dissolve with rising temperature. At 77 percent HgI_2 and 338° the solution and melt become identical and mix in all proportions above that temperature.

t°	Gms. HgI_2 per 100 gms. sat. sol.	Solid Phase	t°	Gms. HgI_2 per 100 gms. sat. sol.	t°	Gms. HgI_2 per 100 gms. sat. sol.
196	3.7	HgI_2	243	12.0	328	54.4
229	9.4	"	257	15.7	336	68.0
241	11.5	"	272	18.7	338	75.0
241	98.0	"	295	27.5	336	82.7
255	100.0	"	314	41.0	322	90.5
			326	49.7	262	97.4

SOLUBILITY OF MERCURIC IODIDE IN AQUEOUS SOLUTIONS AT 25°.

(Herz and Paul, 1913.)

In Aq. BaI_2. Mols. per Liter. BaI_2.	HgI_2.	In Aq. CaI_2. Mols. per Liter. CaI_2.	HgI_2.	In Aq. NaI. Mols. per Liter. NaI.	HgI_2.	In Aq. SrI_2. Mols. per Liter. SrI_2.	HgI_2.
0.099	0.059	0.053	0.050	0.794	0.412	0.254	0.212
0.748	0.742	0.252	0.261	1.385	0.622	0.355	0.320
0.978	0.897	0.468	0.440	2.225	0.945	0.539	0.582
1.508	1.462	1.799	1.706			0.608	0.694

SOLUBILITY OF MERCURIC IODIDE IN AQUEOUS SOLUTIONS OF POTASSIUM IODIDE AT 25°. (Sherrill, 1903; Herz and Paul, 1913.)

Mols. per Liter. KI.	HgI_2.	Gms. per Liter. KI.	HgI_2.	Mols. per Liter. KI.	HgI_2.	Gms. per Liter. KI.	HgI_2.
0.05	0.025	8.3	11.4	1	0.50	166	227.2
0.10	0.05	16.6	22.7	1.5	0.75	249	340.8
0.20	0.10	33.2	45.4	2	1	332	454.5
0.50	0.25	83	113.6	2.5	1.25	415	578

Data for the distribution of mercuric iodide between aq. KI solutions and benzene at 25° are given by Sherrill, 1903.

EQUILIBRIUM IN THE TERNARY SYSTEM MERCURIC IODIDE, POTASSIUM IODIDE, WATER AT 20° AND 30°. (Dunningham 1914.)

Results at 20°. Gms. per 100 Gms Sat Sol. KI.	HgI_2.	Solid Phase.	Results at 30°. Gms. per 100 Gms. Sat. Sol. KI.	HgI_2.	Solid Phase.
50.9	19.3	KI	60.6	...	KI
44.4	32.4	"	40	53	" $+KHgI_3$
39	48	"	39.6	52.7	$KHgI_3$
37.4	53.6	" $+KHgI_3$	40	52.2	"
37.8	52.6	$KHgI_3$	40.2	51.2	"
35.1	52.2	"	39.3	50.3	"
35.5	51.2	$KHgI_3.H_2O$	33.7	49.8	"
26.7	50.3	" $+HgI_2$	33	52	"
26.6	49.4	HgI_2	31.4	51.7	$KHgI_3.H_2O$
23.7	40.2	"	29.1	52.2	"
14.9	22.5	"			

EQUILIBRIUM IN THE SYSTEM MERCURIC IODIDE, POTASSIUM IODIDE AND WATER AT 22.5°.

(Naude, 1927.)

The solutions were analyzed by reducing the mercury and converting the iodine to KI by adding KOH and C_2H_5OH and warming. The total KI in the filtrate from the Hg was titrated with standard solutions of $AgNO_3$ and KSCN.

Gms. per 100 gms. sat. sol. KI	HgI_2	Solid Phase	Gms. per 100 gms. sat. sol. KI	HgI_2	Solid Phase	Gms. per 100 gms. sat. sol. KI	HgI_2	Solid Phase
0.0	0.01	HgI_2	29.18	49.18	1.1.1½	34.84	51.53	1.1
1.95	2.02	"	31.18	49.28	"	36.45	51.28	KI
16.16	10.96	"	32.68	49.15	"	36.69	50.01	"
24.60	45.06	"	33.37	49.67	"	37.61	47.04	"
24.57	46.93	"	33.92	50.10	"	40.41	37.41	"
25.10	49.13	" + 1.1.1½	33.79	51.13	"	49.60	18.37	"
27.58	49.06	1.1.1½	34.04	51.74	1.1	58.33	1.60	"
28.44	48.97	"	34.92	51.58	"	59.20	0.0	"

1.1.1½ = $HgI_2.KI.1\frac{1}{2}H_2O$; 1.1 = $HgI_2.KI$

MERCURIC IODIDE HgI_2

EQUILIBRIUM IN THE SYSTEM MERCURIC IODIDE POTASSIUM IODIDE AND WATER AT SEVERAL TEMPERATURES.

(Pernot, 1928, 1927, 1931.)

The samples were analyzed by separating the HgI_2 from the KI by sublimation in a glass tube which could subsequently be cut and the amount of each component determined by weighing. The accuracy of the results of Dunningham, 1914, is questioned.

Results at 0°

I

Gms. per 100 gms. sat. sol.		Solid Phase
HgI_2	KI	
19.1	13.3	HgI_2
32.7	21.1	"
39.9	25.0	"
41.8	26.7	1.1.1
43.3	29.7	"
45.5	32.1	"
47.8	34.8	"
50.2	37.5	"
47.5	38.1	KI
43.7	38.9	"
39.2	40.0	"
34.0	41.9	"
28.4	43.9	"
24.1	45.6	"
19.3	47.4	"
15.6	49.2	"

Results at 10°

Gms. per 100 gms. sat. sol.		Solid Phase
HgI_2	KI	
19.6	12.0	HgI_2
34.9	22.0	"
41.7	25.5	"
44.8	27.0	1.1.1
46.6	30.7	"
48.1	33.7	"
49.3	35.7	"
50.8	37.5	"
50.9	37.9	" + KI
48.1	38.3	KI
46.5	38.6	"
44.7	39.0	"
38.2	41.2	"
35.7	42.3	"

Results at 20°

Gms. per 100 gms. sat. sol.		Solid Phase
HgI_2	KI	
10.3	7.4	HgI_2
24.3	16.2	"
34.7	21.3	"
41.3	24.6	"
48.2	27.3	" + 1.1.1
48.0	29.0	1.1.1
48.7	31.3	"
49.2	33.4	"
49.9	34.9	"
50.9	36.8	"
50.0	37.9	KI
45.3	39.1	"
31.0	44.4	"
16.7	50.6	"
8.7	53.8	"

Results at 34°

HgI_2	KI	Solid Phase
3.1	2.2	HgI_2
20.3	12.9	"
47.4	26.2	"
53.4	27.7	" + 1.1.1
52.4	29.3	1.1.1
51.9	30.7	"
51.7	34.4	" "
52.5	37.6	" + KI
49.8	38.3	KI
40.1	39.3	"
42.3	40.5	"
33.7	44.2	"
15.6	52.9	"

Results at 56°

HgI_2	KI	Solid Phase
4.1	3.2	HgI_2
27.4	16.6	"
46.1	25.0	"
57.1	27.5	"
57.4	28.8	1.1.1
56.4	30.2	"
54.9	32.8	"
54.2	37.5	" + KI
53.0	37.9	KI
46.6	39.8	"
41.2	42.0	"
24.7	49.4	"
12.8	56.1	"
3.9	61.4	"

Results at 80°

HgI_2	KI	Solid Phase
1.2	0.6	HgI_2
19.1	11.3	"
40.8	20.9	"
54.3	24.6	"
65.0	26.2	" + 1.1.1
63.2	27.6	1.1.1
61.1	29.4	"
58.2	33.0	"
57.5	36.2	" + KI
50.7	36.6	KI
46.5	40.4	"
28.9	48.3	"
15.5	56.2	"
8.0	60.8	"

1.1.1 = $HgI_2.KI.H_2O$. No evidence was obtained of the existance of the compound $HgI_2.KI$.

EQUILIBRIUM IN THE SYSTEM MERCURIC IODIDE, POTASSIUM IODIDE AND ETHYL ALCOHOL AT 34°.

(Pernot, 1931.)

Results using Absolute Alcohol			Results using 95% Alcohol		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
HgI_2	KI		HgI_2	KI	
49.7	14.6	HgI_2	16.9	4.3	HgI_2
58.6	18.5	"	41.4	11.6	"
58.8	18.7	" + $HgI_2.KI.C_2H_5OH$	54.2	16.7	"
57.0	19.5	$HgI_2.KI.C_2H_5OH$	58.2	18.3	" + $HgI_2.KI.H_2O$
54.8	20.9	"	57.0	19.0	$HgI_2.KI.H_2O$
52.7	23.2	"	55.6	20.3	"
51.7	24.8	"	53.0	23.3	"
51.1	25.7	"	51.3	26.9	"
50.1	26.3	KI	50.2	27.0	KI
47.7	25.7	"	20.6	15.3	"
			3.8	6.7	"

EQUILIBRIUM IN THE SYSTEM MERCURIC IODIDE, POTASSIUM IODIDE AND ANHYDROUS ACETONE AT 20°.

(Pernot, 1928, 1929, 1931.)

I

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
HgI_2	KI		HgI_2	KI	
37.1	8.4	HgI_2	65.0	21.0	1.1.1/3-1/4
60.5	13.6	"	64.3	24.4	"
65.8	18.1	"	64.2	21.6	" + KI
66.3	19.6	"	62.9	22.0	KI
66.4	20.4	" + 1.1.1/3-1/4	53.7	22.6	"
65.9	20.5	1.1.1/3-1/4	34.4	20.9	"

1.1.1/3-1/4 = $HgI_2.KI.1/3$ or 1/4 CH_3COCH_3

The author also gives determinations of the equilibrium in acetone containing 2 Vol. % H_2O and 3 Vol. % H_2O, at 20°, 34° and 56°. Great difficulty was experienced in obtaining homogeneous crystals of the double salts. By using different methods of obtaining saturation it was found that in acetone containing 3 Vol. % H_2O the only double salt obtained was $HgI_2.KI.H_2O$. In acetone containing 2 Vol. % H_2O the double salt $2HgI_2.3KI$ was obtained only at 56°. The salt $HgI_2.2KI$ was obtained at 56° and at 34° but not at 20°. The only other double salt found was $HgI_2.KI$.

100 gms. sat. solution of Mercuric Iodide in Acetone contain 3.08 gms. HgI_2 at 25°. (Zapata y Zapata, 1930.)

SOLUBILITY OF MERCURIC IODIDE IN ANHYDROUS ACETIC ACID DETERMINED BY THE SYNTHETIC METHOD.

(Davidson and Chappell, 1938.)

t°	Mols. HgI_2 per 100 mols. HgI_2 + CH_3COOH	Solid Phase	t°	Mols. HgI_2 per 100 mols. HgI_2 + CH_3COOH	Solid Phase
31	0.011	HgI_2	76	0.065	HgI_2
47	0.021	"	90	0.097	"
56	0.030	"	100	0.134	"
67	0.045	"	110	0.192	"

EQUILIBRIUM IN THE TERNARY SYSTEM MERCURIC IODIDE, POTASSIUM IODIDE, ETHYL ETHER AT 20°. (Dunningham, 1914.)

Two liquid layers with compositions as follows, are formed:

Gms. per 100 Gms. Upper Layer.		Gms. per 100 Gms. Lower Layer.		Solid Phase.
KI.	HgI_2.	KI.	HgI_2.	
1.1	2.8	None		$KI+KHgI_3$
1.1	2.4	17.6	53.2	$KHgI_3$
0.8	2.5	16.5	56.1	HgI_2
None		17	58.2	$KHgI_3+HgI_2$

Data are also given for the four component system, $HgI_2 + KI + (C_2H_5)_2O + H_2O$ at 20°. The results are of special interest since 3 liquid layers are formed.

SOLUBILITY OF MERCURIC IODIDE IN AQUEOUS ETHYL ALCOHOL:

At 18°. (Bourgoin.)

Solvent.	Gms. HgI_2 per Liter.
Abs. Alcohol	11.86
H_2O+80% 90° Alc.	2.857
H_2O+10% 90° Alc.	0.086

At 25°. (Herz and Knoch — Z. anorg. Ch. 45, 266, '05.)

Wt. % Alcohol in Solvent.	HgI_2 per 100 cc. Solution. Millimols.	HgI_2 per 100 cc. Solution. Grams.	Sp. Gr. of Solutions 25°/4°.
100	3.86	1.754	0.8033
95.82	2.56	1.162	0.8095
92.44	1.92	0.873	0.8154
86.74	1.38	0.623	0.8300
78.75	0.935	0.425	0.8405
67.63	0.45	0.204	0.8721

SOLUBILITY OF MERCURIC IODIDE IN AQUEOUS METHYL ALCOHOL AND IN AQUEOUS ETHYL ACETATE AT 25°. (Herz and Anders, 1907.)

In Aq. Methyl Alcohol.				In Aq. Ethyl Acetate.		
Wt. % CH_3OH in Solvent.	$d_{25/4}$ of Solvent.	$d_{25/4}$ of Sat. Sol.	Gms. HgI_2 per 100 cc. Sat. Sol.	Wt. % $CH_3COOC_2H_5$ in Solvent.	$d_{25/4}$ of Sat. Sol.	Gms. HgI_2 per 100 cc. Sat. Sol.
47.06	0.9186	0.9187	0.044	4.36	0.9973	0.013
64	0.8800	0.8834	0.158	96.74	0.9063	1.87
78.05	0.8489	0.8519	0.445	100	0.9011	1.09
100	0.7879	0.8155	2.590			

100 gms. sat. solution in 95% alcohol ($d_{15} = 0.8126$) contain 0.72 gm. HgI_2 at 0°, 1.06 gms. at 25° and 2.15 gms. at 50°. (Reinders, 1900.)

MERCURY IODIDE (ic) HgI_2

SOLUBILITY OF MERCURIC IODIDE IN METHYLAL ($HCH(OCH_3)_2$).

(Bourgoin, 1924.)

The methylal was purified by distillation over sodium. At the lower temperatures the solutions were saturated by constant agitation. At the higher temperatures the synthetic method was used.

t°.	Gms. HgI_2 per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. HgI_2 per 100 gms. sat. sol.	Solid Phase.
20	3.81	HgI_2 (red)	74	5.80	HgI_2 (red)
25	4.07	»	77	5.93	»
30	4.19	»	81	6.05	»
53	4.56	»	123	7.89	»
63	5.12	»	125 (tr. pt.)	7.96	» + HgI_2 (yellow)
67	5.32	»	136.5	8.00	HgI_2 (yellow)
71	5.56	»	166	8.14	»

SOLUBILITY OF MERCURIC IODIDE IN ALCOHOLS.

Alcohol.	Formula.	t°.	Sp. Gr. of Solution.	Gms. HgI_2 per 100 Gms. Alcohol.	Observer.
Methyl	CH_3OH	15–20	0.799	3.24	(Rohland.)
"	"	19	...	3.7	(Timofeiew.)
"	"	19.5	...	3.16	(de Bruyn.)
"	"	23	...	3.98	(Beckmann.)
"	"	66 (b. pt.)	...	6.512	(Sulc.)
Ethyl	C_2H_5OH	15–20	0.810	1.42	(Rohland.)
"	"	18	...	1.48	(Bourgoin.)
"	"	19	...	1.86	(Timofeiew.)
"	"	19.5	....	2.09	(de Bruyn.)
"	"	25	0.803	2.19	(Herz and Knoch.)
"	"	78 (b. pt.)	...	4.325	(Sulc.)
Propyl	C_3H_7OH	15–20	0.816	0.826	(Rohland.)
"	"	19	...	1.25	(Timofeiew.)
Amyl	$C_5H_{11}OH$	13	...	0.66	(Laszczynski.)
"	"	71	...	3.66	"
"	"	100	...	5.30	"
"	"	133.5	...	9.57	"
Isopropyl	$(CH_3)_2CH.OH$	81 (b. pt.)	...	2.266	(Sulc.)
Isobutyl	$(CH_3)_2CHCH_2OH$	22.5	...	0.51	(Timofeiew.)
"	"	105–107 (b. pt.)	...	2.433	(Sulc.)

I

SOLUBILITY OF MERCURIC IODIDE IN MIXTURES OF ALCOHOLS AT 25°.

(Herz and Kuhn, 1905.)

In $CH_3OH + C_2H_5OH$.			In $C_3H_7OH + CH_3OH$.			In $C_3H_7OH + C_2H_5OH$.		
Per cent CH_3OH in Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. HgI_2 per 100 cc. Sat. Sol.	Per cent C_3H_7OH in Solvent.	$d_{\frac{25}{4}}$ of Sat Sol.	Gms. HgI_2 per 100 cc. Sat. Sol.	Per cent C_3H_7OH in Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol	Gms. HgI_2 per 100 cc. Sat. Sol.
0	0.8038	1.80	0	0.8156	3.16	0	0.8038	1.80
4.37	0.8039	1.93	11.11	...	...	8.1	0.8036	1.73
10.40	0.8046	2.08	23.80	0.8155	3.04	17.85	0.8043	1.65
41.02	0.8077	2.32	65.20	...	...	56.6	0.8057	1.55
80.69	0.8131	2.89	91.80	0.8101	1.69	88.6	...	...
84.77	0.8140	2.96	93.75	0.8110	1.67	91.2	0.8099	1.52
91.25	0.8146	2.98	96.60	0.8108	1.53	95.2	0.8108	1.44
100	0.8156	3.16	100	0.8116	1.42	100	0.8116	1.42

SOLUBILITY OF MERCURIC IODIDE IN ACETONE IN ETHYL ACETATE AND IN BENZENE.

(Sulc; Krug and McElroy — J. Anal. Ch. 6, 186, '92; Laszczynski — Ber. 27, 2285, '94.)

In Acetone.		In Ethyl Acetate.		In Benzene.	
t°.	Gms. HgI_2 per 100 Gms. $(CH_3)_2CO$.	t°.	Gms. HgI_2 per 100 Gms. $CH_3COOC_2H_5$.	t°.	Gms. HgI_2 per 100 Gms. C_6H_6
−1	2.83	−20	1.49	15	0.22
18	3.36	+17.5	1.56	60	0.88
25	2.09 (K. and McE.)	21	1.64	65	0.95
40	4.73	40	2.53	84	1.24
58	6.07	55	3.19	80 (b.pt.)	0.825 (Sulc.)
56 (b.pt.)	3.249 (Sulc.)	76	4.31		

74–78 (b.pt.) 4.20 (Sulc.)

100 gms. acetone	dissolve 2.04 gms. HgI_2	at 23°.	(Beckmann and Stock, 1895.)
" benzene	" 0.25 " "	"	"
" chloroform	" 0.07 " "	"	"
" acetone	" 2 " "	(red) at 25°.	(Reinders, 1900.)
" "	" 3.09 " "	(yellow) at 25°.	"
" ethyl acetate	" 1.47 " "	at 18°.	(Naumann, 1910.)

One liter sat. solution in benzene contains 2.24 gms. HgI_2 at 25°.
(Abegg and Sherrill, 1903.)

SOLUBILITY OF MERCURIC IODIDE IN ANILINE.

(Pearce and Fry, 1914.)

t°.	Gms. HgI_2 per 100 Gms. Aniline.	Solid Phase.	t°.	Gms. HgI_2 per 100 Gms. Aniline.	Solid Phase.
−11.48*	...	$C_6H_5NH_2+HgI_2.2C_6H_5NH_2$	48.8	128.1	HgI_2 (red)
− 6.5	23.35	$HgI_2.2C_6H_5NH_2$	63.6	163.8	"
+ 0.4	28.69	"	70.82	184.1	"
17.8	42.85	"	76.2	201.6	"
21.1	47.55	"	95.9	246.7	"
26.9	55.47	"	108†	...	" + HgI_2 (yellow)
30.1	62.05	"	115.7	281.8	HgI_2 (yellow)
36.2	75.80	"	137.2	285.2	"
42.9	96.49	"	181.1	297.9	"
46.8†	...	" + HgI_2 (red)	199.1	863.2	"

I

* Eutec. † Tr. pt.

Additional data on this system are also given by Staronka, 1910.

Data for the solubility of mercuric iodide in nitrobenzene and in *p* nitrotoluene, determined by the synthetic (sealed tube method), are given by Smits and Bakhorst (1915). The transition point of HgI_2, red to yellow, was found to be at 1.68 mol. per cent HgI_2 and 127.5° in nitrobenzene and 1.81 mol. per cent HgI_2 and 128° in *p* nitrotoluene. The interesting part of the investigation is the characteristic prolongation of the melting line above the transition point. Similar data for the solubility of mercuric iodide in nitrobenzene, *m* nitrotoluene, *p* nitrotoluene and in nitronaphthalene, determined by the freezing-point method, using a Beckmann apparatus, are given by Mascarelli (1906a). Observations on the appearance and color changes of the HgI_2 are given.

SOLUBILITY OF MERCURIC IODIDE IN CARBON DISULFIDE.

(Linebarger, 1894; Arctowski, 1894, 1895–96.)

t°.	Gms. HgI_2 per 100 Gms. Solution.	t°.	Gms. HgI_2 per 100 Gms. Solution.	t°.	Gms. HgI_2 per 100 Gms. Solution.
−116	0.017	− 5	0.141	15	0.271
− 93	0.023	0	0.173	20	0.320
− 86.5	0.024	+ 5	0.207	25	0.382
− 10	0.107	10	0.239	30	0.445

One liter sat. solution of mercuric iodide in CS_2 contains 3.127 gms. at 15°.
(Dawson, 1909b).

One liter sat. solution of mercuric iodide in CCl_4 contains 0.170 gm. at 18°.
(Dawson, 1909b)

Data are also given by Dawson for the distribution of HgI_2 between aqueous solutions of KI and CS_2 at 15° and aqueous solutions of KI and CCl_4 at 18°.

100 cc. anhydrous hydrazine dissolve 69 gms. HgI_2 with precipitation of Hg at room temp. (Welsh and Broderson, 1915.)

SOLUBILITY OF MERCURIC IODIDE IN SEVERAL ORGANIC SOLVENTS.

(Sulc — Z. anorg. Ch. 25, 401, '00.)

Solvent.	Formula.	t°.	Gms. HgI_2 per 100 Gms. Solvent..
Chloroform	$CHCl_3$	18–20	0.040
Chloroform	$CHCl_3$	61 (b. pt.)	0.163
Bromoform	$CHBr_3$	18–20	0.486
Tetra Chlor Methane	CCl_4	18–20	0.006
Tetra Chlor Methane	CCl_4	75 (b. pt.)	0.094
Ethyl Bromide	C_2H_5Br	18–20	0.643
Ethyl Bromide	C_2H_5Br	38° (b. pt.)	0.773
Ethylene Di Bromide	$C_2H_4Br_2$	18–20	0.748
Ethyl Iodide	C_2H_5I	18–20	2.041
Ethylene Di Chloride	$C_2H_4Cl_2$	85.5° (b. pt.)	1.200
Iso Butyl Chloride	$(CH_3)_2.CHCH_2Cl$	69 "	0.328
Methyl Formate	$HCOOCH_3$	36–38 "	1.166
Ethyl Formate	$HCOOC_2H_5$	52–55 "	2.150
Methyl Acetate	CH_3COOCH_3	56–59 "	2.500
Acetal	$CH_3CH(OC_2H_5)_2$	105 "	2.000
Epi Chlor Hydrine	$CH_2.O.CH.CH_2Cl$	117 "	6.113
Hexane	C_6H_{14}	67 ...	0.072

I

SOLUBILITY OF MERCURIC IODIDE IN ETHER AND IN METHYLENE IODIDE.

In Ether. (Sulc; Laszczynski.)		In Methylene Iodide. (Retgers — Z. anorg. Ch. 3, 253, '93.)	
t°.	Gms. HgI_2 per 100 Gms. $(C_2H_5)_2O$.	t°.	Gms. HgI_2 per 100 Gms. CH_2I_2.
0	0.62	15	2.5
36	0.97	100	16.6
35 (b. pt.)	0.47 (Sulc)	180	58.0

SOLUBILITY OF MERCURIC IODIDE IN FATTY BODIES.

(Mehu — J. pharm. chim. [5] 12, 249, '85.)

Solvent.	t°.	Gms. HgI_2 per 100 Gms. Solvent.	Solvent.	t°.	Gms. HgI_2 per 100 Gms. Solvent
Bitter Almond Oil	25	0.5	Vaseline	25	0.025
Bitter Almond Oil	100	1.3	Vaseline	100	0.20
Castor Oil	25	4.0	Poppy Oil	25	1.0
Castor Oil	100	20.0	Olive Oil	25	0.4
Nut Oil	100	1.3	Carbolic Acid	100	2.0

100 grams oil of bitter almonds dissolve 5.0 grams $HgI_2.KI$ at 25°. (Mehu.)

SOLUBILITY OF MERCURIC IODIDE IN OILS.

(Anon, 1903, 1904.)

Oil.	Gms. HgI_2 per 100 cc. Oil.	Oil.	Gms. HgI_2 per 100 cc. Oil.
Castor Oil	1.90	Peanut Oil	0.52
Walnut "	1.29	Olive "	0.45
Linseed "	1.23	Almond "	0.39
Cod Liver "	0.545	Vaseline	0.26

SOLUBILITY OF MERCURIC IODIDE IN PYRIDINE.

(Determinations from −50° to 98.5° made by saturating the solvent at constant temperatures are given by Mathews and Ritter (1917). Measurements of the points of solidification of various mixtures of the two components, covering the range from 10° to 135°, are given by Staronka (1910).

t°.	Gms. HgI_2 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. HgI_2 per 100 Gms. Sat. Sol.	Solid Phase.
−50	1.93	$HgI_2.2C_5H_5N$	90.08	61.43	$HgI_2.2C_5H_5N$
−31.5	4.27	"	100	65.72	"
−10	10.28	"	105	68.89	"
− 0.1	14.85	"	107 m. pt.	72.09	"
+ 8.83	18.42	"	105	75.67	"
20.02	24.40	"	100	79.73	"
25.55	27.90	"	90	84.16	"
40.08	37.64	"	87 Eutec.	85.17	" $+HgI_2.C_5H_5N$
50.02	43.15	"	100	86	$HgI_2.C_5H_5N$
60.07	48.29	"	120	87.16	"
80.05	57.60	"	135	88.78	"

SOLUBILITY OF MERCURIC IODIDE IN QUINOLINE.

(Staronka, 1910.)

I

t°.	Mols. HgI_2 per 100 Mols. $HgI_2+C_9H_7N$.	Solid Phase.	t°.	Mols. HgI_2 per 100 Mols. $HgI_2+C_9H_7N$.	Solid Phase.
100	4.7	$HgI_2.2C_9H_7N$	160	37.7	$HgI_2.C_9H_7N$
115.5	9.1	"	165	41.6	"
133.5	13.2	"	165	43	"
138	23.1	"	170	48.8	"
145	26.7	$HgI_2.C_9H_7N$	169.5	49.5	"
153	31.4	"	166.5	54.4	"

100 gms. liquid Sulfur Dioxide dissolve 0.012 gm. HgI_2 at 0°. (Jander and Ruppolt, 1937.)

Fusion-point data are given for the following mixtures.

$HgI_2 + AgNO_3$ (Bergmann, 1921, 1922-4, 1926.)
" $+ HgSO_4$ (Paic, 1930, 1933.)
" + I (Olivari, 1908.)
" $+ TlNO_3$ (Bergmann, 1926.)
" $+ TlSO_4$. (Woskresenskaja, 1929.)

MERCURIC Ammonium IODIDE $HgI_2.2NH_4I.H_2O$

100 gms. sat. sol. of Mercuric Ammonium Iodide in Water contain 22.6 gms. Hg, 4.5 gms. NH_4 and 62.3 gms. I at 26°; d of sat. sol. = 2.98. (Duboin, 1905.)

MERCURIC IODIDE Diamine $(NH_3)_2HgI_2$.

Data for the solubility of diamine mercuric iodide in aqueous ammonia solutions at 20° are given by Francois (1900). The solid is not stable in solutions containing less than 48 gms. NH_3 per liter.

MERCUROUS IODATE $Hg_2(IO_3)_2$.

The Solubility Product of Mercurous Iodate in Water at 25° is 1.3×10^{-18} as quoted from Spencer, 1912, by Brodsky, 1929.

MERCURY NITRATE (ic) $Hg(NO_3)_2$, (ous) $Hg_2(NO_3)_2$.

100 gms. anhydrous lanolin (m. pt. about 46°) dissolve 1.15 gm. $Hg(NO_3)_2$ at 45°. (Klose, 1907.)

100 cc. anhydrous hydrazine dissolve about 2 gms. $Hg_2(NO_3)_2$ with precipitation of Hg at room temp. (Welsh and Broderson, 1915.)

MERCUROUS NITRATES

Equilibrium in the System, Mercurous Oxide, Nitrogen Pentoxide and Water at 25°.

(Denham and Fife, 1933.)

In the case of the normal salt, mixtures of the required amounts of HNO_3, H_2O and finely ground mercurous nitrate were shaken in sealed bottles until equilibrium was reached. For the preparation of the basic salts either mercurous nitrate was shaken with the necessary amount of water or mercurous oxide was shaken with HNO_3. The mercury in the saturated solutions was determined by electrolysis and the nitrate by a modification of the Devarda method.

d. of sat. solution	Gms. per 100 gms. sat. sol.		Solid Phase	d of sat. solution	Gms. per 100 gms. sat. sol.		Solid Phase
	Hg_2O	N_2O_5			Hg_2O	N_2O_5	
1.039	3.03	1.00	A	1.557	31.00	12.10	α D
1.058	4.64	1.40	"	1.447	26.88	12.27	"
1.082	6.55	2.30	"	1.396	22.30	12.87	"
1.095	7.57	2.44	"	1.382	21.21	13.30	"
1.113	8.66	3.01	"	1.359	19.25	14.00	"+βD
1.117	9.12	3.22	"+B	1.366	19.63	14.53*	αD
1.139	10.46	3.61	B	1.455	22.97	15.84*	"
1.200	15.10	5.44	"	1.464	23.30	16.20*	"
1.275	18.42	6.60	"	1.563	27.65	17.20*	"
1.328	21.10	7.70	"	1.638	30.80	18.00*	"
1.366	23.53	8.22	"	1.781	34.88	19.35*	"
1.450	27.28	9.61	"	1.485	26.38	13.29*	βD
1.502	29.31	10.43	"+C	1.442	24.22	13.55*	"
1.510	29.70	10.50	C	1.405	22.12	13.82*	"
1.527	30.18	10.75	"	1.365	19.84	13.87*	"
1.565	31.76	11.20	"	1.359	19.25	14.00	"
1.608	33.00	11.79	"+D	1.426	20.66	17.70	"

NO

* = Metastable

A = $2Hg_2O.N_2O_5.H_2O$; B = $5Hg_2O\ 3N_2O_5.3H_2O$; C = $4Hg_2O.3N_2O_5.H_2O$;

D = $Hg_2(NO_3)_2.2H_2O$ which exists in an α and a β form.

MERCURIC Ethyl and Other NITRATES

Solubility of Each Separately in Water at 25°.

(Johns, Peterson and Hixon, 1930.)

Compound	Formula	Gm. Mols. Compound per liter sat. sol.
Ethyl Mercuric Nitrate	$C_2H_5HgNO_3$	0.0239
Butyl " "	$C_4H_9HgNO_3$	0.003
Benzyl " "	$C_6H_5CH_2HgNO_3$	0.00263
p Xylyl " "	$C_6H_4(CH_3)_2HgNO_3$	0.00057
Phenyl " "	$C_6H_5HgNO_3$	0.00236

MERCUROUS OXIDE Hg_2O

The Solubility Product of Mercurous Oxide in Water at 25° is 1.8×10^{-24} as quoted from Burgarsky, 1897, by Brodsky, 1929.

MERCURIC OXIDE HgO

SOLUBILITY IN WATER.

(Schick, 1903.)

t°.	Gms per 1000 cc. Solution.	
25	0.0518 yellow HgO	0.0513 red HgO
100	0.410 yellow HgO	0.379 red HgO

At 25° the mixtures were constantly agitated for 4 days or longer. At 100° the solutions were boiled and stirred for 5 hours. A longer period would probably have caused better agreement between the red and yellow HgO.

One liter H_2O dissolves 0.05 gm. HgO (red, large grains) at 25°. (Hulett, 1901.)

One liter H_2O dissolves 0.15 gm. HgO (red, finest grains) at 25°. "

Very careful determinations of the solubility of yellow and of red Mercuric Oxide in Water - both determined directly and by extrapolation from measurements in aqueous alkali solutions-gave the value 0.000225
0 gm. mols. (= 0.0487 gm.) of red HgO per 1000 gms. H_2O and 0.000237 gm. mols. (= 0.0513 gms.) of yellow HgO per 1000 gms. H_2O, at 25°. (Garrett and Hirschler, 1938.)

One liter sat. sol. of $Hg(OH)_2$ in H_2O contain 0.000251 gm. mol. (= 0.0544 gm.) HgO at 25°. (Herz and Hiebenthal, 1928.)

SOLUBILITY OF YELLOW AND OF RED MERCURIC OXIDE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 25°.

(Garrett and Howell, 1939.)

Results for Yellow Mercuric Oxide						Results for Red HgO	
Gm. Mols. per 1000 gms. H_2O		Gm. Mols. per 1000 gms. H_2O		Gm. Mols. per 1000 gms. H_2O		Gm. Mols. per 1000 gms. H_2O	
$HNO_3 \times 10^{-4}$	$HgO \times 10^{-4}$	$HNO_3 \times 10^{-4}$	$HgO \times 10^{-4}$	$HNO_3 \times 10^{-4}$	$HgO \times 10^{-4}$	$HNO_3 \times 10^{-4}$	$HgO \times 10^{-4}$
0.5	2.43	156	58.5	700	312	1.0	2.98
1.0	2.57	200	65.5	703	312	2.0	3.14
2.0	2.67	200	68.0	722	329	3.0	2.77
4.0	3.11	300	111.0	743	333	5.0	3.48
6.0	3.35	300	108.0	761	349	7.0	3.56
8.0	3.80	400	173.0	780	362	9.0	4.02
10.3	4.15	400	169.0	976	449	20.0	6.32
20.0	6.08	500	217.0	1170	536	30.0	9.17
40.0	12.1	585	236.0	1370	638	50.0	14.2
60.0	18.3	600	253.0	1400	596	70.0	20.2
80.0	23.2	634	262.0	1560	718	90.0	27.9
106.0	30.0	683.	299.0	1600	662	200.0	64.2

The above values for HNO_3 are those of the solutions as made up. The solutions were maintained in an atmosphere of nitrogen. Calculations of the acidity corrected for the amount of acid used to react with the oxide are given.

SOLUBILITY OF MERCURIC OXIDE IN AQUEOUS HYDROFLUORIC ACID AT 25°.

(Jaeger, 1901.)

Normality of HF.	Gms. Hg per 9.6 cc. Sat. Sol.	Gm. Atoms Hg per Liter.
0.12	0.0242	0.01258
0.24	0.0475	0.0247
0.57	0.1210	0.0629
1.11	0.2247	0.1168
2.17	0.4976	0.2586

SOLUBILITY OF MERCURIC OXIDE IN AQUOUS SALT SOLUTIONS AT 25°.

(Herz and Hiebenthal, 1928.)

Results for aqueous:

Potassium Chloride		Lithium Chloride		Sodium Chloride	
Gm. Equivalents per liter		Gm. Equivalents per liter		Gm. Equivalents per liter	
KCl	HgO	LiCl	HgO	NaCl	HgO
0.35	0.0008	0.35	0.0008	1.05	0.0026
0.70	0.0011	0.51	0.0011	1.55	0.0036
0.85	0.0013	0.74	0.0014	2.12	0.0046
1.49	0.0023	0.99	0.0020	3.13	0.0074
2.35	0.0038	2.15	0.0053	4.22	0.0091
3.13	.0.0054	2.47	0.0061	5.45	0.0158

MERCURY OXIDE (ic) HgO.

SOLUBILITY OF MERCURIC OXIDE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE AT 25°. (Fuseya, 1920.)

The mixtures were rotated in sealed tubes for at least 4 days. Equilibrium was approached both from above and below.

Mols. NaOH per liter of sat. sol.	Millimols. HgO per liter of sat. sol.	Mols. NaOH per liter of sat. sol.	Millimols. HgO per liter of sat. sol.
0.0000	23.4	0.502	26.6
0.0096	24.6	1.0758	28.3
0.0503	24.7	2.09	30.9
0.0955	24.9		

It is pointed out by Garrett and Hirschler, 1938, that through an obvious error the above solubilities of HgO are 100 times too high.

SOLUBILITY OF YELLOW AND OF RED MERCURIC OXIDE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE AT 25°.

(Garrett and Hirschler, 1938.)

The determinations were made in an atmosphere of nitrogen. Equilibrium was approached both from under saturation and super saturation. The alkali was determined by titration, using methyl orange as indicator. The mercury was determined by a potentiometric method.

Results for Yellow HgO				Results for Red HgO			
Gm. Mols. per 1000 gms. H_2O		Gm. Mols. per 1000 gms. H_2O		Gm. Mols. per 1000 gms. H_2O		Gm. Mols. per 1000 gms. H_2O	
NaOH	HgO	NaOH	HgO	NaOH	HgO	NaOH	HgO
0.00010	0.000234	0.3467	0.000249	0.00088	0.000225	0.7223	0.000251
0.00082	0.000238	0.5995	0.000255	0.0050	0.000225	1.001	0.000262
0.0018	0.000232	0.8515	0.000265	0.0093	0.000226	1.638	0.000272
0.0040	0.000237	1.512	0.000282	0.0187	0.000224	1.987	0.000276
0.0100	0.000237	2.562	0.000296	0.1064	0.000227	2.940	0.000294
0.0207	0.000237	3.405	0.000306	0.3398	0.000231	3.956	0.000297
0.1015	0.000244	4.460	0.000312	0.4406	0.000242	4.936	0.000298
0.2230	0.000241	5.952	0.000311	0.5818	0.000246		

SOLUBILITY OF YELLOW MERCURIC OXIDE IN AQUEOUS ALKALIES AND ALKALINE SALT SOLUTIONS AT 25°.

(Garrett and Hirschler, 1938.)

Gm. Mols. per 1000 gms. H_2O				
Alkali	+	Salt		HgO
0.1082	KOH	—		0.000240
0.3038	"	—		0.000243
0.8175	"	—		0.000253
0.0689	LiOH	—		0.000239
0.2019	"	—		0.000246
0.4667	"	—		0.000252
0.1361	NaOH	0.8143	KNO_3	0.000291
0.1789	"	1.725	"	0.000337

Gm. Mols. per 1000 gms. H_2O				
Alkali	+	Salt		HgO
0.1328	NaOH	2.400	KNO_3	0.000384
0.1462	"	1.072	$NaNO_3$	0.000326
0.1738	"	2.637	"	0.000496
0.1682	"	6.397	"	0.000753
0.1433	"	0.5863	Na_2SO_4	0.000301
0.1380	"	1.145	"	0.000347
0.1649	"	1.668	"	0.000370
0.1454	"	2.137	"	0.000390

MERCURY SULFIDE HgS.

One liter H_2O dissolves 0.054×10^{-4} mols. HgS = 0.0000125 gm. at 18°.
(Weigel, 1906, 1907. See also Bruner and Zawadzki.)

MERCUROUS SULFATE Hg_2SO_4

The Solubility Product of Mercurous Sulfate in Water at 25° is 4.7×10^{7} as quoted from Bugarsky, 1897, by Brodsky, 1929.

SO

SOLUBILITY IN WATER, IN SULFURIC ACID AND IN POTASSIUM SULFATE AT 25°.

(Drucker, 1901; Wright and Thomson, 1884-85; Wilsmore, 1900.)

Solvent.	Hg_2SO_4 per Liter.		
	Gm. Mol.	Gms.	
Water	11.71×10^{-4}	0.58	(0.47 W. and T., 0.39 W.)
Aq. H_2SO_4 (1.96 gms. per liter)	8.31 "	0.41	
Aq. H_2SO_4 (4.90 gms. per liter)	8.78 "	0.44	
Aq. H_2SO_4 (9.80 gms. per liter)	8.04 "	0.40	
Aq. K_2SO_4 (34.87 gms. per liter)	9.05 "	0.45	

SOLUBILITY OF MERCUROUS SULFATE IN WATER AT DIFFERENT TEMPERATURES.

(Barre, 1911.)

t°.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
	Hg_2SO_4.	H_2SO_4.	
16.5	0.055	0.008	Hg_2SO_4
33	0.060	0.018	"
50	0.065	0.037	"
75	0.074	0.063	"
100	0.092	0.071	"

The mixtures were kept at constant temp. but not constantly agitated. By successive treatment of a given amount of Hg_2SO_4 with H_2O, it is gradually converted to an almost insoluble basic salt, $Hg_2O.Hg_2SO_4.H_2O$.

SOLUBILITY OF MERCUROUS SULFATE IN AQUEOUS POTASSIUM SULFATE SOLUTIONS. (Barre, 1911.)

Results at 15°.			Results at 33°.			Results at 75°.		
Gms. per 100 Gms. Sat. Sol.			Gms. per 100 Gms. Sat. Sol.			Gms. per 100 Gms. Sat. Sol.		
K_2SO_4.	Hg_2SO_4.	H_2SO_4 (free).	K_2SO_4.	Hg_2SO_4.	H_2SO_4 (free).	K_2SO_4.	Hg_2SO_4.	H_2SO_4 (free)
2.90	0.0475	0.0080	2.94	0.0677	0.0250	3.10	0.1344	0.1684
5.70	0.0703	0.0093	5.68	0.1015	0.0350	5.75	0.2120	0.2135
8.22	0.0912	0.0098	8.30	0.1364	0.0441	8.50	0.2951	0.2514
8.77	0.0994	...	10.70	0.1724	0.0438	13.20	0.4610	0.2503
9.44	0.1080	0.0110	11.90	0.1902	0.0420	17.30	0.6440	0.2225

SOLUBILITY OF MERCUROUS SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 0° AND AT 28°.

(Craig, Vinal and Vinal, 1936.)

Equilibrium was approached both from above and below. Mercury was determined electrolytically and the H_2SO_4 in the electrolyzed solution was titrated. The acid equivalent to the Hg was subtracted from the total to obtain the H_2SO_4 in the original solution. The results were plotted and the following average values obtained from the curve.

Gm. Mols. H_2SO_4 per 1000cc solution	Gm. Hg per 100cc sat. sol. at: 0°	28°	Gm. Mols. H_2SO_4 per 1000cc solution	Gm. Hg per 100cc sat. sol. at: 0°	28°
0.001	0.0351	—	0.100	0.0183	0.0344
0.002	0.0290	0.0463	0.200	0.0198	0.0379
0.004	0.0239	0.0395	0.40	0.0224	0.0423
0.006	0.0215	0.0360	0.60	0.0239	0.0451
0.008	0.0203	0.0346	0.80	0.0247	0.0467
0.010	0.0197	0.0338	1.00	0.0249	0.0470
0.020	0.0182	0.0318	1.50	0.0240	0.0452
0.040	0.0178	0.0317	2.00	0.0216	0.0409
0.060	0.0178	0.0327	3.00	0.0139	0.0294
0.080	0.0180	0.0337	4.00	0.0078	—

The above results calculated from 28° to 25° agree very closely with the previous careful determinations of Hulett, 1904.

SO

MERCURY SULFATE (ic) $HgSO_4$.

EQUILIBRIUM IN THE SYSTEM, MERCURY OXIDE, SULFUR TRIOXIDE, WATER

(Hoitsema, 1895.)

Results expressed in molecules per sum of 100 molecules of the three components of the system. The mixtures were rotated for 3 hours or longer.

Results at 25°.

Liquid Phase. H_2O.	SO_3.	HgO.	Solid Phase.
98.5	1.24	0.33	$3HgO.SO_3$
96.6	2.49	0.92	"
94.4	3.93	1.65	"
93.9	4.24	1.85	$3HgO.SO_3$ and $3HgO.2SO_3.2H_2O$
94.4	4.52	2.12	
93.4	4.65	1.94	$3HgO.2SO_3.2H_2O$
92.9*	4.81	2.29	$3HgO.SO_3$
92.9	5.11	1.98	$3HgO.2SO_3.2H_2O$
92.3*	5.20	2.54	$3HgO.SO_3$
92.3	5.58	2.09	$3HgO.2SO_3.2H_2O$
92.1	5.81	2.08	"
91.9	5.97	2.90	$3HgO.SO_3$
91.9	6.15	2.05	$3HgO.2SO_3.2H_2O$
91.3	6.54	2.13	"
91.2	6.77	2.02	$HgO.SO_3.H_2O$
91.3	6.90	1.80	"
91.3	7.67	1.01	"
91.3	7.84	0.89	$HgO.SO_3.H_2O$ and
91	8.36	0.69	$HgO.SO_3$
90.5	8.95	0.53	"
89.2	10.6	0.22	$HgO.SO_3$
75.8	24.2	trace	"
39.2	60.7	trace	"

Results at 50°.

Liquid Phase. H_2O.	SO_3.	HgO.	Solid Phase.
98.9	0.96	0.17	$3HgO.SO_3$
96	3.05	0.93	"
93.2	4.92	1.90	"
92.8	5.10	2.09	"
92.8	5.16	2.06	"
92.5	5.34	2.12	"
92.2	5.57	2.20	$3HgO.SO_3$ and $3HgO.2SO_3.2H_2O$
92.1	5.75	2.11	$3HgO.2SO_3.2H_2O$
92	5.80	2.16	"
91.2*	6.27	2.56	$3HgO.SO_3$ and $HgO.SO_3$
91.5	6.34	2.19	$3HgO.2SO_3.2H_2O$ and $HgO.SO_3$
91.3*	6.37	2.30	$HgO.SO_3$
91.6	6.69	1.75	"
91.1	8.32	0.57	"
90.5	9.11	0.4	"
89.6	10.2	0.23	"
86.7	13.2	0.06	"
31.6	68.4	0.03	"

* Indicates unstable equilibrium

SOLUBILITY OF BASIC MERCURIC SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25-30°.

(Vosburgh and Lackey, 1930.)

The mercury was determined by titration with standard thiocyanate solution.

Gm. Mols. H_2SO_4 per liter	Gm. Mols. per liter HgO	Gm. Mols. per liter SO_3
0.01194	0.00103	0.01228
0.0954	0.0131	0.0998
0.1450	0.0203	0.1518

100 gms. liquid Sulfur Dioxide dissolve 0.010 gm. $HgSO_4$ at 0°. (Jander and Ruppolt, 1937.)

Freezing-point data for mixtures of Hg_2SO_4 + H_2SO_4 are given by Kendall and Davidson, 1921.

SeO

MERCURY SELENITE $HgSeO_3$.

SOLUBILITY IN AQUEOUS SODIUM SELENITE SOLUTIONS AT 25°.

(Rosenheim and Pritze, 1909.)

Normality of Na_4SeO_3 Solution.	Gms. $HgSeO_3$ per 100 Gms. Sat. Sol.	Normality Na_4SeO_3 of Solution.	Gms. $HgSeO_3$ per 100 Gms. Sat. Sol.
0.0625	0.18	0.5	0.70
0.125	0.32	1	1.39
0.25	0.53	2	2.73

HOLMIUM SULFATE $Ho_2(SO_4)_3.8H_2O$

100 gms. H_2O dissolve 8.181 gms. $Ho_2(SO_4)_3.8H_2O$ at 20° and 4.52 gms. at 40°. (Jackson and Reinacker, 1930.)

IODINE I_2

SOLUBILITY OF IODINE IN GASES AND THE VAPORS OF SOLVENTS.

Experimental determinations of the solubility of Iodine vapor in air are given by Baxter, 1907 and Baxter and Grose, 1915; in CO_2 and in H_2 by Braune and Strassmann, 1929; in air N_2, O_2, CH_4, CO and the vapors of $CHCl_3$, CS_2, CCl_4, Hexane and Ethyl Ether, by Brüll and Ellerbrock, 1934.

SOLUBILITY OF IODINE IN WATER.

The results of Sammet, 1905; Carter, 1925, 1928; Hartley, 1908; Lanza, 1931, and Kracek, 1931, were plotted on cross section paper and the following values read from the average curve.

t°	Gms. I per liter sat. sol	t°	Gms. I per liter sat. sol.	t°	Gms. I per liter sat. sol.
0	0.14	30	0.385	80	2.25
10	0.20	40	0.52	90	3.15
20	0.285	50	0.71	100	4.45
25	0.335	60	1.00	106	5.60
		70	1.50	112.3	7.20*

*Invariant Point.

Lanza found that supersaturation occurs easily, especially at the higher temperatures, and such solutions give up their iodine very slowly.

By means of determinations made in sealed tubes by the synthetic method, Kracek found that above 112.3° two liquid layers are formed. The critical solution temperature, estimated to be above 300°, could not be reached because of the extremely high vapor pressure developed by the system. The following points on the curve for the liquid layers were determined.

Aqueous Layer		Liquid Iodine Layer	
t°	Gms. I. per 100 gms. liquid layer	t°	Gms. I per 100 gms. liquid layer
126.5	0.976	112.3	99.907*
143.2	1.422	155	99.712
156.4	1.947	186	99.530
175.9	3.082	>225	99.083
188.4	4.125		
206.7	6.587		

SOLUBILITY OF IODINE IN AQUEOUS SOLUTIONS OF HYDROBROMIC ACID.

(Lee and Lee, 1936.)

Gm. Mols. HBr per liter sat. sol.	Gm. Mols. I_2 per liter sat. solution at:			
	15°	25°	35°	45°
0.05	0.00167	0.00221	0.00281	0.00302
0.100	0.00241	0.00319	0.00400	0.00533
0.588	0.00849	0.01048	0.01348	0.01766
1.209	0.01678	0.02109	0.02690	0.03511
1.851	0.02720	0.03284	0.04165	0.04878
3.182	0.04241	0.05192	0.06478	0.08354

SOLUBILITY OF IODINE IN AQUEOUS SOLUTIONS OF BARIUM IODIDE AT 25°.

(Pearce and Eversole, 1924.)

Gm. mols. per 1000 gms. H_2O		Gm. mols. per 1000 gms. H_2O	
BaI_2.	I_2.	BaI_2.	I_2.
0.0000	0.001329	0.16497	0.16872
0.000686	0.002044	0.34880	0.39500
0.003120	0.004482	0.39633	0.45460
0.006287	0.007574	0.57189	0.81690
0.031674	0.032199	0.87640	1.4674
0.047716	0.048413	1.1922	2.2880
0.080477	0.079370		

SOLUBILITY OF IODINE IN AQUEOUS SOLUTIONS OF HYDROBROMIC ACID, HYDROCHLORIC ACID AND OF HYDRIODIC ACID.

(Oliveri-Mandala and Angenica, 1920.)

In aq. H Br at 25°.		In aq. H Cl at 25°.4.		In aq. HI at 25°.2.	
Gm. mols. per liter		Gm. mols. per liter		Gm. mols. per liter	
HBr.	I_2.	HCl.	I_2.	HI.	I_2.
0.500	0.0081	0.500	0.00170	0.0604	0.0295
0.635	0.0096	1.1230	0.00256	0.0922	0.0459
1.2433	0.0203	1.5540	0.00320	0.1209	0.0610
1.8649	0.0328	1.8010	0.00373	0.2110	0.1117
2.7973	0.0514	2.0539	0.00430	0.3120	0.1633
3.7297	0.0750	2.5530	0.00511	0.4230	0.2358
		2.3139	0.00640	0.5000	0.3000
		3.8550	0.00730	0.6350	0.3959

Results for the solubility of iodine in aq. H Cl solutions at 25°, which do not agree with the above, are given by Rây and Sarkar, 1922.

SOLUBILITY OF IODINE IN AQUEOUS SOLUTIONS OF NITRIC ACID.

(Carter, 1925.)

Results at 10°.		Results at 25°.		Results at 35°.	
Wt. per cent HNO_3.	Gm. mols. I_2 per liter.	Wt. per cent HNO_3.	Gm. mols. I_2 per liter.	Wt. per cent HNO_3.	Gm. mols. I_2 per liter.
11.80	0.000969	10.91	0.00160	3.31	0.00187
23.88	0.001035	23.16	0.00179	6.50	0.00204
32.35	0.001020	33.62	0.00186	15.50	0.00233
40.82	0.000985	42.28	0.00185	28.72	0.00260
49.57	0.000957	52.77	0.00189	42.63	0.00275
55.82	0.000962	63.81	0.00236	43.13	0.00273
64.30	0.00108	69.65	0.00312	58.37	0.00368
70.00	0.00178	72.60	0.00394		

SOLUBILITY OF IODINE IN AQUEOUS SOLUTIONS OF ACIDS.

Aqueous Acid.	Mols. I per Liter Sat. Sol.	Gms. I per Liter Sat. Sol.	Authority.
0.001 *n* HCl	0.001332	0.338	(Bray and MacKay, 1910.)
0.10 *n* HNO_3	0.001340	0.340	(Sammet, 1905.)
0.10 *n* H_2SO_4	0.001342	0.341	"

SOLUBILITY OF IODINE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°.

(Carter, 1925.)

I

Wt. per cent H_2SO_4.	Gm. mols. I_2 per liter.	Color of solution.	Wt. per cent H_2SO_4.	Gm. mols. I_2 per liter.	Color of solution.
11.87	0.00102	Brown	59.53	0.000380	Pinkish + brown
22.72	0.00082	"	72.04	0.000270	Pink
33.25	0.000615	"	87.37	0.000200	"
40.42	0.000545	" + Pinkish			

SOLUBILITY OF IODINE IN AQUEOUS SOLUTIONS OF HYDRIODIC ACID AT 25°.

(Carter and Hoskins, 1929.)

Gm. Mols. per 1000 gm. Mols. H_2O		Gm. Mols. per 1000 gm. Mols. H_2O	
HI	I_2	HI	I_2
0.2117	0.1326	1.321	0.7908
0.5284	0.2956	1.763	0.9228
0.8810	0.4715	4.964	2.784

SOLUBILITY OF IODINE IN AQUEOUS MERCURIC CHLORIDE AND IN AQUEOUS CADMIUM IODIDE SOLUTIONS AT 25°.

In Aq. $HgCl_2$.

(Herz and Paul, 1914.)

Millimols per Liter.		Gms. per Liter.	
Hg.	I_2.	$HgCl_2$.	I.
0	1.34	0	0.340
94.44	12.94	25.64	3.285
124.42	14.60	33.78	3.706
195.42	18.06	54.29	4.583
334.60	25.43	90.84	6.454

In Aq. CdI_2.

(Van Name and Brown, 1917.)

Gms. per Liter.	
CdI_2.	I.
3.66	2.072
45.78	9.056
91.56	11.386
183.12	14.040

SOLUBILITY OF IODINE IN AQUEOUS SOLUTIONS OF CHLORIDES AT 25°.

(Carter and Hoskins, 1929.)

In Aqueous Solutions of:

Hydrochloric Acid		Potassium Chloride		Magnesium Chloride		Barium Chloride	
Gm. Mols. per 1000 gm. Mols. H_2O		Gm. Mols. per 1000 gm. Mols. H_2O		Gm. Mols. per 1000 gm. Mols. H_2O		Gm. Mols. per 1000 gm. Mols. H_2O	
HCl	I_2	KCl	I_2	1/2 $MgCl_2$	I_2	1/2 $BaCl_2$	I_2
8.48	0.0431	6.15	0.0349	8.48	0.0394	3.67	0.0305
17.9	0.0655	12.3	0.0438	13.0	0.0465	4.89	0.0318
25.1	0.0793	24.6	0.0589	26.3	0.0634	12.1	0.0426
31.5	0.0951	36.3	0.0711	53.5	0.0741	24.0	0.0538
65.3	0.170	48.2	0.0822	67.5	0.0750	35.6	0.0610
79.5	0.197	60.6	0.0905	96.1	0.0732	46.9	0.0660
109.2	0.252	73.9	0.0975	125.9	0.0636	57.8	0.0676
141.0	0.299	86.8	0.1003	141.3	0.0573	68.6	0.0671

The authos also give results for the solubility of iodine at 25° in aqueous solutions of $NaBr + Na_2SO_4$, $NaI + NaNO_3$ and $NaI + Na_2SO_4$.

I

SOLUBILITY OF IODINE IN AQUEOUS SOLUTIONS OF CHLORIDES AT 25°.

(Herz and Hiebenthal, 1929.)

In aqueous solutions of:

Lithium Chloride		Sodium Chloride		Potassium Chloride	
Gm. Mols. per liter sat. solution		Gm. Mols. per liter sat. solution		Gm. Mols. per liter sat. solution	
LiCl	I_2	NaCl	I_2	KCl	I_2
0.46	0.00379	0.20	0.00274	0.20	0.00276
0.96	0.00503	0.44	0.00344	0.34	0.00292
1.98	0.00679	1.23	0.00511	0.64	0.00389
3.90	0.00746	2.39	0.00612	1.93	0.00670
6.43	0.00596	3.45	0.00613	2.75	0.00800
12.08	0.00127	5.34	0.00534	4.85	0.00756

Magnesium Chloride		Strontium Chloride		Barium Chloride	
Gm. Mols. per liter sat. solution		Gm. Mols. per liter sat. solution		Gm. Mols. per liter sat. solution	
1/2 $MgCl_2$	I_2	1/2 $SrCl_2$	I_2	1/2 $BaCl_2$	I_2
0.39	0.00339	0.46	0.00371	0.23	0.00278
0.59	0.00419	0.86	0.00468	0.52	0.00388
1.49	0.00620	1.46	0.00571	0.83	0.00453
3.00	0.00764	2.37	0.00665	1.59	0.00571
4.55	0.00718	4.50	0.00637	2.70	0.00675
9.72	0.00148	6.16	0.00489	3.35	0.00675

IODINE I_2

SOLUBILITY OF IODINE IN SOLUTIONS OF VARIOUS SALTS IN WATER AND IN SOLUTIONS OF THE SAME SALTS IN 0.025 NORMAL POTASSIUM IODIDE AT 25°.

(v. Kiss and Urmanczy, 1931.)

Gm. Mols. Salt per liter		Gm. Mols. I_2 per liter in: H_2O Solution	Gm. Mols. I_2 per liter in: 0.025n KI Solution	Gm. Mols. Salt per liter		Gm. Mols. I_2 per liter in: H_2O Solution	Gm. Mols. I_2 per liter in: 0.025n KI Solution
0.0		0.001332	0.01362	0.5	$NaNO_3$	0.001238	0.01280
0.5	KCl	0.002206	0.01342	1.5	"	0.001048	0.01146
1.0	"	0.002821	0.01308	3.0	"	0.000780	0.00798
1.5	"	0.003315	0.01271	5.0	"	0.000573	0.00567
2.0	"	0.003753	0.01250	7.5	"	0.000369	0.00370
3.0	"	0.004476	0.01231	0.5	$LiNO_3$	0.001270	0.01292
4.0	"	0.004890	0.01219	1.5	"	0.001187	0.01202
0.5	NaCl	0.002083	0.01306	3.5	"	0.001038	0.01045
1.5	"	0.002960	0.01196	5.5	"	0.000856	0.00836
3.0	"	0.003320	0.00987	8.7	"	0.000564	0.00586
5.0	"	0.002942	0.00707	0.5	K_2SO_4	0.001190	0.01246
0.5	LiCl	0.002330	0.01351	1.0	"	0.001034	0.01126
1.5	"	0.003246	0.01270	1.37	"	0.000909	0.01052
3.5	"	0.003876	0.00971	0.25	Na_2SO_4	0.001210	0.01283
6.0	"	0.003275	0.00655	0.75	"	0.001052	0.01139
9.0	"	0.002012	0.00349	2.0	"	0.000705	0.00837
13.0	"	0.000301	0.00136	3.5	"	0.000440	0.00526
0.6714	$CaCl_2$	0.002505	0.01338	0.5	Li_2SO_4	0.001127	0.01224
1.676	"	0.003675	0.01265	1.5	"	0.000798	0.01015
3.35	"	0.004382	0.01080	3.0	"	0.000474	0.00692
5.025	"	0.003811	0.00869	5.0	"	0.000238	0.00386
6.714	"	0.003136	0.00671	0.6855	$Mg(NO_3)_2$	0.001230	0.1303
0.6882	$MgCl_2$	0.002492	0.01314	1.714	"	0.001053	0.01193
1.72	"	0.003595	0.01240	3.427	"	0.000891	0.01045
3.441	"	0.003959	0.01023	5.135	"	0.000674	0.00874
5.162	"	0.003752	0.00774	6.855	"	0.000550	0.00717
6.882	"	0.002999	0.00565	0.5	$MgSO_4$	0.001174	0.01239
0.5	$BaCl_2$	0.002226	0.01286	3.0	"	0.000600	0.00742
1.5	"	0.003035	0.00941	5.0	"	0.000351	0.00396
3.0	"	0.003550	0.00665	0.5264	$Ca(NO_3)_2$	0.001229	0.01314
0.5	KNO_3	0.001257	0.01305	1.316	"	0.001097	0.01234
1.0	"	0.001161	0.01277	2.632	"	0.000910	0.01104
2.0	"	0.001041	0.01215	3.948	"	0.000736	0.00967
3.0	"	0.000902	0.01178	5.264	"	0.000615	0.00854
				0.25	$Ba(NO_3)_2$	0.001300	0.01286
				0.50	"	0.001243	1.01249

SOLUBILITY OF IODINE IN AQUEOUS SOLUTIONS OF MIXTURES OF SALTS AT 25°.

(LaMer and Lewinsohn, 1934.)

Gm. Mols. Salts per liter	Gm. Mols. I_2 per liter
0.0 (= H_2O at *pH* 5.0)	0.001321
2.0 KNO_3 + 0.0025KI	0.002138
1.65 KCl + 0.10 KI	0.004421

Results are also given for a number of other mixtures of salts.

SOLUBILITY OF IODINE IN AQUEOUS SOLUTIONS OF POTASSIUM IODIDE AT 25°.

(Linhart, 1918.)

Mols. KI per 1000 gms. H_2O......	0.4136	0.5954	0.8065	1.0246
Mols. I_2 "	0.2313	0.3538	0.5176	0.7079

SOLUBILITY OF IODINE IN VERY DILUTE AQUEOUS SOLUTIONS OF POTASSIUM IODIDE.

(Determinations made with very great care.)

Results at 0°. (Jones and Hartman, 1915.)			Results at 25°. (Bray and MacKay, 1910.)		Results at 25°. (Noycs and Seidenstricker, 1898.)	
Normality of Aq. KI Sol.	$d_{\frac{0}{4}}$ of Sat. Sol.	Gms. I per 100 Gms. Sat. Sol.	Normality of Aq. KI Sol.	Millimols I_2 per Liter Sat. Sol.	Normality of Aq. KI Sol.	Millimols I_2 per Liter Sat. Sol.
0.000992	1.0002	0.0282	0	1.333	0	1.342
0.00200	1.0004	0.0409	0.001	1.788	0.00083	1.814
0.00500	1.0010	0.0760	0.002	2.266	0.00166	2.235
0.01000	1.0020	0.1356	0.005	3.728	0.00664	4.667
0.01988	1.0044	0.2533	0.010	6.185	0.01329	8.003
0.0500	1.0109	0.609	0.020	11.13	0.02657	14.68
0.09993	1.0219	1.199	0.050	25.77	0.05315	28.03
			0.100	51.35	0.1063	55.28

SOLUBILITY OF IODINE IN AQUEOUS SOLUTIONS OF POTASSIUM IODIDE AT 25° AND VICE VERSA.

(Parsons and Whittemore, 1911.)

(Time of rotation 6 mos. or longer. Duplicate determinations at different lengths of time, were made.)

I

Sp. Gr. Sat. Sol.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Sp. Gr. Sat. Sol.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
	KI	I			KI	I	
1.349	16.03	18.49	Iodine	3 246	27.92	66.45	KI
1.516	19.70	26.16	"	3.232	29.71	62.81	"
1.769	22.88	36.06	"	2.665	35.80	49.61	"
1.910	23.55	40.52	"	2.539	38.09	44.58	"
2.403	24.78	53.60	"	2.216	44.82	31.01	"
2.904	25	63.12	"	2.066	49.04	23.08	"
3.082	25.18	66.04	"	1.888	54.41	11.63	"
3.316	26	68.09	" +KI	1.733	60.39	0	"

Additional data for this system are given by Bruner, 1898; Hamberger, 1906; and Lami, 1908.

Data for the solubility of iodine in aq. 40% ethyl alcohol and aq. 60% ethyl alcohol solutions of potassium iodide at 25°, are given by Parsons and Corliss, 1910. The solid phases were identified in each case and it was demonstrated that no polyiodides of potassium exist in the solid phase or in solution at 25°.

An extensive series of determinations of the simultaneous solubility of iodine and potassium iodide in nitrobenzene and in other organic solvents, as well as in mixtures of nitrobenzene and other solvents are given by Dawson and Gawler, 1902, and Dawson, 1904. The determinations were made to obtain information on the formation of polyiodides in solution. The molecular ratio of dissolved I_2/KI was found to be 1 or more in all cases.

A review of the evidence for and against the existance of potassium tri iodide is given by Bancroft, Scherer and Gould, 1931. The authors verified one of the results (analysis No. 8) of Parsons and Whittemore, 1911, of which there appeared some doubt. This was done by adding an excess of either iodine, potassium iodide or so-called potassium tri iodide to a synthetically prepared solution corresponding to the quadruple point of the system. No change in the composition of the solution occurred. From this and other evidence it was concluded that potassium tri iodide does not exist at 25°.

For additional results upon the system I + KI see under Potassium Iodide.

Solubility of Iodine in Aqueous Solutions of Potassium Iodide at 25°.

(Reichstein, Ewentow and Kasanowsky, 1933.)

$d\frac{25}{4}$ of sat. sol.	Gm. Mols. KI per liter	Ratio $\frac{I}{KI}$	$d\frac{25}{4}$ of sat. sol.	Gm. Mols. KI per liter	Ratio $\frac{I}{KI}$
1.008	0.055	0.96	1.776	2.870	2.09
1.025	0.136	1.00	1.889	3.281	2.23
1.055	0.273	1.08	1.900	3.315	2.25
1.095	0.541	1.15	2.006	3.647	2.34
1.255	1.052	1.39	2.090	4.024	2.45
1.335	1.330	1.50	2.200	4.376	2.56
1.390	1.551	1.59	2.289	4.710	2.69
1.508	1.985	1.74	2.357	5.030	2.82
1.512	2.001	1.75	2.390	5.160	2.83
1.652	2.448	1.91	2.504	5.630	2.98
1.760	2.809	2.07	2.640	6.259	3.17

The mixtures were rotated constantly for 200 hours. The saturated solutions were analyzed by diluting an unweighed portion of the filtered solution with water and distilling the free iodine into KI solution. This was titrated with thio sulfate and the fixed iodine remaining in the distilling flask titrated with silver nitrate according to Volhard. The densities of the saturated solutions were measured in a 1.5cc pycnometer. The authors also give results in the form of a diagram showing the effect of additions of sugar upon the ratio of I_2/KI at different KI concentrations. The presence of sugar increases the solubility of I at low concentrations of KI and diminishes it at high concentrations.

Equilibrium in the System Iodine, Potassium Iodide and Water in the Region of Low Water Concentration at 25°.

(Grace, 1931.)

The mixtures were initially heated to about 50° and then rotated at 25° for one month. Both the sat. solution and moist solid phases were analyzed. The diagram and the analyses confirm the existance of the two polyiodides $KI_3.H_2O$ and $KI_7.H_2O$.

Gms. per 100 gms. sat. solution			Solid Phase	Gms. per 100 gms. sat. solution			Solid Phase
I_2	KI	H_2O		I_2	KI	H_2O	
57.83	32.18	9.96	KI	66.65	27.04	6.38	$KI_7.H_2O$
61.97	30.25	7.83	" + $KI_3.H_2O$	67.34	26.52	6.20	"
63.40	29.09	7.45	$KI_3.H_2O$	68.02	26.00	6.00	" + I
63.88	28.92	7.16	"	65.98	25.08	—	I
64.85	28.36	6.87	"				
66.10	27.26	6.59	" + $KI_7.H_2O$				

The author also gives several experiments upon equilibrium in the non aqueous solvents, tetra chlor ethane and benzene.

SOLUBILITY OF IODINE IN AQUEOUS SOLUTIONS OF POTASSIUM BROMIDE AND OF SODIUM BROMIDE AT 25°.

(Bell and Buckley, 1912.)

In Aq. KBr Solutions.		In Aq. NaBr Solutions.	
Gms. KBr per Liter.	Gm. Atoms I per Liter.	Gms. NaBr per Liter.	Gm. Atoms I per Liter.
60.6	0.0176	96.4	0.0266
106.9	0.0278	187.7	0.0425
175.9	0.0415	271.8	0.0538
229.8	0.0532	357.4	0.0598
281.9	0.0628	422.21	0.0638
330.6	0.0717	499.1	0.0648
377.1	0.0797	569.9	0.0644
411	0.0864	632	0.0622
461.7	0.0948	679.7	0.0595
509.8	0.1006	750.5	0.0551
567.9 sat.	0.1094	756.1 sat.	0.0550

SOLUBILITY OF IODINE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AND OF SODIUM NITRATE. (Carter, 1925.)

Results for Sodium Chloride at 25°.		Results for Sodium Nitrate at 25°.		Results for Sodium Nitrate at 35°.	
Wt. per cent NaCl.	Gm. mols. I_2 per 1000 gm. mols. H_2O.	Wt. per cent $NaNO_3$.	Gm. mols. I_2 per 1000 gm. mols. H_2O.	Wt. per cent $NaNO_3$.	Gm. mols. I_2 per 1000 gm. mols. H_2O.
4.52	0.04403	5.89	0.0222	1.98	0.0327
7.43	0.05295	11.10	0.0202	3.48	0.0320
14.14	0.06289	15.31	0.0185	6.85	0.0302
20.31	0.06311	25.67	0.0145	15.89	0.0268
23.15	0.06105	29.75	0.0125	29.06	0.0201
25.95	0.05790	35.43	0.0108	40.17	0.0143
		39.83	0.00911	50.1	0.0100
		44.16	0.00753		

SOLUBILITY OF IODINE IN AQUEOUS SODIUM IODIDE SOLUTIONS.

(Gill, 1913–14.)

Aqueous NaI solutions were prepared by dissolving the stated amounts of the salt in water and diluting to 100 cc. An excess of iodine was added to each of these solutions, the mixtures heated to 60° and shaken for several minutes. They were then allowed to cool in a thermostat at 25° for four hours. The dissolved iodine in weighed amounts of the saturated solutions was titrated with thiosulfate. The densities of the Aq. NaI mixtures and also of the solutions after saturation with iodine were determined.

Gms. NaI per 100 cc. Aq. Solution.	d_{25} of Aq. NaI Solution.	d_{25} of Aq. NaI after Saturation with I.	Gms. I Dissolved at 25° per 100 Gms. of the Sat. Sol.
5	1.0369	1.0698	4.99
10	1.0720	1.1415	9.96
15	1.1072	1.2162	14.93
20	1.1458	1.2998	20.02

Determinations at other temperatures were made in an apparatus which permitted constant stirring of the solutions at the several temperatures. Results, interpolated from the original, are as follows:

t°.	Gms. I Dissolved per 100 Gms. Sat. Solution in Aq. NaI of:		t°.	Gms. I Dissolved per 100 Gms. Sat. Solution in Aq. NaI of:	
	10 Gms. per 100 cc.	20 Gms. per 100 cc.		10 Gms. per 100 cc.	20 Gms. per 100 cc.
10	8.9	17.6	30	10.3	20.5
15	9.3	18.3	40	10.9	22
20	9.6	19	50	11.7	23.4
25	10	19.4	60	12.6	24.9

SOLUBILITY OF IODINE IN AQUEOUS SODIUM IODIDE ALONE AND CONTAINING SODIUM SULFATE AT 25°.

(Carter, 1928.)

Results for:

Aq. NaI Solutions		Aq. NaI + Na_2SO_4 Solutions		
Gm. Mols. per 1000 gms. H_2O		Gm. Mols. per 1000 gms. H_2O		Gm. Mols. I_2 per 1000 gms. H_2O
NaI	I_2	NaI	Na_2SO_4	
0.0	0.001324	0.000251	1.698	0.000413
0.000392	0.001494	0.000655	"	0.000497
0.000784	0.001676	0.001431	"	0.000666
0.001959	0.002260	0.003271	"	0.001048
0.003918	0.003199	0.006531	"	0.001738
0.007838	0.005126	0.01274	"	0.003063
0.01959	0.01096	0.02619	"	0.006031
		0.05253	"	0.01190

SOLUBILITY OF IODINE IN AQUEOUS SOLUTIONS OF MONO SODIUM PHOSPHATE AND OF SODIUM SULFATE. (Carter, 1925.)

Results for $NaH_2(PO_4)_2$ at 25°.		Results for Na_2SO_4 at 25°.		at 35°.	
Wt. per cent $NaH_2(PO_4)_2$	Gm. mols. I_2 per 1000 gms. mols. H_2O.	Wt. per cent Na_2SO_4	Gm. mols I_2 per 1000 gms. mols. H_2O.	Wt. per cent Na_2SO_4.	Gm. mols I_2 per 1000 gms. mols. H_2O.
7.53	0.0194	5.66	0.0173	1.05	0.0318
14.40	0.0161	8.64	0.0144	4.93	0.0252
20.64	0.0135	16.24	0.00855	9.13	0.0202
26.4	0.0111	19.66	0.00656	14.79	0.0133
31.66	0.00893			21.10	0.00839
41.06	0.0043			25.31	0.00585
45.26	0.0018			33.10	0.00258

SOLUBILITY OF IODINE IN AQUEOUS SALT SOLUTIONS AT 25.

(McLauchlan, 1903.)

Salt.	Gms. Salt per Liter.	Gms. Dissolved I per Liter.	Salt.	Gms. Salt. per Liter.	Gms. Dissolved I per Liter.
Na_2SO_4	29.77	0.160	NH_4Cl	53.4	0.735
K_2SO_4	43.5	0.238	NaBr	103	3.29
$(NH_4)_2SO_4$	33	0.246	KBr	119	3.801
$NaNO_3$	85	0.257	NH_4Br	98	4.003
KNO_3	101.2	0.266	$NH_4C_2H_3O_2$	77.1	0.440
NH_4NO_3	80	0.375	$(NH_4)_2C_2O_4$	86.9	0.980
NaCl	58.5	0.575	H_3BO_3	55.8	0.300
KCl	73.6	0.658			

SOLUBILITY OF IODINE IN AQUEOUS ETHYL AND NORMAL PROPYL ALCOHOL SOLUTIONS AT 15°.

(Bruner, 1898.)

In Aq. Ethyl Alcohol.				In Aq. (n.) Propyl Alcohol.			
Vol. % C_2H_5OH in Solvent.	Gms. I per 100 cc Solution	Vol % C_2H_5OH in Solvent.	Gms. I per 100 cc. Solution.	Vol. % C_3H_7OH in Solvent.	Gms. I per 100 cc. Solution.	Vol % C_3H_7OH in Solvent.	Gms. I per 100 cc. Solution.
10	0.05	60	1.14	10	0.05	60	2.71
20	0.06	70	2.33	20	0.11	70	4.10
30	0.10	80	4.20	30	0.40	80	6.05
40	0.26	90	7.47	40	0.94	90	9.17
50	0.88	100	15.67	50	1.64	100	14.93

SOLUBILITY OF IODINE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 15°.

(Schoorl and Regenbogen, 1919.)

Due to the ready formation of HI, accurate determinations of the solubility of iodine in aqueous alcohol can be made best by diluting a solution of iodine in absolute alcohol with water, and determining immediately the C_2H_5OH and iodine content of the resulting solution. At concentrations of alcohol less than 18 per cent the addition of water does not precipitate iodine from its saturated solution. The maximum precipitation of iodine occurs when just enough water is added to bring the alcohol concentration to 18 per cent.

The determinations were plotted and the following values read from the curve.

Wt. per cent C_2H_5OH in aq.-alc. solvent.	Gms. I per 100 gms. solvent	Wt. per 100 C_2H_5OH in aq.-alc. solvent.	Gms. I per 100 gms. solvent.	Wt. per 100 C_2H_5OH in aq.-alc. solvent.	Gms. I per 100 gms. solvent
0.0	0.025	35.0	0.35	70.0	4.3
5.0	0.033	40.0	0.55	75.0	5.6
10.0	0.045	45.0	0.80	80.0	7.2
15.0	0.06	50.0	1.20	85.0	9.0
20.0	0.08	55.0	1.70	90.0	11.4
25.0	0.11	60.0	2.30	95.0	14.8
30.0	0.20	65.0	3.20	100.0	20.0

SOLUBILITY OF IODINE IN AQUEOUS ETHYL ALCOHOL AND IN AQUEOUS ACETIC ACID SOLUTIONS AT 25°.

(McLauchlan, 1903.)

In Aq. C_2H_5OH Solutions.		In Aq. CH_3COOH Solutions.	
Gms. C_2H_5OH per 100 Gms. Solvent.	Gms. I per 100 cc. Sat. Solution.	Gms. CH_3COOH per 100 Gms. Solvent.	Gms. I per 100 cc. Sat. Solution.
0	0.034	0	0.034
4.55	0.039	20	0.076
28.48	0.172	39.5	0.173
44.41	0.955	61.1	0.510
72.51	6.698	80.7	1.363
100	24.548	100	3.162

Since McLauchlan's value for the solubility of iodine in water was apparantly too low, the figure 0.034 gm. per 100cc was substituted and used as a basis for calculating the remaining results for the solubility of iodine in aqueous alcohol and acetic acid.

SOLUBILITY OF IODINE IN ETHYL ALCOHOL CONTAINING ONLY SMALL AMOUNTS OF WATER.

(Delepine and Arquet, 1928.)

t°	Wt. Percent C_2H_5OH in Solvent	Gms. I per 100 gms. sat. Solution	t°	Wt. Percent C_2H_5OH in Solvent	Gms. I per 100 gms. sat. Solution
15	85	6.50	24.5	85	7.97
"	90	8.50	"	90	10.2
"	95	12.5	"	95	14.8
"	99.8	18.7	"	99.8	21.0

Several determinations of the reciprocal solubility of Iodine, Ethyl Ether and Water at 20° are given by Nesteroro and Petine, 1931.

100 gms. Glycerol of d = 1.2326 (= 86.5%) dissolve 0.47 gm. I at 20°.
" " " " d = 1.2645 (= 98.5%) " 0.67 " " " "
" (Holm, 1921-1922.)

100 gms. Glycerol of d_{15} = 1.256 dissolve 2.0 gm. I at 15-16°.
(Ossendowski, 1907.)

SOLUBILITY OF IODINE IN AQUEOUS GLYCEROL SOLUTIONS AT 25°.

(Herz and Knoch, 1905.)

Density of glycerine at 25°/4° = 1.2555; impurities about 1.5%.

Wt.% Glycerine in Solvent.	Millimols I per 100 cc. Solution.	Grams I per 100 cc. Solution.	Density of Solutions at 25°/4°.
0	0.24	0.0304	0.9979
7.15	0.27	0.0342	1.0198
20.44	0.38	0.0482	1.0471
31.55	0.49	0.0621	1.0750
40.95	0.69	0.0875	1.0995
48.7	1.07	0.135	1.1207
69.2	2.20	0.278	1.1765
100.0	9.70	1.223	1.2646

EQUILIBRIUM IN THE SYSTEM IODINE, PYRIDINE AND WATER AT 18°.

(Chatelet, 1934.)

The solubility of iodine in pyridine was found to be about 450 gms. I per 1000cc of sat. solution at 18 . From such a solution upon evaporation, clear yellow needles separate, but within 2-5 minutes they begin to decompose with liberation of iodine.

In the case of the mixtures of iodine, pyridine and water they were agitated about 15 minutes and then filtered through a porus glass disc. The clear filtrate and several samples of the mixture of solid and solution were analyzed. The results when plotted indicate the formation to two molecular compounds.

Gms. per 100 gms. sat. solution			Solid Phase
I_2	C_5H_5N	H_2O	
3.6	47.5	48.9	$I_2(C_5H_5N)_2.29(?)H_2O$
1.0	33.9	65.1	"
1.5	24.1	74.1	"
2.7	9.0	88.3	$I_2(C_5H_5N).6H_2O$
2.0	8.4	89.6	"
1.1	6.1	92.8	"

DISTRIBUTION OF IODINE BETWEEN WATER AND BROMOFORM, WATER AND CARBON DISULFIDE, AND WATER AND CARBON TETRACHLORIDE AT 25°.

(Jakowkin, 1895.)

The original results were plotted on cross-section paper and the following table made from the curves. Jakowkin points out that the results of Berthelot and Jungfleisch, 1872, are incorrect on account of the presence of HI.

Gms. I per Liter of H_2O Layer in Each Case.	Gms. I per Liter of:		
	$CHBr_3$ Layer.	CS_2 Layer.	CCl_4 Layer.
0.05	20	30	4
0.10	45	60	8.5
0.15	71	91	13
0.20	100	126	17.5
0.25	130	160	22

A theoretical discussion of the results of Jakowkin is given by Schükarew (1901).

DISTRIBUTION OF IODINE BETWEEN WATER AND CARBON TETRACHLORIDE AT 25°.

Results of Linhart, 1918.

Gm. mols. I_2 per 1000 gms.		$\frac{C}{W}$.
H_2O layer (W).	CCl_4 layer (C).	
0.000402	0.022988	57.2
0.000623	0.035260	56.6
0.000724	0.040828	56.4
0.000754	0.043020	57.1
0.000907	0.051304	56.6

Results of Pearce and Eversole, 1924.

Gms. I_2 per 1000 gms.		$\frac{C}{W}$.
H_2O layer (W).	CCl_4 layer (C).	
0.0745	3.8990	52.35
0.1020	5.3584	52.53
0.1078	5.6775	52.64
0.1432	7.5145	52.49
0.2432	12.6950	52.21

Data for the distribution of iodine between aqueous solutions of barium iodide and carbon tetrachloride at 25° are given by Pearce and Eversole, 1924.

Data for the distribution of iodine between aqueous solutions of hydrobromic acid and carbon tetrachloride at 30°, and between aqueous solutions of hydrochloric acid and carbon disulfide at 25° are given by Rây and Sarkar, 1922.

Data for the distribution of Iodine between aqueous solutions of sodium iodide (0.4933 and 0.994 gm. mols. per liter) and carbon tetrachloride at 25° are given by Carter, 1928.

DISTRIBUTION OF IODINE (WHEN AN EXCESS IS PRESENT) AT 25° BETWEEN:

(Schilow and Lepin, 1922.)

Water and Chloroform.

Gms. I per 100 cc. saturated		$\frac{C}{W}$.
H_2O layer (W).	$CHCl_3$ layer (C).	
0.0425	2.97	70

Water and Toluene.

Gms. I per 100 cc. saturated		$\frac{T}{W}$.
H_2O layer (W).	Toluene layer T.	
0.036	3.50	97.5

DISTRIBUTION OF IODINE BETWEEN:

(Herrero, 1931, 1932, 1936.)

Water and Carbon Tetrachloride at 20°

Gms. I per liter of:		$\frac{c}{w}$
CCl_4 layer (c)	H_2O layer (w)	
1.2722	0.0169	75.1
2.0856	0.0273	76.2
3,0241	0.0391	77.3
5.2244	0.0651	80.16
7.6124	0.0938	81.1
9.9587	0.1199	83.0
15.4491	0.1825	84.7

Water and Carbon Disulfide at 25°

Gms. I per liter of:		$\frac{c}{w}$
CS_2 layer (c)	H_2O layer (w)	
41.3694	0.06979	592
60.1506	0.09999	602
78.6780	0.12994	605
85.6575	0.14009	611
98.4744	0.15862	620
126.1386	0.20100	627
137.5596	0.21496	639
152.7876	0.23476	650

The author found that the solubility of iodine in water is not appreciably affected by the presence of carbon disulfide. He found 0.2691 gms. I per liter pure water at 18° and 0.2876 gms. at 20°. Practically identical figures were obtained when water sat. with CS_2 was used instead of pure water.

DISTRIBUTION OF IODINE AT 20° BETWEEN:

(Herrero, 1933.)

Water and Ethylene Bromide

Gms. I per liter of: $CH_2Br.CH_2Br$ layer (c)	H_2O layer (w)	$\frac{c}{w}$
20.40	0.03137	650
39.12	0.05881	665
62.46	0.09149	683
92.29	0.13331	692
127.43	0.18298	696

Water and Trichlor Ethylene

Gms. I per liter of: $CCl_2.CHCl$ layer (c)	H_2O layer (w)	$\frac{c}{w}$
2.749	0.02499	110
5.098	0.04498	113
7.748	0.06623	117
10.872	0.07873	119
17.033	0.14246	119.6
22.832	0.18870	121
30.242	0.24994	121

1000cc sat. solution of Iodine in Ethylene Bromide contain, 201.03 gms. I at 20°.

1000cc sat. solution of Iodine in Trichlor Ethylene contain 38.78 gms. I at 20°. (Herrero, 1933.)

DISTRIBUTION OF IODINE AT 20° BETWEEN:

(Herrero, 1933.)

I

Water and Benzene

Gms. I per liter of: C_6H_6 layer (c)	H_2O layer (w)	$\frac{c}{w}$
12.972	0.03499	368
20.432	0.05498	371
41.240	0.10997	375
56.261	0.14621	385
79.984	0.20245	395
90.633	0.22494	403
97.326	0.23869'	407
105.749	0.25868	409

Water and Nitrobenzene

Gms. I per liter of: $C_6H_5NO_2$ layer (c)	H_2O layer (w)	$\frac{c}{w}$
10.28	0.05230	196
14.38	0.07371	195
19.00	0.09593	198
23.17	0.11815	196
31.06	0.15762	196
37.98	0.19343	196
44.14	0.22532	196

1000cc sat. solution of Iodine in Benzene contain 119.343 gms. I at 20°.
" " " " " " nitrobenzene " 56.465 " " " "
(Herrero, 1933)

DISTRIBUTION OF IODINE AT ROOM TEMPERATURE BETWEEN AQUEOUS STARCH SOLUTIONS AND CHLOROFORM. (Firth and Watson, 1922.)

Ten cc. of a chloroform solution of iodine was shaken with 10 cc. of the starch solution for 10 minutes and, after separation of the two layers, the iodine remaining in the CH Cl_3 layer was determined by titration with standard thiosulfate solution.

Gms. I per liter in the original $CHCl_3$ sol	Gms. I per liter in the starch solution containing: 5 gms. starch per liter	2 gms. starch per liter	1 gm. starch per liter	0.5 gm. starch per liter.
0.15204	0.02534	0.015175	0.007587	0.004434
0.1267	0.02281	0.011405	0.006335	0.003794
0.11403	0.02154	0.010135	0.006335	0.003167
0.10136	0.02027	0.010135	0.005712	0.002534
0.08869	0.01901	0.009505	0.005068	0.002534
0.07602	0.01584	0.008235	—	—

The results show that the amount of iodine withdrawn from the CH Cl_3 is proportional to the concentration of the starch. The authors also give results showing the effect of various amounts of KI in the starch solution upon the amount of iodine withdrawn from the CH Cl_3.

DISTRIBUTION OF IODINE BETWEEN CARBON DISULFIDE AND AQ. POTASSIUM OXALATE.

(Dawson — Z. physik. Chem. 56, 610, '06; Dawson and McRae — J. Chem. Soc. 81, 1086, '02.)

Concentration of Aq. $K_2C_2O_4$.	Gms. I per Liter of Aq. Layer.	Gms. I per Liter of CS_2 Layer.	Vol. of Solution which Contains 1 Mol. I.	Fraction of I Uncombined in Solution.
1.0 Equiv.	2.408	10.82	105.3	0.005495
1.0 "	3.555	16.32	71.37	0.00561
1.0 "	5.766	27.91	43.99	0.005915
1.0 "	6.861	34.01	36.98	0.006055
1.2 "	3.525	17.07	71.97	0.005645

DISTRIBUTION OF IODINE BETWEEN AMYL ALCOHOL AND WATER AND BETWEEN AMYL ALCOHOL AND AQUEOUS POTASSIUM IODIDE SOLUTIONS AT 25°.

(Herz and Fischer — Ber. 37, 4752, '04)

The original results were plotted on cross-section paper, and the following tables made from the curves.

Millimols I per 10 cc. Amyl Alcohol Layer in Each Case.	Millimols I per 10 cc. of H_2O and of Aq. KI Layers. H_2O.	$\frac{N}{10}$ KI.	$\frac{2N}{10}$ KI.	$\frac{3N}{10}$ KI.	$\frac{4N}{10}$ KI.	$\frac{10N}{10}$ KI.
2.5	0.012	0.135	0.160	0.170	0.170	...
3.0	0.014	0.150	0.185	0.200	0.200	0.160
4.0	0.018	0.180	0.235	0.255	0.270	0.240
5	0.021	0.210	0.280	0.315	0.340	0.315
6	0.025	0.230	0.330	0.375	0.410	0.390
7	0.029	0.250	0.375	0.430	0.480	0.470
8	...	0.260	0.420	0.490	0.550	0.555
9	...	0.270	0.450	0.550	0.620	0.640
10	...	0.280	0.470	0.605	0.690	0.720
12	...	...	0.490	0.700	0.830	0.900
14	...	...	0.510	0.790	0.980	1.200
20	...	...	0.575	...	...	...

Gms. I per 100 cc. Amyl Alcohol Layer in Each Case.	Gms. I per 100 cc. of H_2O and of KI Layers. H_2O.	$\frac{N}{10}$ KI.	$\frac{2N}{10}$ KI.	$\frac{3N}{10}$ KI	$\frac{4N}{10}$ KI.	$\frac{10N}{10}$ KI.
3	0.014	0.164	0.20	0.21	0.21	...
4	0.016	0.196	0.24	0.26	0.26	0.21
6	0.026	0.252	0.34	0.38	0.40	0.37
8	0.033	0.297	0.43	0.49	0.54	0.51
10	0.040	0.328	0.51	0.61	0.67	0.69
12	...	0.341	0.58	0.73	[illegible]	0.84
14	...	...	0.60	0.83	0.95	1.00
16	...	...	0.63	0.91	1.09	1.20
18	...	...	0.64	...	...	...
25	...	...	0.71	...	...	...

The original figures for 5N/10 and 10N/10 KI solutions give practically identical curves.

Results for the distribution of Iodine between N/10 KI solutions on the one hand, and mixtures in various proportions of $C_6H_6 + CS_2$, $C_6H_5CH_3 + CS_2$, $C_6H_6 + C_6H_5CH_3$, C_6H_6 + light petroleum, CS_2 + light petroleum, $CS_2 + CHCl_3$, $CHCl_3 + C_6H_6$, $CCl_4 + CS_2$ and $CCl_4 + C_6H_5CH_3$ on the other hand, are given by Dawson — J. Chem. Soc., **81**, 1086, '02.

DISTRIBUTION OF IODINE BETWEEN WATER AND IMMISCIBLE ORGANIC SOLVENTS.

Results for Water + Carbontetrachloride at 18°. (Dawson, 1908.)

Mols. Iodine per Liter.	
H_2O Layer.	CCl_4 Layer.
0.000416	0.0344
0.000535	0.0443

Results for Water + Nitrobenzene at 18°. (Dawson, 1908.)

Mols. Iodine per Liter.	
H_2O Layer.	$C_6H_5NO_2$ Layer.
0.00019	0.0333
0.00050	0.0854
0.00133	0.2275
0.00189	0.3328

Results for Water + Carbon Disulfide at 15°. (Dawson, 1902.)

Gms. Iodine per Liter.	
H_2O Layer.	CS_2 Layer.
0.0452	27.85
0.0486	30.09
0.0486	30.31

Results for Water + Chloroform at 25°. (Herz & Kurzer, 1910.)

Mols. Iodine per Liter.	
H_2O Layer.	$CHCl_3$ Layer.
0.00025	0.0338
0.00120	0.1546
0.00184	0.2318
0.00259	0.3439

Results for Water + Trichlorethylene at 25°. (Herz & Rathmann, '13.)

Mols. Iodine per Liter.	
H_2O Layer.	$CHCl.CCl_2$ Layer.
0.00046	0.0543
0.00070	0.0778
0.00112	0.1275
0.00236	0.2672

Results for Water + Tetrachlorethylene at 25°. (Herz & Rathmann,,'13.)

Mols. Iodine per Liter.	
H_2O Layer.	$CCl_2\,CCl_2$ Layer.
0.00088	0 0653
0.00127	0 0932
0.00172	0.1285
0.00281	0.2161

Results for Water + Tetrachlorethane at 25°. (Herz & Rathmann, '13.)

Mols Iodine per Liter.	
H_2O Layer.	$C_2H_2Cl_4$ Layer.
0.00119	0.1101
0.00145	0.1247
0.00159	0.1479
0.00217	0.2103

Results for Water + Pentachlorethane at 25°. (Herz & Rathmann, '13.)

Mols. Iodine per Liter.	
H_2O Layer.	C_2HCl_5 Layer.
0.00092	0.0848
0.00117	0.1067
0.00160	0.1434
0.00204	0.1963

Data for the distribution of iodine between water and mixtures of CS_2+CCl_4 at 25° are given by Herz and Kurzer, 1910.

Data for the distribution of iodine between carbon disulfide and aqueous solutions of each of the following iodides at 25° are given by van Name and Brown, 1917. Cadmium iodide, cadmium potassium iodide, lanthanum iodide, nickel iodide, strontium iodide, zinc iodide and zinc potassium iodide. Results for the distribution of iodine between carbon tetrachloride and aq. mercuric potassium iodide are also given.

Results for distribution between CS_2 and aq. BaI_2 sols. are given by Herz and Kurzer, 1910.

Data for the distribution of iodine between carbon disulfide and aqueous solutions of potassium iodide at 15° and at 13.5°, and between carbon disulfide and aqueous solutions of hydriodic acid at 13.5°, are given by Dawson, 1901 and 1902.

Data for the distribution of iodine between carbon tetrachloride and aqueous solutions of mercuric bromide and of mercuric chloride at 25° are given by Herz and Paul, 1914.

DISTRIBUTION OF IODINE BETWEEN CARBON DISULFIDE AND AQ. ETHYL ALCOHOL AT 25°. (Osaka, 1903–08.)

Gms. C_2H_5OH per 100 cc. Aq. Alcohol.	Gms. Iodine per Liter:		$\frac{c}{c'}$.	Gms. C_2H_5OH per 100 cc. Aq. Alcohol.	Gms. Iodine per Liter:		$\frac{c}{c'}$.
	CS_2 Layer c.	Aq. Alcohol Layer c'.			CS_2 Layer c.	Aq. Alcohol Layer c'.	
7.6	0.072	35.86	0.0020	19.1	0.330	97	0.0034
7.6	0.211	107.79	0.0020	22.9	0.115	23.78	0.0048
11.4	0.077	32.93	0.0023	22.9	0.418	89.61	0.0047
11.4	0.280	133 22	0.0021	26.7	0.0756	9.8	0 0077
15.3	0.075	25.61	0.0029	26.7	0.495	65.10	0.0076
15.3	0.315	115.34	0.0027	30.5	0 0636	4.90	0.0130
19.1	0.045	13.42	0.0034	30.5	0.546	42.27	0.0129

DISTRIBUTION OF IODINE BETWEEN ETHER AND ETHYLENE GLYCOL. (Landau, 1910.)

Results at 0°.			Results at 25°.		
Gms. Iodine per Liter:			Gms. Iodine per Liter:		
$(C_2H_5)_2O$ Layer (a).	$(CH_2OH)_2$ Layer (b).	$\frac{a}{b}$.	$(C_2H_5)_2O$ Layer (a).	$(CH_2OH)_2$ Layer (b).	$\frac{a}{b}$.
2.139	1.449	1.48	2.208	1.449	1.52
7.820	4.347	1.80	4.255	2.541	1.60
16.620	9.486	1.75	7.728	4.347	1.78
20.564	11.685	1.76	16.200	9.120	1.78
31.785	18.135	1.75	30.322	17.062	1.78
79.950	44.460	1.80	78.195	44.460	1.76

DISTRIBUTION OF IODINE BETWEEN GLYCEROL AND BENZENE AND BETWEEN GLYCEROL AND CARBON TETRACHLORIDE.

(Landau, 1910.)

Results for Glycerol and Benzene.

t°.	Grams Iodine per Liter: Glycerol Layer. (a)	Benzene Layer. (b)	$\frac{(b)}{(a)}$.
25°	0.407	1.922	4.72
"	0.676	4.086	6.04
"	1.470	10.212	6.95
"	2.622	20.102	7.67
"	5.280	42.458	8.04
40°	0.459	2.168	4.72
"	0.658	3.911	5.94
"	1.584	11.244	7.10
"	3.048	24.104	7.91
"	5.564	46.960	8.44
50°	0.467	2.194	4.70
"	0.642	3.864	6.02
"	1.463	11.196	7.65
"	2.391	19.872	8.31
"	5.383	46.782	8.69

Results for Glycerol and CCl_4.

t°.	Gms. Iodine per Liter: Glycerol Layer. (a)	CCl_4 Layer. (b)	$\frac{(b)}{(a)}$.
25°	0.365	0.565	1.55
"	0.684	1.224	1.78
"	1.416	2.652	1.87
"	5.064	9.888	1.95
"	7.636	14.766	1.93
40°	0.322	0.575	1.79
"	0.690	1.169	1.74
"	1.224	2.772	1.69
"	2.832	6.444	2.26
"	6.854	15.410	2.25
50°	0.299	0.653	2.19
"	0.570	1.270	2.23
"	1.511	3.457	2.29
"	2.664	6.468	2.43
"	6.348	16.008	2.52

DISTRIBUTION OF IODINE BETWEEN GLYCEROL AND CHLOROFORM.

Results at 25°.

(Herz & Kurzer, 1910.)

Mols. Iodine per 1000 Gms.: Glycerol Layer c.	$CHCl_3$ Layer c'.	$\frac{c}{c'}$.
0.0244	0.0564	0.43
0.0397	0.0910	0.43
0.0500	0.1151	0.43

Results at 30°.

(Hantzsch & Vagt, 1901.)

Mols. Iodine per Liter: Glycerol Layer c.	$CHCl_3$ Layer c'.	$\frac{c}{c'}$.
0.00097	0.00172	0.056
0.00204	0.00412	0.495
0.00418	0.00898	0.465
0.00782	0.0216	0.362

Results at Dif. Temps.

(Hantzsch & Vagt, 1901.)

t°.	Mols. I per Liter: Glycerol Layer c.	$CHCl_3$ Layer c'.	$\frac{c}{c'}$.
0	0.0119	0.0177	0.675
20	0.0084	0.0213	0.400
40	0.0077	0.0221	0.349
50	0.0074	0.0226	0.330

Data are also given by the above named investigators for the distribution of iodine between aqueous glycerol solutions and chloroform at several temperatures.

DISTRIBUTION OF IODINE BETWEEN GLYCEROL AND ETHYL ETHER.

(Hantzsch & Vagt, 1901.)

t°.	Mols. Iodine per Liter: Glycerol Layer (c).	Ether Layer (c')	$\frac{c}{c'}$.
0	0.00566	0.0270	0.21
30	0.00544	0.0272	0.20
30	0.00100	0.0051	0.20

SOLUBILITY OF IODINE IN LIQUID CARBON DIOXIDE.

(Quinn, 1928.)

t°	d of CO_2	Sat. density of sat. sol.	Gm. I per 1 Gm. Mol. CO_2	Gms. I per 100 gms. CO_2
-21	1.031 (-20°)	1.031 (-20°)	0.0102	0.0232
-11.4	0.981 (-10)	0.982 (-10)	0.0191	0.0434
0	0.927	0.929	0.0347	0.0788
+10	0.858	0.863	0.0526	0.1195
20	0.770	0.775	0.0774	0.1759
25	0.710	0.720	0.0915	0.2079

SOLUBILITY OF IODINE IN CARBON DISULFIDE.

(Arctowski, 1894.)

t°.	Gms. I per 100 Gms. Solution.	t°.	Gms. I per 100 Gms. Solution.	t°.	Gms. I per 100 Gms. Solution.
−100	0.32	0	7.89	30	19.26
− 80	0.51	10	10.51	36	22.67
− 63	1.26	15	12.35	40	25.22
− 20	4.14	20	14.62	42	26.75
− 10	5.52	25	16.92		

SOLUBILITY OF IODINE IN SEVERAL SOLVENTS AT 25°.

(Herz and Rathmann, 1913.)

Solvent.	Iodine per Liter of Sat. Sol.		Solvent.	Iodine per Liter of Sat. Sol.	
	Mols.	Gms.		Mols.	Gms.
Chloroform	0.352	44.68	Trichlorethylene	0.312	39.61
Carbon Tetrachloride	0.237	30.08	Tetrachlorethane	0.244	30.97
Tetrachlorethylene	0.241	30.59	Pentachlorethane	0.272	34.53

SOLUBILITY OF IODINE IN SEVERAL SOLVENTS.

(Margosches, Hinner and Friedmann, 1924.)

t°	Gms. I per 100cc sat. solution in:					
	Carbon Tetrachloride CCl_4	Chloroform $CHCl_3$	Methylene Chloride CH_2Cl_2	Tetra chloro Ethylene $CCl_2.CCl_2$	Trichloro Ethylene $CHCl.CCl_2$	Di chlor Ethylene CH_2CCl_2
11	1.77	2.84	3.68	1.87	2.48	2.99
15	2.05	3.26	4.22	2.10	2.80	3.38
18	2.25	3.54	4.65	2.32	3.05	3.72
21	2.51	3.95	5.13	2.59	3.41	4.13
25	2.91	4.52	5.86	3.06	3.96	4.76

t°	Gms. I per 100 cc sat. solution in:				
	Pentachloro Ethane $CHCl_2.CCl_3$	Acetylene Tetra Chloride $CHCl_2.CHCl_2$	Chloro Ethylene Chloride $CH_2.CHCl$	Ethylene Chloride $CH_2Cl.CH_2Cl$	Ethylidene Chloride $CH_3.CHCl_2$
11	2.02	2.71	3.72	4.59	3.00
15	2.31	3.01	4.15	5.11	3.25
18	2.50	3.22	4.50	5.59	3.49
21	2.80	3.61	4.91	6.13	3.92
25	3.09	4.10	5.47	6.87	4.39

SOLUBILITY OF IODINE IN SEVERAL SOLVENTS.

Solvent	Formula	t°	Gms. Iodine per 100 gms. sat. sol.	Gms. Iodine per 100 cc sat. sol.	Authority
Acetic Acid	CH_3COOH	20	1.727	—	(Anders, 1933.)
" "	"	30	2.706	—	" "
" "Ethyl Ester	$CH_3COOC_2H_5$	8	11.1	—	(Knott, 1932.)
" " " "	"	11	12.39	—	" "
" " " "	"	30	16.15	—	" "
Carbon Disulfide	CS_2	25	--	23.0	(Jakowkin, 1895
Carbon Tetrachloride	CCl_4	0	—	1.04	(Groh, 1927.)
" "	"	11.5	—	1.83	" "
" "	"	25	—	3.03	(Jakowkin, 1895
Tetra chlor ethane	$CHCl_2.CHCl_2$	25	—	4.16	(Grace, 1931.)
Bromoform	$CHBr_3$	5.6	3.22	—	(Amadori, 1922.)
"	"	25	6.6	—	(Turner and English, 1914.)
"	"	25	—	18.96	(Jakowkin, 1895.)
Benzene	C_6H_6	25	—	13.83	(Grace, 1931.)
"	"	20	8.15	—	(Anders, 1933.)
"	"	30	11.64	—	" "
Nitrobenzene	$C_6H_5NO_2$	16-17	—	5.06	(Dawson and Gawler, 1902.)
Toluene	$C_6H_5CH_3$	25	—	3.56	(Schilow and Lepin, 1922.)
Hexane	$CH_3(CH_2)_4CH_3$	25	12.2	—	(Hildebrand and Jenks, 1920.)
Anhy. Lanolin	(m. pt. 46°)	45	5.5	—	(Klose, 1907.)

SOLUBILITY OF IODINE IN CARBON TETRACHLORIDE.

(Jacek, 1926; Hildebrand and Jenks, 1920.)

t°.	Gms. I per 100 gms. CCl_4.	t°.	Gms. I per 100 gms. CCl_4.	t°.	Gms. I per 100 gms. CCl_4.
−24.75	0.254	−16.5	0.352	−7.25	0.527
−24.0	0.257	−14.5	0.375	−6.00	0.539
−22.0	0.270	−11.25	0.447	−2.75	0.632
−19.0	0.297	−9.5	0.466	0.0	0.733
−18.5	0.319	−8.5	0.480	0.0	0.693 (H. and J.)
−17.0	0.327	−8.25	0.496	35.0	2.667 "
				50.0	4.547 "

SOLUBILITY OF IODINE IN CARBON DISULFIDE. (Jacek, 1915.)

t°.	Gms. I per 100 gms. CS_2.	t°.	Gms. I per 100 gms. CS_2.	t°	Gms. I per 100 gms. CS_2.
−107	0.158	−69	0.520	−29.5	2.597
−80	0.255	−51	1.089	−22.25	3.541
−77.5	0.342	−45	1.361	−15.75	4.544
−71.5	0.422	−35.25	2.007	−5	6.788
				0	8.385

SOLUBILITY OF IODINE IN CHLOROFORM.

(Below 0°, Jacek, 1915; above 0°, Grimbert, Malmy and Poirot, 1924; Malmy, 1926.)

t°.	Gms. I per 100 gms. $CHCl_3$.	t°.	Gms. I per 100 gms. $CHCl_3$.	t°.	Gms. I per 100 gms. $CHCl_3$.
-60	0.089	-9	0.856	10	1.805 (G. M. and P.)
-51	0.128	-5	1.054	15	2.176 »
-45.5	0.180	-1	1.198 (M.)	19	2.533 »
-35.0	0.243	0	1.240	20	2.630 »
-30	0.372	0	1.237 (M.)	24	3.092 »
-25	0.404	+0.5	1.267 (M.)	25	3.200 (3.38*)
-22.25	0.514	5.0	1.483 (G. M. and P.)	30	3.836 (M.)

* Gms. per 100 cc. sat. sol. at 25° (Schilow and Lepin, 1922.)

100 gms. chloroform for anasthesia, containing 0.005 per cent C_2H_5OH, dissolve 2.19 gm. I at 15°. (G. M. and P.)

SOLUBILITY OF IODINE IN ETHYL ETHER. (Jacek, 1915.)

I

t°.	Gms. I per 100 gms. $(C_2H_5)_2O$.	t°.	Gms. I per 100 gms. $(C_2H_5)_2O$.	t°.	Gms. I per 100 gms. $(C_2H_5)_2O$.
—108	15.10	—51	16.44	—21	20.38
— 94.5	15.43	—47	17.08	—19.5	20.80
— 83.25	15.46	—40.25	17.67	—14.75	21.59
— 75	15.67	—34.75	18.64	0.0	26.08
— 63	16.16	—24.5	19.67		

SOLUBILITY OF IODINE IN HEPTANE. (Hildebrand and Jenks, 1920.)

t°.	Gms. I per 100 gms sat. sol.	Mols I_2 per 100 mols sat. sol.
0	0.6176	0.00245
25	1.702	0.006786
35	2.491	0.00998
50	4.196	0.01699

SOLUBILITY OF IODINE IN BENZENE, CHLOROFORM, AND IN ETHER.

(Arctowski — Z. anorg. Chem. 11, 276, '95–'96.)

In Benzene.		In Chloroform.		In Ether.	
t°.	Gms. I per 100 Gms. Solution.	t°.	Gms. I per 100 Gms. Solution.	t°.	Gms. I per 100 Gms. Solution.
4.7	8.08	−49	0.188	−83	15.39
6.6	8.63	−55½	0.144	−90	14.58
10.5	9.60	−60	0.129	−108	15.09
13.7	10.44	−69½	0.089		
16.3	11.23	−73½	0.080		
		+10	1.76 per 100 gms. $CHCl_3$		

(Duncan — Pharm. J. Trans. 22, 544, '91–'92.)

Solubility of Iodine in Acetone and in Benzene.

Results for Acetone.

(Jacek, 1915.)

t°.	Gms. I per 100 gms. $CH_3.CO.CH_3$.	t°.	Gms. I per 100 gms. $CH_3.CO.CH_3$.
—84.....	2.73	—34.....	6.54
—75.....	6.76	—30.....	5.30
—70.5...	8.83	—22.5...	4.5
—54.75..	15.06	—18.0...	4.25
—53 5...	13.5	—16.0...	3.9
—51.0...	12.1	— 5.0...	2.66
—44.5...	8.6	0.0...	2.56
—42.0...	8.6		

Results for Benzene.

(Hildebrand and Jenks, 1920.)

t°.	Gms. I per 100 gms. sat. sol.	Mols. I_2 per 100 mols. sat. sol.
25.....	14.09	0.0480
30.....	16.10	0.0558
35.....	17.90	0.0629
40.....	20.05	0.0716
45.....	22.78	0.0832
50.....	25.51	0.0953
54.64..	28.26	0.1081

Solubility of Iodine in Several Solvents.

(Negishi, Donnally and Hildebrand, 1933.)

Solvent	t°	Gms. I per 100 gms. sat. sol.	Gm. Mols. I_2 per 100 gm. mols. sat. sol.
Titanium tetra chloride, $TiCl_4$	0.1	1.153	0.8633
" " " "	25.0	2.855	2.150
" " " "	40.0	4.631	3.499
" " " "	49.9	6.500	4.939
Silicon tetra chloride, $SiCl_4$	0.1	0.2555	0.1713
" " " "	25.0	0.7433	0.4987
" " " "	40.0	1.309	0.8801
Ethylene Bromide, $CH_2Br.CH_2Br$	8.0	6.557	4.925
" " "	10.0	6.850	5.161
" " "	15.0	7.859	5.937
" " "	20.0	9.091	6.895
" " "	25.0	10.32	7.815
" " "	35.0	13.42	10.28
" " "	45.0	17.43	13.51
" " "	49.6	19.12	14.89
" " "	60.0	25.54	20.24
" " "	70.0	33.30	26.97
" " "	75.0	37.61	30.85
" " "	70.4	42.40	35.26
Iso Octane, $CH_3C(CH_3)_2CH_2CH(CH_3)CH_3$	24.92	1.302	0.590
(2.2.4-tri methyl pentane)"	35.0	1.918	0.8711

In the cases of the titanium and silicon tetrachloride the determinations were made in an atmosphere of nitrogen.

Solubility of Iodine in Normal Pentane and in Iso Pentane.

(Jacek, 1926.)

Results for Normal Pentane.

t°.	Gms. I per 100 gms. $CH_3(CH_2)_3CH_3$.	t°.	Gms. I per 100 gms. $CH_3(CH_2)_3CH_3$.
−71.25..	0.018	−26.75..	0.160
−69.75..	0.021	−26.0...	0.171
−54.25..	0.042	−15.25..	0.297
−48.75..	0.057	− 7.0...	0.423
−45.25..	0.067	− 5.5...	0.483
−40.75..	0.078	0.0...	0.605
−34 25..	0.113	+19.0...	1.377

Results for Iso Pentane.

t°.	Gms. I per 100 gms. $(CH_3)_2CHCH_2CH_3$.	t°.	Gms. I per 100 gms. $(CH_3)_2CHCH_2CH_3$.
−79.25..	0 017	−31.5...	0.117
−66.25..	0.018	−25.25..	0.155
−56.00..	0.033	−23.5...	0.172
−49 0...	0.039	−21.0...	0.200
−42.5...	0.063	−10.0...	0.345
−37.5...	0.080	− 8.0...	0.381
−36.95..	0.089	− 8.0...	0.375
−34.25..	0.096	0.0...	0.562

I IODINE

RECIPROCAL SOLUBILITY OF IODINE AND SULFUR IN BENZENE AND IN CARBON DISULFIDE AT 25°. (Amadori, 1922.)

Results for Benzene.

Gms per 100 gms. sat. sol. I.	S.	Solid Phase.
15.79	0.0	I
16.08	0.40	»
16.28	1.75	»
16.42	2.58	I + S
12.72	2.42	S
8.31	2.35	»
0.0	2.09	»

Results for Carbon Disulfide.

Gm's. per 100 gms. sat. sol. I.	S.	Solid Phase.
19.14	0 0	I
19.83	7.76	»
20.64	12.83	»
21.45	27.73	»
22.11	36.74	»
22.64	40.82	S + I
16.08	39.56	S
9. 4	37.12	»
6.62	36.42	»
0.0	34.76	»

Data for the reciprocal solubility of iodine and sulfur in carbon disulfide at 10° and at 18° are given by Mori, 1923. This author also found no evidence of the existence of compounds of iodine and sulfur.

Bromoform simultaneously saturated with iodine and sulfur contains 3.7 gms. I and 4.2 gms. S per 100 gms. sat solution at 3.65°. (Amadori, 1922.)

I

RECIPROCAL SOLUBILITY OF IODINE AND SULFUR IN CARBON TETRACHLORIDE.

(Jakowkin and Archangelsky, 1936.)

Results at 0°

Gms. per 100cc sat. sol. I	S	Solid Phase
1.145	0.0	I
1.157	0.596	I + S
0.818	0.596	S
0.0	0.596	S

Results at 25°

Gms. per 100cc sat. sol. I	S	Solid Phase
2.905	0.0	I
3.083	1.466	I + S
2.069	1.405	S
1.998	1.394	S
0.0	1.329	S

Solubility results on mixtures of Iodine and Potassium Iodide with Chloroform and with Toluene, given by Foote and Bradley, 1932, show that between 0.7° and 25.0° no solid binary addition product of Iodine and Potassium Iodide exists. With benzene a ternary addition product having the composition $KI.4I_2.3C_6H_6$ was found.

SOLUBILITY OF IODINE IN NITROBENZENE SOLUTIONS CONTAINING VARIOUS IODIDES AT ROOM TEMPERATURE. SOLUTIONS SAT. WITH I IN EACH CASE.

(Dawson and Goodson, 1904.)

Iodide.	Gms. per Liter Iodide.	Gms. per Liter Iodine.	Iodide.	Gms. per Liter Iodide.	Gms. per Liter Iodine.
Potassium Iodide	12.35	112.7	Caesium Iodide*	48.2	213
" "	45.56	295.7	Caesium Iodide	223	858
" "	115.8	698.2	Ammonium Iodide	69.5	482
" "	155.2	943.6	Ammonium Iodide*	94.3	669
Sodium Iodide	13.55	125	Aniline Hydriodide	164	721
" "	57.7	393	Dimethylaniline Hydriodide	160	626
" "	109.1	738	Tetramethylammonium Iodide	49.3	266
" "	228	1251	Tetramethylammonium Iodide	51.4	280
Rubidium Iodide	85.4	421	Strontium Iodide	106.5	599
Rubidium Iodide	217.5	1060	Barium Iodide	42.2	237
Lithium Iodide	84.1	642	Barium Iodide	158.5	809

* Solvent = *o* nitrotoluene instead of nitrobenzene.

Similar results are also given for solutions containing KI in addition to the other iodide, and one series for the simultaneous solubility of KBr and I in nitrobenzene. It is considered that the increased solubility is most easily explained on the assumption that periodides are formed in solution.

SOLUBILITY OF IODINE IN MIXTURES OF SOLVENTS AT 25°.

(Mahieu, 1936.)

In Ether + Chloroform: Gms. $(C_2H_5)_2O$ per 100 gms. solvent mixture	Gms. I per 100 gms. solvent mixture	In Methyl Alcohol + Chloroform: Gms. $CHCl_3$ per 100 gms. solvent mixture	Gms. I per 100 gms. solvent mixture
0.0(= $CHCl_3$)	2.01	0.0(= CH_3OH)	23.35
25.1	4.80	24.1	17.97
48.1	7.34	50.3	12.75
73.6	15.03	74.4	7.71
100.0	23.86	100.0	2.11

SOLUBILITY OF IODINE IN MIXTURES OF ACETIC ACID AND BENZENE.

(Anders, 1933.)

Results at 0°		Results at 20°		Results at 30°	
Gms. CH_3COOH per 100 gms. solvent mixture	Gms. I per 100 gms. sat. solution	Gms. CH_3COOH per 100 gms. solvent mixture	Gms. I per 100 gms. sat. solution	Gms. CH_3COOH per 100 gms. solvent mixture	Gms. I per 100 gms. sat. solvent
21.788	3.892	0.0	8.152	0.0	11.642
47.961	3.156	21.516	7.107	21.371	9.745
58.263	3.224	39.045	6.162	42.681	7.597
		59.761	4.046	58.624	5.492
		75.407	3.011	77.623	4.224
		100.00	1.727	100.0	2.706

Solubility of Iodine in Mixtures of Chloroform and Ethyl Alcohol, Chloroform and Normal Propyl Alcohol, Chloroform and Benzene, and Chloroform and Carbon Disulfide at 15°.

(Bruner, 1898.)

Vol. % $CHCl_3$ in Solvent.	Gms. I Dissolved per 100 cc. of Mixtures of:			
	$CHCl_3+C_2H_5OH$.	$CHCl_3+C_3H_7OH$.	$CHCl_3+C_6H_6$.	$CHCl_3+CS_2$.
0	15.67	14.93	10.40	17.63
10	9.43	13.16	9.84	15.93
20	8.69	11.20	8.78	14.20
30	7.80	8.98	7.74	12.16
40	7.09	8.09	6.96	10.20
50	6.62	7.82	6.20	9.08
60	6.24	7.09	5.34	7.72
70	5.77	6.42	4.89	6.42
80	5.06	5.54	4.53	5.27
90	4.34	4.52	4.07	4.32
100	3.62	3.62	3.62	3.62

Solubility of Iodine in Mixtures of Carbon Tetrachloride and Benzene and in Mixtures of Carbon Tetrachloride and Carbon Disulfide at 15°.

(Bruner, 1898.)

I

Vol. % CCl_4 in Solvent.	Gms. I per 100 cc. of Mixture of:	
	$CCl_4+C_6H_6$.	CCl_4+CS_2.
0	10.40	17.6
10	9.44	14.44
20	8.53	12.33
30	7.77	10.34
40	6.63	8.60
50	5.70	6.83
60	4.90	5.55
70	4.09	4.50
80	3.41	3.37
90	2.74	2.60
100	2.06	2.06

In the case of the above determinations the volume change occurring on mixing the solvents was neglected. The temperature was not accurately regulated and the mixtures not shaken during the saturation. The curves plotted from the results are not smooth.

Solubility of Iodine in Mixtures of Chloroform and Ether at 25°.

(Marden and Dover, 1916.)

Gms. $CHCl_3$ per 100 Gms. $CHCl_3+(C_2H_5)_2O$.	Gms. Iodine per 100 Gms. $CHCl_3+(C_2H_5)_2O$.
0	35.1
10	29.6
20	24.8
30	20.2
40	16.3
50	12.7
60	9.83
70	7.5
80	5.73
90	4.31
100	3.10

100 cc. of a mixture of $CHCl_3$ + CS_2 (3:1) dissolve 7.39 gms. iodine (t° ?.) The addition of S even up to the point of saturation does not affect the amount of iodine held in solution.

(Olivari, 1908.)

Diagrammatic results for mixtures of iodine and each of the following compounds are given by Olivari, 1911: CHI_3, *p* $C_6H_4Br_2$, $[C_6H_4]N_2$, *p* $C_6H_4(NO_2)_2$, $(C_6H_5CO)_2O$ and C_6H_5COOH.

SOLUBILITY OF IODINE IN MIXED SOLVENTS AT 16.6°.

(Strömholm, 1903.)

Solvent.	Gms. I per Liter Sat. Sol.	Solvent.	Gms. I per Liter Sat. Sol.
Ether	206.3	Ether + 20.96 gms. CS_2 per liter	202.3
Carbon Disulfide	178.5	Ether + 41.9 " CS_2 "	217.2
Ether + 3.96 gms. H_2O per liter	221	CS_2 + 22.5 " ether "	189.3
" + 7.91 gms. H_2O "	235.7	CS_2 + 45.1 " ether "	201.1
" + excess H_2O	251.4	Ether + 47.63 " $CHCl_3$ "	195.2
" + 9.79 gms. C_2H_5OH "	219.1	CS_2 + 50.06 " $CHCl_3$ "	172.8
" + 19.6 " " "	231.5	Ether + 80.3 " C_6H_6 "	204.1
" + 29.4 " " "	243.9	Ether + 77.85 " CH_3I "	220.2
" + 39.2 " " "	254.4	CS_2 + 62.2 " S "	189.4

One liter sat. solution in ether contains 167.3 gms. I at 0°. (Strömholm, 1903.)

SOLUBILITY OF IODINE IN CARBON TETRACHLORIDE CONTAINING OTHER SOLVENTS.

(Oroh, 1927.)

Results for Carbon Tetrachloride containing:

Methyl Alcohol

t°	Gm. Mols. per liter sat. sol. in CCl_4	
	CH_3OH	I_2
0	0.192	0.0524
"	0.411	0.0601
"	0.617	0.0673
"	0.814	0.0743
"	0.993	0.0806
"	1.234	0.0891
"	1.607	0.1022
"	2.032	0.1168
11.8	0.188	0.0816
"	0.404	0.0920
"	0.596	0.1006
"	1.011	0.1191
"	1.120	0.1237

Ethyl Alcohol

t°	Gm. Mols. per liter sat. sol. in CCl_4	
	C_2H_5OH	I_2
0	0.205	0.0556
"	0.410	0.0653
"	0.609	0.0741
"	0.808	0.0829
"	1.025	0.0924
"	1.232	0.1015
"	1.621	0.1193
"	2.013	0.1365
11.7	0.201	0.0849
"	0.404	0.0970
"	0.596	0.1080
"	0.807	0.1202
"	1.010	0.1319

Propyl-Alcohol

t°	Gm. Mols. per liter sat. sol. in CCl_4	
	C_3H_7OH	I_2
0	0.208	0.0547
"	0.414	0.0636
"	0.622	0.0721
"	0.815	0.0800
"	1.035	0.0889
"	1.307	0.1001
"	1.543	0.1096
"	2.045	0.1312
11.6	0.198	0.0835
"	0.403	0.0947
"	0.594	0.1051
"	0.805	0.1163
"	1.005	0.1267

Acetic Acid

t°	Gm. Mols. per liter sat. sol. in CCl_4	
	CH_3COOH	I_2
0	0.0	0.0450
"	0.201	0.0464
"	0.395	0.0477
"	0.797	0.0501
"	0.992	0.0513
"	1.148	0.0522
11.15	0.204	0.0715
"	0.406	0.0730
"	0.547	0.0744
"	0.897	0.0765
"	1.181	0.0786

Ethyl Ether

t°	Gm. Mols. per liter sat. sol. in CCl_4	
	$(C_2H_5)_2O$	I_2
0	0.211	0.0549
"	0.422	0.0650
"	0.633	0.0748
"	0.844	0.0853
"	1.055	0.0960
"	1.266	0.1063
11.4	0.0	0.0710
"	0.196	0.0815
"	0.390	0.0927
"	0.585	0.1037
"	0.865	0.1206
"	1.171	0.1399

MUTUAL SOLUBILITY OF LIQUID IODINE AND CARBON TETRACHLORIDE.

(Hildebrand, 1937.)

The determinations were made by the synthetic method but due to the opacity of concentrate iodine solutions advantage was taken of the difference in density of the two liquid phases for detecting their points of separation.

t^0	Wt % Iodine	Mol % Iodine	t^0	Wt % Iodine	Mol % Iodine
128.8	44.8	33.0	160.5 (max.)	—	67.0
155.0	63.0	50.8	160.1	80.8	71.8
158.1	67.0	55.1	159.9	81.7	73.1
160.6	76.0	65.7	153.5	86.6	79.7

SOLUBILITY OF IODINE IN ARSENIC TRICHLORIDE. (Sloan and Mallet, 1882.)

t°.	0°.	15°.	96°.
Gms. I per 100 gms. $AsCl_3$	8.42	11.88	36.89

FREEZING-POINTS OF MIXTURES OF IODINE AND IODOFORM.

(Vasilev, 1916.)

I

t°.	I content of mixture.		Solid Phase.	t°.	I content of mixture.		Solid Phase.
	Wt. %.	Atom %.			Wt. %.	Atom %.	
114.0	100.0	100.0	I	66.1 (Eutec.)	42.3	–	$I+CHI_3$
97.8	87.84	95.70	»	70.9	38.85	66.33	CHI_3
94.8	85.38	94.82	»	78.1	31.45	58.76	»
79.8	70.22	87.98	»	86.2	24.63	50.35	»
73.6	59.41	81.96	»	95.8	17.63	39.40	»
71.2	53.30	77.96	»	111.9	5.20	14.55	»
69.5	49.08	74.94	»	119.7	0.0	0.0	»

Similar data for iodine + naphthalene gave a single eutectic at 65°.7 and 39.43 wt. % I.

Fusion-point data are given for the following mixtures:

I + As	(Jaeger and Doornbosch, 1912.)
I + CaI_2	(Olivari, 1908.)
I + HgI_2	" "
I + In	(Thiel and Koelsch, 1910.)
I + KI	(Olivari, 1914; Briggs and Geigle, 1930; Fialkow and Kensmenkc, 1936.)
I + LiI	(Fialkow and Kensmenko, 1936.)
I + S	(Olivari, 1908; Boulouch, 1903; Smith and Carson, 1908.)
I + Sb	(Jaeger and Doornbosch, 1912.)
I + Se	(Pellini and Pedrina, 1908.)
I + Sn	(Van Klooster, 1912-13; Reinders and Lange, 1912-13; Vasileu, 1916, 1917.)
I + Te	(Jaeger and Menke, 1912; Damiens, 1921, 1923.)
I + Tl	(Fialkow and Kensmenko, 1936.)

I + Each of the following compounds: Azobenzene, benzoic acid, Benzoic anhydride, Dibrom benzene, *p* Dinitrobenzene, Iodoform, Tetra methyl ammonium Iodide and Tri methyl phenyl ammonium iodide. (Olivari, 1911.)

IODINE CYANIDE ICN

One liter sat. solution of iodine cyanide in water contains 0.2523 gm. mols. at 25°. (Yost and Stone, 1933.)

Distribution of Iodine Cyanide Between Water and Carbon Tetrachloride at 25°

(Yost and Stone, 1933.)

Gm. Mols. ICN per liter of:		$\frac{c}{w}$
H_2O layer (w)	CCl_4 layer (c)	
0.02480	0.004460	0.1798
0.03312	0.006007	0.1814
0.05144	0.009441	0.1835
0.06697	0.01239	0.1850
0.07960	0.01482	0.1862

IODINE PENTOXIDE I_2O_5.

Solubility of Iodine Pentoxide in Sulfuric Acid at 24°.77.

(Lamb and Phillips, 1923.)

Constant rotation in a thermostat was employed. Equilibrium was reached in some cases within one day, but with higher concentrations of sulfuric acid, there was a slow decrease from a definite initial solubility. This was studied over a period of 55 days and constancy was reached in all cases within 40 days.

Per cent conc. of H_2SO_4.	Gms I_2O_5 per liter		Per cent conc. of H_2SO_4.	Gms I_2O_5 per liter	
	Initial.	Final.		Initial.	Final.
50.0.......	54.79	54.79	89.0.......	22.1	15.1
60.0.......	34.68	34.68	90.3.......	22.7	14.5
75.0.......	19.48	19.48	92.0	23.4	13.5
78.0.......	18.66	18.66	96.0.......	(23.2)	11.0
79.6.......	19.0	18.5	98.0.......	(22.0)	9.5
82.0.......	19.9	18.8	99.9.......	–	3.48
84.6.......	20.5	19.3	102.0*......	–	1.28
86.0.......	21.0	17.1	104.0.......	–	1.90
87.4.......	21.5	15.8	106.0......	–	2.67

* This percentage represents weights of 100 % H_2SO_4 equivalent to 100 gm. of the acid in question. The 106.5 % of acid, therefore, contained 29.0 % of free SO_3.

INDIUM In

Solubility of Indium in Mercury.

(Parks and Moran, 1937.)

t°	Gms. In per 100 gms. In + Hg	Gm. Atoms In per 100 gms. Atoms In + Hg
0	1.23	2.14
12.5	1.27	2.20
25	1.26	2.18
37.5	1.28	2.22
50	1.31	2.27

INDIUM IODATE $In(IO_3)_3$.

100 gms. H_2O dissolve 0.067 gm. $In(IO_3)_3$ at 20°. (Mathers and Schluederberg, 1908.)

INDIUM Ammonium SULFATE $In_2(NH_4)_2(SO_4)_4.24H_2O$

100 gms. H_2O dissolve 200 gms. of the salt at 16° and 400 gms. at 30°. (Rossler, 1873.)

IRIDIUM 'CHLORIDE $IrCl_4$.

When 1 gm. iridium as chloride is dissolved in 100 cc. of 10% HCl and shaken at 18° with 100 cc. of ether, 0.02 per cent of the metal enters the ethereal layer. When 20% HCl is used 5% of the metal enters the ether. When dissolved in 1% HCl or in water approximately 0.01 per cent of the metal enters the ethereal layer. (Mylius, 1911.)

IRIDIUM Potassium CHLORIDE IrK_2Cl_6

100 gms. H_2O dissolve 1.25 gms. IrK_2Cl_6 at 18-20°.

100 gms. H_2O dissolve 9.18 gms. dipotassium aquo penta chloroiridite, $IrCl_5(H_2O)K_2$ at 19°. (Delepine, 1908.)

IRIDIUM Ammonium **CHLORIDE** $IrCl_4.2NH_4Cl$.

SOLUBILITY IN WATER.

(Rimbach and Korten, 1907.)

t°.	Gms. $IrCl_4.2NH_4Cl$ per 100 Gms. Water.	Gms. $IrCl_4.2NH_4Cl$ per 100 Gms. Sat. Sol.	t°.	Gms. $IrCl_4.2NH_4Cl$ per 100 Gms. Water.	Gms. $IrCl_4.2NH_4Cl$ per 100 Gms. Sat. Sol.
14.4	0.699	0.694	52.2	1.608	1.583
26.8	0.905	0.899	61.2	2.130	2.068
39.4	1.226	1.124	69.3	2.824	2.746

AMMONIUM Iridium **CLORIDE** $(NH_4)_2IrCl_6$.

SOLUBILITY IN WATER. (Archibald and Kern, 1917.

Cl

t°.	Gms. $(NH_4)_2IrCl_6$ per 100 gms. H_2O.	t°.	Gms. $(NH_4)_2IrCl_6$ per 100 gms. H_2O.
0.2	0.5561	40.0	1.5665
10.0	0.7055	50.0	1.9664
25.0	1.0910	60.0	2.4567
30.0	1.2066	80.0	4.3815

Decomposition occurs at higher temperatures.

SOLUBILITY IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE AT 20°.

(Archibald and Kern, 1917.)

Gm. mols. NH_4Cl per liter.	Gms. $(NH_4)_2IrCl_6$ per 100 gms. solvent.	Gm. mols. NH_4Cl per liter.	Gms. $(NH_4)_2IrCl_6$ per 100 gms solvent
0.10	0.1793	1.00	0.0064
0.20	0.0780	2.00	0.0027

IRIDIUM Ammonium CHLORIDE $Ir(NH_4)_2Cl_6$

SOLUBILITY OF IRIDIUM AMMONIUM CHLORIDE IN AQUEOUS SOLUTIONS OF PLATINUM AMMONIUM CHLORIDE AND VICE VERSA AT 18°.

(Ogawa, 1930.)

Gms. per 100 gms. sat. solution $Ir(NH_4)_2Cl_6$	Gms. per 100 gms. sat. solution $Pt(NH_4)_2Cl_6$	Gms. per 100 gms. sat. solution $Ir(NH_4)_2Cl_6$	Gms. per 100 gms. sat. solution $Pt(NH_4)_2Cl_6$
1.086	0.0	0.424	0.364
1.016	0.089	0.258	0.481
0.902	0.106	0.197	0.594
0.605	0.267	0.105	0.605
0.524	0.288	0.0	0.768

Solubility of Iridium Ammonium Chlorides in Water at 19°.

(Telepine, 1909.)

Name of Salt.	Formula.	Gms. per 100 Gms. H_2O.
Ammonium iridium chloride	$(NH_4)_2IrCl_6$	0.77
Diammonium aquo penta chloro iridite	$IrCl_5(H_2O)(NH_4)_2$	15.4
Triammonium hexa chloro iridite	$IrCl_6(NH_4)_3+H_2O$	10.5

IRIDIUM Sodium CHLORIDE $IrNa_2Cl_6.12H_2O$

Solubility of Iridium Sodium Chloride in Water.

(Ogawa, 1930.)

t°	Gms. $IrNa_2Cl_6$ per 100 gms. H_2O	t°	Gms. $IrNa_2Cl_6$ per 100 gms. H_2O	t°	Gms. $IrNa_2Cl_6$ per 100 gms. H_2O
15	34.46	40	96.00	63	202.63
22	41.39	45	123.96	70	231.66
25	46.11	51	155.26	75	253.17
30	56.17	55	169.27	80	279.34
35	74.03	60	191.18	85	307.26

IRIDIUM DOUBLE SALTS.

Solubility in Water.

(Palmaer — Ber. 23, 3817; 24, 2090, '91.)

Double Salt.	Formula.	t°.	Gms per 100 Gms. H_2O.
Irido Pentamine Bromide	$Ir(NH_3)_5Br_3$	12.5	0.284
" " Bromonitrate	$Ir(NH_3)_5Br(NO_3)_2$.	18	5.58
" " Tri Chloride	$Ir(NH_3)_5Cl_3$	15.1	6.53
" " Chloro Bromide	$Ir(NH_3)_5ClBr_2$	15	0.47
" " Chloro Iodide	$Ir(NH_3)_5ClI_2$	15	0.95
" " Chloro Nitrate	$Ir(NH_3)_5Cl(NO_3)_2$	15.4	1.94
" " Chloro Sulphate	$Ir(NH_3)_5ClSO_4.2H_2O$	15.0	0.74
" " Nitrate	$Ir(NH_3)_5(NO_3)_3$	16	0.28
" Aquo Pentamine Bromide	$Ir(NH_3)_5(OH_2)Br_3$	ord. temp.	25.0
" " " Chloride	$Ir(NH_3)_5(OH_2)Cl_3$	ord. temp.	74.7
" " " Nitrate	$Ir(NH_3)_5(OH_2)(NO_3)_3$	17	10.0

C1

Solubility of Each in Water at 20° (Benrath, 1924.)

Compound.	Formula.	Gms. cmpd. per 100 cc. H_2O.	Gms. mols. cmpd. per liter sat. sol.
Mono quinine hexa chlor iridate...	$C_{20}H_{24}N_2O_2.H_2IrCl_6$	0.0439	$6.0.10^{-4}$
» » » brom » ...	$C_{20}H_{24}N_2O_2H_2IrBr_6$	0.0174	$1.7.10^{-4}$
Di quinine » chlor » ...	$(C_{20}H_{24}N_2O_2)_2.H_2IrCl_6$	0.0012	$1.2.10^{-5}$
Mono cinchonine » » » ...	$C_{19}H_{22}N_2O.H_2IrCl_6$	0.1263	$1.8.10^{-3}$
» » » brom » ...	$C_{19}H_{22}N_2O.H_2IrBr_6$	0.0062	$6.5.10^{-5}$
Di cinchonine » chlor » ...	$(C_{19}H_{22}N_2O)_2.H_2IrCl_6$	0.0037	$3.5.10^{-5}$
Mono cinchonidine » » » ...	$C_{19}H_{22}N_2O.H_2IrCl_6$	0.0277	$3.9.10^{-4}$
» » » brom » ...	$C_{19}H_{22}N_2O.H_2IrBr_6$	0.0048	$5.0.10^{-5}$
Di cinchonidine » chlor » ...	$(C_{19}H_{22}N_2O).H_2IrCl_6$	0.0034	$3.4.10^{-5}$
Strychnine » » » ...	$(C_{21}H_{22}N_2O_2)_2H_2IrCl_6$	0.0045	$4.3.10^{-5}$
» » brom » ...	$(C_{21}H_{22}N_2O_2)_2H_2IrBr_6$	0.0015	$1.2.10^{-5}$
Brucine » chlor » ...	$(C_{23}H_{26}N_2O_4)_2H_2IrCl_6$	0.0083	$7.0.10^{-5}$
» » brom » ...	$(C_{23}H_{26}N_2O_4)_2H_2IrBr_6$	0.0015	$1.2.10^{-4}$
Nitron » chlor » ...	$(C_{20}H_{16}N_4)_2.H_2IrCl_6$	0.0082	$8.0.10^{-5}$
» » brom » ...	$(C_{20}H_{16}N_4)_2.H_2IrBr_6$	0.0086	$1.2.10^{-5}$

IRIDIUM OXIDE $IrO_2.xH_2O$

One liter of water sat. with Iridium Oxide contains 0.002 gm. IrO_2 at 20°.

One liter of 0.002 n HCl sat. with Iridium Oxide contains 0.0005 gm. IO_2 at 20°. (Moser and Hachhofer, 1932.)

POTASSIUM K_2

SOLUBILITY OF POTASSIUM IN LIQUID AMMONIA.

Results of Ruff and Geisel, 1906

t°	Mols. NH_3 to dissolve 1 gm. atom K
-100	4.82
-50	4.79
0	4.74

Results of Johnston and Meyer, 1929

t°	Gms. K dissolved per 100 gms. NH_3
-50.38	45.56
-33.5	46.38
0	49.05

SOLUBILITY OF POTASSIUM IN MELTED KOH. (von Hevesy, 1909.)

Difficulty was experienced due to the failure of the excess of K to separate completely from the saturated solution. Time of heating, 50 hours.

t°.	Gms. K per 100 Gms. KOH.
480	7.8-8.9
600	3 -4
650	2 -2.7
700	0.5-1.3

Fusion-point data for mixtures of Potassium and Rubidium are given by Goria, 1935.)

A10

POTASSIUM ALUMINATE $K_2O.Al_2O_3.3H_2O$.

EQUILIBRIUM IN THE SYSTEM POTASSIUM HYDROXIDE, ALUMINUM HYDROXIDE AND WATER AT 30°.

(Jucaitis, 1934.)

The mixtures were shaken for 3 months.

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
K_2O	Al_2O_3		K_2O	Al_2O_3	
30.21	15.58	$K_2O.Al_2O_3.3H_2O$	39.40	3.01	$K_2O.Al_2O_3.3H_2O$
30.87	12.51	"	41.25	2.20	"
31.65	10.90	"	43.86	1.73	"
32.03	9.79	"	44.74	1.26	"
32.40	8.62	"	45.41	1.80	"
35.67	4.68	"	46.06	1.25	"
38.38	3.93	"	47.83	0.92	

POTASSIUM (Dihydrogen) ARSENATE KH_2AsO_4.

100 gms. sat. aq. solution contain 15.9 gms. KH_2AsO_4, or 100 gms. H_2O dissolve 18.86 gms. at 6°. Sp. Gr. of solution = 1.1134. (Field, 1859.)

100 cc. sat. aq. solution contain 28.24 gms. KH_2AsO_4 at about 7°. (Muthmann and Kuntze, 1894.)

100 gms. glycerol (d_{15} = 1.256) dissolve 50.1 gms. potassium arsenate at 15-16°. (Ossendowski, 1907.)

POTASSIUM ARSENITES $K_2As_4O_7$, $K_6As_4O_9.12H_2O$.

EQUILIBRIUM IN THE SYSTEM POTASSIUM OXIDE, ARSENIC TRIOXIDE AND WATER AT 25°.

(Schreinemakers and De Baat, 1920.)

For saturation 4 to 6 weeks agitation at 25° was employed.

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
As_2O_3.	K_2O.		As_2O_3.	K_2O.	
2.02	0.0	As_2O_3	48.96	24.16	$D_{3.2.12}$
22.63	5.61	»	44.84	23.61	»
36.29	8.79	»	39.49	23.49	»
41.93	9.69	»	33.60	24.07	»
54.02	11.62	»	24.16	28.05	»
58.11	13.74	$D_{1.2}$	20.98	32.93	»
53.49	15.24	»	22.47	35.96	»
49.58	17.28	»	29.61	38.32	»
49.21	18.61	»	23.82	42.48	$KOH.H_2O$
49.02	20.19	»	17.57	43.52	»
49.47	22.01	(?)	11.53	44.13	$KOH.2H_2O$
49.65	23.00	(?)	0.0	45.5	»

AsO

$D_{1.2} = K_2As_4O_7 = K_2O(As_2O_3)_2$, $D_{3.2.12} = K_6As_4O_9.12H_2O = (K_2O)_3(As_2O_3)_2.12H_2O$

POTASSIUM BORATES.

SOLUBILITY OF POTASSIUM BORATES IN WATER AT 30°.

(Dukelski — Z. anorg. Chem. 50, 42, '06, complete references given.)

Gms. per 100 Gms. Solution.		Gms. per 100 Gms. Residue.		Solid Phase.
K_2O.	B_2O_3.	K_2O.	B_2O_3.	
47.50	. . .	. . .	. . .	$KOH.2H_2O$
46.36	0.91	46.13	9.02	$K_2O.B_2O_3.2\frac{1}{2}H_2O$
40.51	1.25	41.62	9.71	"
36.82	1.80	39.90	13.19	"
32.74	3.51	37.22	14.58	"
29.63	6.98	35.05	17.92	"
24.84	17.63	30.02	21.70	"
23.30	18.19	26.84	31.49	$K_2O.2B_2O_3.4H_2O$
16.21	13.10	25.12	33.18	"
11.78	9.82	20.57	26.43	"
9.18	8.00	22.38	31.30	"
6.22	9.13	20.87	31.06	"
7.73	13.37	22.21	36.24	$K_2O.2B_2O_3.4H_2O + K_2O.5B_2O_3.8H_2O$
7.81	13.28	17.50	34.18	
7.71	13.21	11.49	34.81	$K_2O.5B_2O_3.8H_2O$
7.63	13.28	12.51	40.52	"
3.42	7.59	10.77	37.35	"
1.80	4.15	5.88	20.00	"
0.51	3.19	10.81	40.89	"
0.33	4.58	7.72	34.21	$K_2O.5B_2O_3.8H_2O + B(OH)_3$
0.31	4.46	3.91	30.68	"
. . .	3.54	. . .	. . .	"

BO

POTASSIUM MetaBORATE KBO_2.

Fusion-point data for potassium metaborate + sodium metaborate and for potassium metaborate + potassium metaphosphate are given by van Klooster (1910–11).

POTASSIUM Per**BORATES**, $2KBO_3.H_2O$, $2KBO_3.H_2O_2$.

SOLUBILITY OF EACH IN WATER.

(v. Girsewald and Wolokitin, 1909.)

Borate.	% Active O in Borate.	t°.	Gms. Salt per 100 Gms. Water.
$2KBO_3.H_2O$	14.93	0	1.25
"	14.93	15	2.50
$2KBO_3.H_2O_2$	20.84	15	0.70

POTASSIUM Di **BORATE** $K_2O.2B_2O_3.5$ or $6\ H_2O$

1000cc sat. solution of Potassium Diborate in Water has a normality of 0.9 with respect to K at 0°. A similar solution saturated with potassium pentaborate has a normality of 0.07 with respect to K. (Rosenheim and Leyser, 1921.)

POTASSIUM Penta **BORATE** $K_2O.5B_2O_3.8H_2O$

SOLUBILITY OF POTASSIUM PENTA BORATE IN WATER.

(Rollet and Andres, 1930.)

The pentaborate was prepared by the action of boric acid upon potassium chloride and upon potassium nitrate at temperatures above 100° in presence of water vapor. The anhydrous salt hydrates easily in moist air.

BO

t°	Gms. $K_2O.5B_2O_3$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $K_2O.5B_2O_3$ per 100 gms. sat. sol.	Solid Phase
-0.53 (Eutec)	1.54 (1.50)	Ice + $K_2O.5B_2O_3.8H_2O$	75	13.22	$K_2O.5B_2O_3.8H_2O$
0	1.56	$K_2O.5B_2O_3.8H_2O$	76.65	13.62	"
5	1.77	"	82.3	15.5	"
18	2.66 (2.75)	"	87.15	17.02	"
25	— (3.41)	"	89.8	18.00	"
30	3.8	"	94.8	19.85	"
45	5.72	"	100	22.3	"
57.6	8.45	"	101.65	23.0	"
62.8	9.85	"	102.3 (b.pt.)	23.4	"
69.0	11.5	"			

The authors also found that at about 170° the solid phase is transformed to $K_2O.5B_2O_3.2H_2O$ and above 350° it becomes the anhydrous compound—which melts at 780°.

The values in parentheses in the above table are by Menzel, 1927.)

EQUILIBRIUM IN THE SYSTEM POTASSIUM TETRABORATE, POTASSIUM PENTABORATE POTASSIUM CHLORIDE AND WATER AT 35°.

(Teeple, 1929.)

Gms. per 100 gms. H_2O			Solid Phase
KCl	$K_2B_4O_7$	$K_2B_{10}O_{16}$	
39.0	—	—	KCl
—	21.3	—	$K_2B_4O_7.4H_2O$
—	—	5.0	$K_2B_{10}H_{16}.8H_2O$
37.3	5.9	—	KCl + $K_2B_4O_7.4H_2O$
38.1	—	3.0	KCl + $K_2B_{10}O_{16}.8H_2O$
—	23.8	8.0	$K_2B_4O_7.4H_2O$ + $K_2B_{10}O_{16}.8H_2O$
36.8	6.7	3.5	KCl + " + "

POTASSIUM Fluo BORATE KF_4B

One liter of water sat. with Potassium fluoborate at room temperature (20°?) contains 0.045 gm. mols. KF_4B. (deBoer and van Liempt, 1927.)
100 gms. H_2O dissolve 0.44 gm. KF_4B at 20° and 6.27 gms. at 100°. (Stolba, 1889.)

Equilibrium in the System Potassium Fluoborate, Potassium Perchlorate and Water at 25°.

(Ray and Mitra, 1934.)

Gms. per 100 gms. sat. sol.		Solid	Gms. per 100 gms. sat. sol.		Solid
KF_4B	$KClO_4$	Phase	KF_4B	$KClO_4$	Phase
0.574	0.0	KF_4B	0.420	0.814	$8KF_4B.KClO_4$
0.562	0.213	"	0.427	0.943	"
0.569	0.276	"	0.437	1.012	" + $2KF_4B.KClO_4$
0.589	0.328	"	0.406	1.077	$2KF_4B.KClO_4$
0.588	0.393	" + $8KF_4B.KClO_4$	0.385	1.165	"
0.558	0.432	$8KF_4B.KClO_4$	0.337	1.433	"
0.476	0.549	"	0.243	1.616	$KClO_4$
0.433	0.684	"	0.0	1.971	"

BF

Equilibrium in the System Potassium Fluoborate Potassium Periodate and Water at 35°.

(Ray and Mitra, 1935.)

The results are given only in the form of a triangular diagram from which the following approximate values were read.

Gms. per 100 gms. sat. sol.		Solid	Gms. per 100 gms. sat. sol.		Solid
KF_4B	KIO_4	Phase	KF_4B	KIO_4	Phase
0.92	0.0	KF_4B	0.60	0.48	KIO_4
0.91	0.2	"	0.40	0.55	"
0.90	0.4	" + KIO_4	0.20	0.68	"
0.80	0.42	KIO_4	0.0	0.80	"

Equilibrium in the System Potassium Fluoborate Potassium Permanganate and Water at 25°.

(Ray and Chatterji, 1932.)

Gms. per 100 gms. sat. sol.		Solid	Gms. per 100 gms. sat. sol.		Solid
KF_4B	$KMnO_4$	Phase	KF_4B	$KMnO_4$	Phase
0.57	0.0	KF_4B	0.48	4.78	$KF_4B.6KMnO_4$
0.54	1.12	"	0.37	5.42	"
0.46	1.58	"	0.22	6.03	" + $KMnO_4$
0.22	2.07	" + $KF_4B.6KMnO_4$	0.33	6.32	$KMnO_4$
0.41	3.19	$KF_4B.6KMnO_4$	0.28	6.76	"
0.50	4.08	"	0.0	6.90	"

POTASSIUM BROMIDE KBr.

Br

Freezing-Points of Aqueous Solutions of Potassium Bromide.

(Klein and Svanberg, 1920; Rodebush, 1918.)

t°.	Gms. KBr per 100 cc. sat. sol.		t°.	Gms. KBr per 100 gms. H_2O.	t°.	Gms. KBr per 100 gms. H_2O.
—0.348....	1.19	(K and S)	—3.19.....	11.53	—10.55.....	38.33
—0.863....	2.975	"	—5.61.....	20.42	—10.90.....	39.50
—1.694....	5.95	"	—6.57.....	23.82	—12.6Eutec...	45.65
			—8.51.....	30.87		

POTASSIUM BROMIDE KBr.

SOLUBILITY IN WATER.

(Average curve from results of Meusser — Z. anorg. Chem. 44, 79, '05; Etard — Compt. rend. 98, 1432, '84; Ann. chim. phys. (7) 2, 526, '94; de Coppet — *Ibid.* [5] 30, 416, '83; Tilden and Shenstone — Phil. Trans. 175, 23, '84.)

t°.	Grams KBr per 100 Grams Solution.	Grams KBr per 100 Grams Water.	t°.	Grams KBr per 100 Grams Solution.	Grams KBr per 100 Grams Water.
− 6.5	20.0	25.0	30	41.4	70.6
− 8.5	26.5	35.7	40	43.0	75.5
−10.5	29.5	41.8	50	44.5	80.2
−11.5	31.2	45.3	60	46.1	85.5
−10	31.8	46.7	70	47.4	90.0
− 5	33.3	50.0	80	48.7	95.0
0	34.9	53.5	90	49.8	99.2
5	36.1	56.5	100	51.0	104.0
10	37.3	59.5	110	52.3	109.5
15	38.5	62.5	140	54.7	120.9
20	39.5	65.2	181	59.3	145.6
25	40.4	67.7			

More recent very careful determinations of the Solubility of Potassium Bromide in Water are as follows:

t°	d of sat. sol.	Gms. KBr per 100 gms. sat. sol.	t°	d of sat. sol.	Gms. KBr per 100 gms. sat. sol.
-12.5 (Eutec)	—	31.27 (1)	35	1.3941	42.58 (3)
0	1.3237	35.08 (3)	50	—	44.85 (1)
+15	1.3597	38.59 (3)	50.21	1.4160	44.95 (3)
20	1.3701	39.73 (2)	75	—	48.3 (1)
25	1.3790	40.65 (1)	91.95	1.4590	50.36 (3)
25	1.3794	40.71 (2)	100	1.465	51.2 (1)
25	1.3794	40.57 (4)	100	—	51.29 (5)

(1) Hering, 1936; (2) Flottmann, 1928; (3) Scott and Durham, 1930; (4) Scott and Frazier, 1927; (5) Brönsted, 1913.

The following values for the solubility of Potassium Bromide in water at temperatures above 100°, determined by the synthetic method, are given by Benrath, Gjedebo, Schiffers and Wunderlich, 1937.

t°	Gms. KBr per 100 gms. sat. sol.	t°	Gms. KBr per 100 gms. sat. sol.	t°	Gms. KBr per 100 gms. sat. sol.
103	51.5	232	63.1	301	67.7
167	57.5	251	65.2	359	70.4
208	61.1	275	66.7	421	73.3

SOLUBILITY OF MIXTURES OF POTASSIUM BROMIDE AND SILVER BROMIDE IN WATER.

(Lambert, 1926.)

The mixtures were constantly stirred in a thermostat.

t°.	Gms. per 100 gms. sat. sol. AgBr.	Gms. per 100 gms. sat. sol. KBr.	Solid Phase.	t°.	Gms. per 100 gms. sat. sol. AgBr.	Gms. per 100 gms. sat. sol. KBr.	Solid Phase.
−13....	1.67	39.87	AgBr+KBr	70....	5.80	45.48	AgBr+KBr
+30....	1.636	39.54	»	70....	5.60	45.53	»
40....	2.24	40.88	»	80....	6.72	46.91	»
50....	3.25	43.09	»	90....	8.47	48.15	»
50....	3.12	42.43	»	90....	9.00	47.98	»
60....	4.20	44.24		100....	10.55	48.66	»

Solubility of Potassium Bromide in Bromine Water at 32°.4

(Joseph, 1920.)

The mixtures were constantly agitated in a thermostat for 24 hours.

d of sat. sol.	Gms. per 100 gms. H_2O		d of sat. sol.	Gms. per 100 gms. H_2O	
	Br.	K Br.		Br.	K Br.
1.3917	0.0	72.56	1.4753	13.72	77.11
1.4063	2.40	73.39	1.5236	22.97	80.13
1.4070	3.21	73.82	1.5980	38.21	84.59
1.4132	3.96	74.07	2.596	430.4	210.4*
1.4356	7.43	75.02	2.860	1472.0	279.6*
1.4633	12.09	76.43			

* In these two cases the mixtures were simply left in bottles for some days at about 20°, and the heavy dark liquid filtered through glass wool and analyzed. The densities were taken by means of a Westphal balance.

Solubility of Potassium Bromide in Aqueous Solutions of Hydrobromic Acid at 25°.

(Scott and Durham, 1930.)

Gms. per 100 gms. sat. solution	
HBr	KBr
0.0	40.62
6.88	30.99
13.23	22.69
18.07	17.60

Solubility of Potassium Bromide in Aqueous Solutions of Potassium Bromate and Vice Versa.

(Guerassimow, 1934.)

Gms. per 100 gms. sat. sol.		Solid Phase
KBr	$KBrO_3$	
Results at 0°		
35.30	0.0	KBr
35.08	0.57	"
35.16	0.65	" + $KBrO_3$
0.0	2.96	$KBrO_3$
Results at 20°		
39.4	0.0	KBr
39.26	1.22	" + $KBrO_3$
22.20	1.85	$KBrO_3$
11.80	2.73	"
0.0	6.43	"
Results at 40°		
43.54	0.0	KBr
42.97	0.34	"
Results at 40° (con.)		
42.44	1.28	KBr
42.34	2.19	" + $KBrO_3$
35.97	2.60	$KBrO_3$
20.84	4.32	"
8.50	7.32	"
0.0	11.70	"
Results at 60°		
46.2	0.0	KBr
45.17	3.70	" + $KBrO_3$
49.93	3.75	$KBrO_3$
44.56	3.73	"
31.90	5.71	"
12.69	12.09	"
Results at 60° (con.)		
10.07	12.74	$KBrO_3$
9.52	12.83	"
9.37	13.14	"
4.48	14.92	"
4.35	15.58	"
3.94	16.43	"
0.0	18.21	"
Results at 80°		
49.72	0.0	KBr
46.5	5.62	" + $KBrO_3$
45.57	5.60	$KBrO_3$
7.45	20.74	"
0.0	25.53	"

SOLUBILITY OF POTASSIUM BROMIDE IN AQUEOUS SOLUTIONS OF POTASSIUM BROMATE AND VICE VERSA AT 25°.

(Ricci, 1934.)

d of sat. sol.	Gms. per 100 gms. sat. sol. KBr	Gms. per 100 gms. sat. sol. $KBrO_3$	Solid Phase
1.381	40.62	0.0	KBr
1.389	40.08	1.20	"
1.392	40.00	1.43	" + $KBrO_3$
1.328	34.82	1.62	$KBrO_3$
1.237	26.05	2.06	"
1.161	17.48	2.73	"
1.089	7.82	4.29	"
1.054	0.0	7.533	"

SOLUBILITY OF POTASSIUM BROMIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE, AND OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM BROMIDE, AT 25.2°.

(Touren — Compt. rend. 130, 1252, '00.)

Br

KBr in Aq. KCl Solutions.

Mols. per Liter. KCl.	Mols. per Liter. KBr.	Grams per Liter. KCl.	Grams per Liter. KBr.
0.0	4.761	0.0	567.0
0.67	4.22	50.0	502.5
0.81	4.15	60.4	494.2
1.35	3.70	100.7	440.7
1.48	3.54	110.4	421.6
1.61	3.42	120.0	407.2
1.70	3.34	126.8	397.7
2.46	2.50	183.5	297.7
3.775	0.525	281.6	625.3

KCl in Aq. KBr Solutions.

Mols. per Liter. KBr.	Mols. per Liter. KCl.	Grams per Liter. KBr.	Grams per Liter. KCl.
0.0	4.18	0.00	311.8
0.49	3.85	58.4	287.2
0.85	3.58	101.3	267.1
1.31	3.19	156.1	238.0
1.78	2.91	211.9	217.1
2.25	2.58	268.0	192.4
2.69	2.33	320.4	173.8

SOLUBILITY OF POTASSIUM BROMIDE IN AQUEOUS SOLUTION OF POTASSIUM CHLORIDE AND VICE VERSA AT 25°.

(Foca, 1897.)

Grams per Liter Solution. KBr.	Grams per Liter Solution. KCl.	Milligram Mols. per Liter KBr.	Milligram Mols. per Liter KCl.	Mol. per cent KCl in Solution.	Sp. Gr. of Solutions.	Mol. per cent KCl in Solid Phase.
558.1	0.00	4686.2	0.0	0.0	1.3756	0.00
531.5	23.44	4462.7	314.2	6.16	1.3700	0.00
503.6	46.57	4228.5	624.3	12.86	1.3648	8.23
454.6	82.62	3817.8	1108.0	22.49	1.3544	15.68
379.6	136.6	3188.1	1830.7	36.48	1.3320	33.66
324.8	166.9	2727.6	2237.4	45.06	1.3119	63.51
218.0	213.9	1830.2	2868.0	60.30	1.2689	82.29
140.7	250.9	1181.1	3363.9	74.01	1.2455	88.04
47.5	291.7	398.8	3911.4	85.22	1.1977	96.98
0.0	311.3	0.0	4173.1	100.00	1.1756	100.00

SOLUBILITY OF POTASSIUM BROMIDE AT 25° IN:

Aq. Solutions of KCl and Vice Versa.

(Amadori and Pampanini, 1911.)

Gms. per 100 Gms. H_2O. KBr.	Gms. per 100 Gms. H_2O. KCl.
68.47	0
62.26	5.43
58.50	8.46
52.45	12.48
45.42	17.17
38.70	21.23
26.62	25.88
12.94	31.02
0	36.12

Aq. Solutions of KI and Vice Versa.

(Amadori and Pampanini, 1911.)

Gms. per 100 Gms. H_2O. KBr.	Gms. per 100 Gms. H_2O. KI.
53.21	35.92
42.32	66.63
34.14	95.36
30.08	119.52
29.62	119
22.15	127.10
21.88	127.31
18.54	130.61
0	149.26

SOLUBILITY OF MIXTURES OF POTASSIUM BROMIDE AND CHLORIDE AND OF MIXTURES OF POTASSIUM BROMIDE AND IODIDE IN WATER.

(Etard — Ann. chim. phys. [7] 3, 275, '97.)

	Mixtures of KBr and KCl.		Mixtures of KBr and KI.	
t°.	Grams per 100 Gms. Solution.		Grams per 100 Grams Solution.	
	KBr.	KCl.	KBr.	KI.
−20	17.5	10.5	9.2	42.5
0	21.5	10.8	9.9	45.3
10	23.2	11.0	10.2	46.6
20	24.8	11.2	10.5	47.5
25	25.5	11.3	10.7	48.0
30	26.3	11.4	10.9	48.6
40	28.0	11.5	11.2	49.6
60	30.6	11.8	11.9	51.3
80	33.4	12.1	12.6	52.7
100	35.7	12.6	13.2	53.8
120	38.0	12.9	14.0	54.8
150	40.6	13.4	14.9	55.5

Data for the reciprocal Salt pair

$$(KBr)_2 + MgCl_2 \rightleftharpoons (KCl)_2 + MgBr_2$$

recalcultated from the results of Boeke, 1908, and others are given by Jänecke, 1938.

SOLUBILITY OF POTASSIUM BROMIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORATE AND VICE VERSA AT 25°.

(Ricci, 1937.)

d of sat. sol.	Gms. per 100 gms. sat. sol. KBr	Gms. per 100 gms. sat. sol. $KClO_3$	Solid Phase
1.380	40.63	0.0	KBr
1.356	40.02	1.42	" + $KClO_3$
1.376	39.47	1.42	$KClO_3$
1.292	31.66	1.87	"
1.216	24.20	2.41	"
1.160	16.99	3.21	"
1.100	9.30	4.59	"
1.047	0.0	7.905	"

SOLUBILITY OF POTASSIUM BROMIDE IN AQUEOUS SOLUTIONS OF POTASSIUM IODATE AND VICE VERSA AT 5°, 25° AND 50°.

(Ricci, 1934.)

d of sat. sol.	Gms. per 100 gms. sat. sol. KBr	Gms. per 100 gms. sat. sol. KIO_3	Solid Phase	d of sat. sol.	Gms. per 100 gms. sat. sol. KBr	Gms. per 100 gms. sat. sol. KIO_3	Solid Phase
Results at 5°				Results at 25° (con.)			
1.333	36.25	0.0	KBr	1.168	17.40	3.26	KIO_3
1.352	35.71	1.80	" + KIO_3	1.106	8.35	4.53	"
1.290	30.50	1.77	KIO_3	1.071	0.0	8.452	"
1.208	22.39	1.80	"				
1.136	14.80	1.95	"	Results at 50°			
1.080	7.58	2.45	"				
1.043	0.0	5.186	"	—	44.77	0.0	KBr
				—	43.88	2.22	"
Results at 25°				—	43.50	3.07	" + KIO_3
				—	38.03	3.32	KIO_3
1.381	40.62	0.0	KBr	—	30.57	3.87	"
1.396	40.28	0.98	"	—	23.19	4.66	"
1.407	39.75	2.36	" + KIO_3	—	15.65	5.80	"
1.341	34.38	2.47	KIO_3	—	8.18	8.16	"
1.294	25.91	2.73	"	—	0.0	13.20	"

Br

SOLUBILITY OF POTASSIUM BROMIDE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE, AND OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF POTASSIUM BROMIDE, AT 14.5° AND AT 25.2°.

(Touren — Compt. rend. 130, 908, '00.)

KBr in Aqueous KNO_3 Solutions.				KNO_3 in Aq. KBr Solutions.			
Mols. per Liter.		Grams per Liter.		Mols. per Liter		Grams per Liter	
KNO_3.	KBr.	KNO_3.	KBr.	KBr.	KNO_3	KBr	KNO_3.
Results at 14.2°.				Results at 14.20°.			
0.0	4.332	0.0	515.9	0.0	2.228	0.0	225.4
0.362	4.156	36.6	494.9	0.356	2.026	42.4	205.0
0.706	4.093	71.4	487.4	0.784	1.835	93.4	185.7
1.235	3.939	124.9	469.1	1.092	1.730	130.0	175.0
				1.577	1.587	187.8	160.6
Results at 25.2°.				2.542	1.406	302.7	142.2
0.0	4.761	0.0	566.2	3.536	1.308	421.1	132.3
0.131	4.72	13.3	561.0	Results at 25.2°.			
0.527	4.61	53.3	549.1	0.0	3.217	0.0	325.5
0.721	4.54	72.9	540.8	0.38	3.026	45.3	306.2
1.09	4.475	110.3	533.0	0.93	2.689	110.8	272 0
1 170	4.44	118 4	528.8	1.37	2.492	163.1	252.2
1.504	4.375	152.2	521 1	1.208	2.216	143.8	224.3
				2.87	1.958	341.8	198.1
				3.55	1 807	422.8	182.8

SOLUBILITY OF POTASSIUM BROMIDE IN AQUEOUS SOLUTIONS OF POTASSIUM HYDROXIDE.

(Ditte — Compt. rend. 124, 30, '97.)

Grams per 1000 Grams H_2O.		Grams per 1000 Grams H_2O.	
KOH	KBr.	KOH.	KBr.
36.4	558.4	277.6	248.1
113.5	433.6	434.7	137.1
177.2	358.1	579.6	64.8
231.1	281.2	806.9	33.4

SOLUBILITY OF POTASSIUM BROMIDE IN AQUEOUS SOLUTIONS OF POTASSIUM HYDROXIDE AT 20°.

(Brönsted, 1920 *a*.)

Gm. mols. per liter.		Gm. mols. per liter.		Gm. mols. per liter.	
KOH.	KBr.	KOH.	KBr.	KOH	KBr.
7.90	1.012	12.19	0.348	14.02	0.246
9.41	0.693	12.92	0.306	14.85	0.214
10.95	0.512	13.84	0.247	15.02	0.210
11.10	0.451				

SOLUBILITY OF MIXTURES OF POTASSIUM BROMIDE AND AMMONIUM BROMIDE IN WATER AT 25°.

(Fock — Z. Kryst. Min. 28, 357, '97.)

Grams per Liter Solution.		Mol. per cent in Solution.		Sp. Gr. of Solutions.	Mol. per cent in Solid Phase	
NH_4Br.	KBr.	NH_4Br.	KBr.		NH_4Br.	KBr.
0.00	558.1	0.0	100	1.3756	0.00	100
6.4	554.2	1.38	98.62	1.3745	0.26	99.74
24.64	536.5	5.29	94.71	1.3733	1.27	98.73
51.34	516.8	10.77	89.23	1.3721	3.02	96.98
152.9	441.2	29.63	70.37	1.3711	8.42	91.58
262.2	347.3	47.84	52.16	1.3715	17.20	82.80
347.6	262.3	61.69	38.31	1.3753	27.98	72.02
381.4	260.3	64.03	35.97	1.3753	32.53	67.47
417.8	232.2	68.61	31.39	1.3766	39.45	60.55
432.5	222.3	70.27	29.73	1.3777	variable	variable
480.8	179.9	76.47	23.53	1.3766	98.53	1.47
577.3	0.0	100.0	0.0	1.3763	100.0	0.00

SOLUBILITY OF POTASSIUM BROMIDE IN AQUEOUS SOLUTIONS OF METHYL ALCOHOL AT 25°.

(Akerlof and Turck, 1935.)

Gms. CH_3OH per 100 gms. solvent mixture	Gm. Mols. KBr per 1000 gms. solvent mixture	Gms. CH_3OH per 100 gms. solvent mixture	Gm. Mols. KBr per 1000 gms. solvent mixture
0.0	5.784	80.03	0.4625
20.0	3.711	89.79	0.2629
40.82	2.180	94.76	0.2049
59.56	1.182	100.0	0.1805
72.39	0.7697		

SOLUBILITY OF POTASSIUM BROMIDE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AND OF METHYL ALCOHOL.

(Zeitlin, 1926.)

The mixtures were agitated frequently by hand during 5 days. The temperatures remained constant to 1°.

Results for Methyl Alcohol.			Results for Ethyl Alcohol.		
Wt. per cent CH_3OH in solvent.	Gm. mols. K Br per liter at 10°.2.	19°.9.	Wt. per cent C_2H_5OH in solvent.	Gm. mols. K Br per liter at 10°.2.	19°.9
25.96	2.475	2.493	25.07	2.327	2.437
45.13	1.426	1.466	50.01	1.016	1.161
74.88	0.411	0.434	75.03	0.2704	0.2955
100.00	0.1376	0.142	97.03	–	0.0114

100 gms. aq. 50 wt. % ethyl alcohol dissolve 16.4 gms. K Br at 20°.

(Wright, 1926.)

SOLUBILITY OF POTASSIUM BROMIDE IN AQUEOUS SOLUTIONS OF METHYL ALCOHOL AT 25°.

(Herz and Anders, 1907.)

Wt. % CH_3OH in Solvent.	Gms. KBr per 100 cc. Sat. Sol.	$d_{\frac{25}{4}}$ of Sat. Sol.	Wt. % CH_3OH in Solvent.	Gms. KBr per 100 cc. Sat. Sol.	$d_{\frac{25}{4}}$ of Sat. Sol.
0	56.04	1.3797	64	10.35	0.9801
10.6	46.28	1.300	78.1	5.24	0.8906
30.8	29.98	1.159	98.9	2.74	0.8411
47.1	19.28	1.058	100	1.69	0.8047

The solubility of potassium bromide in methyl alcohol at the critical temperature is given by Centnerszner (1910), as 0.2 gm. KBr per 100 gms. sat solution.

SOLUBILITY OF POTASSIUM BROMIDE IN DILUTE AQUEOUS ETHYL ALCOHOL.

Results at 0°.

(Armstrong and Eyre, 1910–11.)

Wt. % C_2H_5OH in Solvent.	Gms. KBr per 100 Gms. Sat. Sol.
0	34.92
1.14	34.35
2.25	32.96
4.41	31.99
8.44	29.43

Results at 25°.

(Armstrong, Eyre, Hussey and Paddison, 1907.)

Wt. % C_2H_5OH in Solvent.	Gms KBr per 100 Gms. Sat. Sol.	$d_{\frac{25}{25}}$ of Sat. Sol.
0	40.78	1.3824
1.14	39.98	1.3727
2.25	39.54	1.3634
4.41	38.41	1.3443
12.14	34.97	1.2815
18.73	30.91	1.2322

THE SYSTEM POTASSIUM BROMIDE, TERTIARY BUTYL ALCOHOL AND WATER AT 30°.

(Ginnings and Robbins, 1930.)

The points on the binodal curve of this system were determined by observing the appearance or disappearance in a mixture of weighed amounts of the other. Conjugated points were

The points on the binodal curve of this system were determined by observing the appearance or disappearance of clouding in a mixture of weighed amounts of KBr and one of the liquids, upon addition of a weighed amount of the other. Conjugated points were found by determination of KBr in two liquid phases in contact with each other and from these the plait point (p.p.) was obtained by plotting.

Gms. per 100 gms. mixture		Gms. per 100 gms. mixture		Gms. per 100 gms. mixture		Gms. per 100 gms. mixture	
$(CH_3)_3COH$	KBr	$(CH_3)_3COH$	KBr	$(CH_3)_3COH$	KBr	$(CH_3)_3COH$	KBr
70.2	3.1	50.3	6.7	27.7	12.6	11.3	22.6
65.7	4.2	44.7	7.8	25.6	13.4	9.2	25.3
60.7	4.8	42.0	8.7p.p.	20.0	15.7	7.7	28.5
56.9	5.4	35.7	10.0	17.0	17.0	6.8	30.4
53.4	6.1	29.7	11.9	13.4	19.8	6.1	33.1

SOLUBILITY OF POTASSIUM BROMIDE IN AQUEOUS ALCOHOL.

(Taylor — J. Physic. Ch. 1, 724, '96–'97.)

Wt. per cent Alcohol in Solution.	Results at 30°. Gms. KBr per 100 Gms. Sat. Solution.	Results at 30°. Gms. KBr per 100 Gms. Solvent.	Results at 40°. Gms. KBr per 100 Gms. Sat. Solution.	Results at 40°. Gms. KBr per 100 Gms. Solvent.
0	41.62	71.30	43.40	76.65
5	38.98	67.25	40.85	72.70
10	36.33	63.40	38.37	69.00
20	31.09	56.40	33.27	62.30
30	25.98	50.15	28.32	56.45
40	21.24	44.95	23.22	50.46
50	16.27	38.85	18.11	44.25
60	11.50	32.50	13.02	37.40
70	6.90	24.70	7.98	28.90
80	3.09	15.95	3.65	18.95
90	0.87	8.80	1.03	10.45

SOLUBILITY OF POTASSIUM BROMIDE AT 25° IN:

(Herz and Knoch, 1905.)

Br

Aqueous Acetone.

cc. Acetone per 100 cc Solvent.	Per 100 cc. Sat. Solution. Millimols KBr.	Per 100 cc. Sat. Solution. Gms. KBr.	Per 100 cc. Sat. Solution. Gms. H_2O.	Sp. Gr. Solutions.
0	481.3	57.3	80.6	1.3793
20	366.7	43.67	69.5	1.2688
30	310.5	36.98	62.97	1.2118
40	259	30.85	55.60	1.1558
50	202.9	24.16	47.60	1.0918
60	144.9	17.22	39.15	1.0275
70	95.3	11.35	29.78	0.9591
80	46.5	5.54	20.10	0.8942
90	10.1	1.20	10.15	0.8340

Aqueous Glycerol.

Wt. % Glycerol in Solvent.	KBr per 100 cc. Sol. Millimols.	KBr per 100 cc. Sol. Gms.	Sp. Gr. Solutions.
0	481.3	57.32	1.3793
13.28	444.3	52.91	1.3704
25.98	404	48.11	1.3655
45.36	340.5	40.55	1.3594
54.23	310.4	36.98	1.3580
83.84	219.25	26.11	1.3603
100	172.65	20.56	1.3691

100 gm. acetone dissolve 0.023 gm. KBr at 25°.

(Krug and McElroy — J. anal. Chem. 6, 184, '92.)

100 gms. Glycerol of $d = 1.2326$ (= 86.5 %) dissolve 20.59 gms. K Br at 20°.

» » $d = 1.2645$ (= 98.5 %) » 17.15 » »

(Holm, 1921, 1922.)

100 cc. sat .solution of potassium bromide in ethyl urethan (m. pt. 49°.6) contain 0.387 gms. K Br at 60°.

(Stuckgold, 1917.)

THE SYSTEM POTASSIUM BROMIDE ETHYLENE GLYCOL AND WATER AT 30°.

(Trimble, 1931.)

d of sat. solution	Gms. per 100 gms. sat. solution KBr	Gms. per 100 gms. sat. solution CH_2OHCH_2OH	Gms. per 100 gms. sat. solution H_2O
1.3876	41.58	0.0	58.42
1.3417	35.32	12.73	51.45
1.2995	29.64	28.29	42.07
1.2637	23.58	46.08	30.34
1.2338	18.03	65.67	16.30
1.2131	13.68	86.32	0.0

Solubility of Potassium Bromide in Aqueous Solutions of Dioxane at 25°.

(Herz and Lorentz, 1929.)

cc Dioxane per 100cc solvent	Gm. Mol. KBr per liter sat. sol.	Gms. KBr per liter sat. solution
10	4.20	500
20	3.70	440
33	2.90	345

Two liquid layers are formed between 47 and 85 vol. percent Dioxane. The lower contains 2.1 gm. mol. KBr per liter and the upper 0.03 gm. mol. per liter.

Solubility of Potassium Bromide in Aqueous Solutions of Urethan at 25°.

(Palitzsch, 1928, 1929.)

Gm. Mols. per 1000 gms. H_2O		Solid Phase
$NH_2COOC_2H_5$	KBr	
0.0	5.797	KBr
1.1225	5.616	"
7.215	4.886	"
14.60	4.421	" + $NH_2COOC_2H_5$
53.09	0.0	$NH_2COOC_2H_5$

Br

Solubility of Potassium Bromide in Alcohols at 25°.

(de Bruyn — Z. physik. Chem. 10, 783, '92; Rohland — Z. anorg. Chem. 18, 327, '98.)

Alcohol.	Grams KBr Dissolved by 100 Gms. Alcohol at:	
	Room Temp. (R.).	25° (de B.).
Methyl Alcohol	1.92	1.51 Abs. Alcohol
Ethyl Alcohol	0.28 (Sp. Gr. 0.81)	0.13 "
Propyl Alcohol	0.055	...

100 gms. methyl alcohol dissolve 2.17 gms. KBr at 25°. (Turner and Bissett, 1913.)
" ethyl " " 0.142 gm. " " "
" propyl " " 0.035 " " " "
" amyl " " 0.003 " " " "

Solubility of Potassium Bromide in Methyl Alcohol.

(Lloyd, Brown, Glynwyn, Bonnell and Jones, 1928.)

t°	Gms. KBr per 100 gms. CH_3OH	t°	Gms. KBr per 100 gms. CH_3OH
0	1.82	30	2.23
10	1.93	40	2.37
15	2.00	50	2.55
20	2.08	60	2.74

Solubility of Potassium Bromide in Methyl Alcohol, Ethyl Alcohol and n Butyl Alcohol.

(Germuth, 1931.)

t°	Gms. KBr per 100 gms. sat. solution in:		
	CH_3OH	C_2H_5OH	$CH_3(CH_2)_2CH_2OH$
20	2.542	0.453	0.0112
30	2.496	0.501	0.0130
40	2.440	0.563	0.0137
50	2.316	0.568	0.0148
55	2.241	0.537	0.0148

SOLUBILITY OF POTASSIUM BROMIDE IN WATER AND IN SEVERAL ALCOHOLS AT 25°

(Larson and Hunt, 1930.)

Solvent	Formula	d of sat. sol.	Gms. KBr per 100 gms. solvent
Water	H_2O	—	67.75
Methanol	CH_3OH	0.8025	2.11
Ethanol	C_2H_5OH	0.7861	0.135
1-Propanol	$CH_3CH_2CH_2OH$	0.8010	0.0314
1-Butanol	$CH_3(CH_2)_2CH_2OH$	0.8058	0.0132
2-Propanol	$CH_3CHOHCH_3$	0.7810	0.0110
2-Methyl-1-propanol	$(CH_3)_2CHCH_2OH$	0.7980	0.0076
1- Pentanol	$CH_3(CH_2)_3CH_2OH$	0.8096	0.0048
2-Butanol	$CH_3CH_2CHOHCH_3$	0.8022	0.0044

SOLUBILITY OF POTASSIUM BROMIDE IN ACETONE.

(Lannung, 1932.)

t°	d of sat. sol.	Gm. Mol. KBr per liter sat. sol.	Gms. KBr per liter sat. sol.
18	0.792	0.000239	0.0359
37	0.770	0.000212	0.0328

SOLUBILITY OF POTASSIUM BROMIDE IN ACETONE AND IN ACETONE SOLUTIONS OF SEVERAL SALTS AT 25°.

(Robinson, 1928.)

Added Salt	Gm. Equiv. salt per liter	Gm. Equiv. KBr per liter sat. sol.	Added Salt	Gm. Equiv. salt per liter	Gm. Equiv. KBr per liter sat. sol.
None	(= Pure Acetone)	0.000369(=.044gm)	KI	0.000343	0.000414
$BaBr_2$	0.000240	0.000430	"	0.000877	0.000489
"	0.000730	0.000482	"	0.001763	0.000579
"	0.001206	0.000531	NaI	0.000382	0.000418
BaI_2	0.000137	0.000424	"	0.000939	0.000494
"	0.000408	0.000510	"	0.001849	0.000571
"	0.001206	0.000623	"	0.003542	0.000657

SOLUBILITY OF POTASSIUM BROMIDE IN 95% ETHYL ALCOHOL CONTAINING INCREASING AMOUNTS OF HYDROBROMIC ACID AT 25°.

(Yagoda, 1930.)

Normality of HBr in 95% C_2H_5OH	d of sat. sol.	Gms. KBr per 100 gms. solvent	Normality of HBr in 95% C_2H_5OH	d of sat. sol.	Gms. KBr per 100 gms. solvent
0.0	0.7997	0.289	0.400	0.839	0.176
0.05	0.805	0.191	0.537	0.853	0.186
0.10	0.810	0.165	0.800	0.878	0.190
0.204	0.820	0.162	0.954	0.893	0.242

The composition of the homogeneous mixture (plait point) of the system composed of:

Potassium Bromide + tertiary Butyl Alcohol + Water at 25° was found by Ginnings, Herring and Webb, 1933, to be:

11.5 percent KBr + 35.1 percent ter. $(CH_3)_3COH$ + 53.4 percent H_2O

The original results for the remaining points of the binodal curve are not given but only the values of a series of arbitrary constants calculated from them by means of empirical equations.

SOLUBILITY OF POTASSIUM BROMIDE IN SEVERAL SOLVENTS.

Solvent	Formula	t°	Gms. KBr per 100 gms. solvent	Authority
Formic Acid (95%)	HCOOH	18.5	23.2	(Aschan, 1913.)
Furfural	C_4H_3OCHO	25	0.12	(Walden, 1906.)
Iso Amyl Alcohol	$(CH_3)_2CH(CH_2)_2OH$	25	0.00175	(Yagoda, 1930.)
Hydroxylamine	NH_2OH	17-18	44.7	(de Bruyn, 1892.)
Hydrazine	$NH_2.NH_2$	Ca20	60.0	(Welsh and Broderson, 1915.)
Ammonia (liquid)	NH_3	-33.9(d = 0.9098)	40.32	(Johnson and Kromboltz, 1933.)
" "	"	0	26.87	(Linhard and Stephen, 1933, 1934.)
" "	"	25	13.50	(Hunt, 1932.)
Sulfur Dioxide(liquid)	SO_2	0	2.81	(Jander and Ruppolt, 1937.)

FUSION-POINT DATA FOR MIXTURES OF KBr AND OTHER SALTS.

KBr + KF	(Kurnakow and Wrzesnewsky, 1912; Ruff and Plato, 1903.)
KBr + KCl	(Wrzesnewsky, 1912; Amadori and Pampanini, 1911; Ruff and Plato, 1903; Tammann and Krings, 1923.)
KBr + KI	(Wrzesnewsky, 1912; Amadori and Pampanini, 1911; Ruff and Plato, 1903.)
KBr + NaCl	(Ruff and Plato, 1903.)
KBr + KOH	(Scarpa, 1915.)
KBr + KNO_3	" "
KBr + RbCl	(Tammann and Krings, 1923.)
KBr + $SrBr_2$	(Kellner, 1917.)
KBr + TlBr	(Rostowski, 1929.)
KBr + $TlNO_3$	" "

Br

POTASSIUM Iodo **DIBROMIDE** $KIBr_2$

One gm. H_2O dissolves 10-12 gms. $KIBr_2$, at 18°.

One liter sat. solution of Potassium iodo di bromide in carbon tetrachloride, contain 0.0473 gm. mol. (?) $KIBr_2$ at 25°. (Cremer and Duncan, 1931.)

POTASSIUM Stanno**BROMIDES** Mono $KSnBr_3.H_2O$, Tetra $K_4SnBr_6.H_2O$.

SOLUBILITY OF MONO POTASSIUM STANNO BROMIDE IN WATER.

(Rimbach and Fleck, 1916.)

t°.	Gms. per 100 gms. sat. sol. Br	+ Sn	+ K	= $SnBr_3K$	Solid Phase.
0.2*	11.21	3.88	2.94		$KSnBr_3.H_2O+SnBr_3.H_2O$
17.1*	16.17	6.05	3.94		" "
36.3*	24.56	10.84	4.90		" "
46.3	30.83	15.22	5.09	51.14	$KSnBr_3.H_2O$
74.6	40.88	20.24	6.70	67.82	"

SOLUBILITY OF TETRA POTASSIUM STANNO BROMIDE IN WATER.

(Rimback and Fleck, 1916.)

t°.	Gms. per 100 gms. sat. sol. Br	+ Sn	+ K	Solid Phase.
0.3*	19.26	1.00	8.77	$K_4SnBr_6.H_2O+SnBr_3.H_2O$
16.4*	28.62	2.33	12.48	" "
43.3*	33.38	4.28	13.52	" "
62.1*	39.43	8.44	13.75	" "
77.1*	43.76	12.73	13.03	" "

* At these temperatures the atomic ratios of the constituents in solution do not correspond to the double compound, hence the solid phase is not a single substance.

POTASSIUM BROMATE $KBrO_3$.

SOLUBILITY IN WATER.

(Kremers — Pogg. Ann. 97, 5, '56; Rammelsberg — *Ibid.* 55, 79, '42; Pohl — Sitzber. Akad. Wiss Wien. 6, 595, '51.)

t°.	Gms. $KBrO_3$ per 100 Gms.		t°.	Gms. $KBrO_3$ per 100 Gms.	
	Water.	Solution.		Water.	Solution.
0	3·1	3·0	40	13·2	11·7
10	4·8	4·6	50	17·5	14·9
20	6·9	6·5	60	22·7	18·5
25	8·0	7·4	80	34·0	25·4
30	9·5	8·7	100	50·0	33·3

Sp. Gr. of solution saturated at 19.5° = 1.05.

The following more recent determinations are by Ricci, 1934.

t°	d of sat. solution	Gms. $KBrO_3$ per 100 gms. sat. sol.	t°	d of sat. solution	Gms. $KBrO_3$ per 100 gms. sat. sol.
5	1.024	3.642	30	1.062	8.785
10	1.035	4.510	35	1.074	10.13
15	1.042	5.397	40	1.083	11.58
20	1.048	6.460	45	—	13.08
25	1.054	7.533	50	—	14.69

BrO

The following determinations of the solubility of Potassium Bromate in Water at temperatures above 100°, made by the synthetic method, are given by Benrath, Gjedebo, Schiffers and Wunderlich, 1937.

t°	Gms. $KBrO_3$ per 100 gms. sat. sol.	t°	Gms. $KBrO_3$ per 100 gms. sat. sol.	t°	Gms. $KBrO_3$ per 100 gms. sat. sol.
134	43.6	186	59.9	265	77.2
149	48.4	204	64.2	279	81.1
160	51.1	226	70.6	297	83.1
170	54.1	249	72.6	312	86.4

EQUILIBRIUM IN THE SYSTEM POTASSIUM BROMATE, POTASSIUM CHLORATE AND WATER AT 25°.

(Swenson and Ricci, 1930.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$KBrO_3$	$KClO_3$			$KBrO_3$	$KClO_3$	
1.054	7.533	0.0	$KBrO_3$	1.072	4.02	6.75	SS2(96.0)
—	6.46	2.26	SS1(0.46)	1.064	2.79	7.08	" (97.2)
1.067	5.75	4.08	" (1.10)	—	2.07	7.26	" (98.3)
—	5.63	4.29	" (2.0)	1.053	1.02	7.60	" (99.1)
1.078	4.945	6.531	" + SS2	1.048	0.0	7.895	$KClO_3$

SS1 = Solid Solution of $KClO_3$ in $KBrO_3$ with a limit of 3% $KClO_3$.
SS2 = Solid Solution of $KBrO_3$ in $KClO_3$ with a limit of 5% $KBrO_3$.
The figures in parentheses show the percentage of $KClO_3$ in the solid solutions.

SOLUBILITY OF POTASSIUM BROMATE AT 25° IN AQUEOUS SOLUTIONS OF:

(Ricci, 1934.)

Potassium Chloride

d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$KBrO_3$	KCl	
1.054	7.533	0.0	$KBrO_3$
1.058	4.63	4.33	"
1.082	3.24	9.03	"
1.112	2.44	14.45	"
1.147	1.97	19.71	"
1.183	1.65	24.87	"
1.192	1.61	25.89	" + KBr
1.187	1.48	25.93	KBr
1.179	0.0	26.36	"

Potassium Iodide

d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$KBrO_3$	KCl	
1.054	7.533	0.0	$KBrO_3$
1.103	4.54	8.77	"
1.182	2.96	18.85	"
1.278	2.17	28.60	"
1.402	1.63	38.99	"
1.565	1.21	50.06	"
1.707	0.99	58.14	"
1.729	0.96	59.20	" + KI
1.718	0.0	59.76	KI

Potassium Nitrate

BrO

d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$KBrO_3$	KNO_3	
1.074	5.61	5.05	$KBrO_3$
1.110	4.64	11.10	"
1.148	4.23	16.98	"
1.193	4.00	23.17	"
1.225	3.90	27.01	" + KNO_3
1.211	2.64	27.27	KNO_3
1.193	0.0	27.71	"

Potassium Sulfate

d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$KBrO_3$	K_2SO_4	
1.066	6.08	2.67	$KBrO_3$
1.083	5.02	5.44	"
1.100	4.27	8.20	"
1.108	4.00	9.35	" + K_2SO_4
1.103	3.40	9.45	K_2SO_4
1.094	1.69	10.12	"
1.083	0.0	10.76	"

SOLUBILITY OF POTASSIUM BROMATE IN AQUEOUS SOLUTIONS OF VARIOUS COMPOUNDS AT 25°.

(Rothmund, 1910.)

Solvent, 0.5 Normal Aq. Sol. of:	Mols. $KBrO_3$ per Liter.	Gms $KBrO_3$ per Liter.	Solvent, 0.5 Normal Aq. Sol. of:	Mols. $KBrO_3$ per Liter.	Gms. $KBrO_3$ per Liter.
Water alone	0.478	79.84	Dimethylpyrone	0.478	79.84
Methyl Alcohol	0.444	74.16	Ammonia	0.445	74.33
Ethyl Alcohol	0.421	70.33	Dimethylamine	0.384	64.13
Propyl Alcohol	0.409	68.31	Pyridine	0.415	69.31
Tertiary Amyl Alcohol	0.383	63.97	Piperidine	0.396	66.15
Acetone	0.425	70.99	Urethan	0.433	72.33
Ethyl Ether	0.395	65.98	Formamide	0.473	79.02
Formaldehyde	0.397	66.31	Acetamide	0.445	74.33
Glycol	0.448	74.84	Glycocol	0.501	83.68
Glycerol	0.451	75.34	Acetic Acid	0.456	76.17
Mannitol	0.451	75.34	Phenol	0.426	71.15
Grape Sugar	0.431	71.99	Methylal	0.405	67.66
Urea	0.477	79.68	Methyl Acetate	0.420	70.15

SOLUBILITY OF POTASSIUM BROMATE IN AQUEOUS SOLUTIONS OF SODIUM NITRATE AND OF SODIUM CHLORIDE.

(Geffcken — Z. physik. Chem. 49, 296, '04.)

In Sodium Nitrate.			In Sodium Chloride.		
Grams per Liter.		Mols. $KBrO_3$ per Liter.	Grams per Liter.		Mols. $KBrO_3$ per Liter.
$NaNO_3$.	$KBrO_3$.		NaCl.	$KBrO_3$.	
0 0	78.79	0.4715	0.0	78 79	0.4715
42.54	96 01	0.5745	29 25	82.24	0.5220
85.09	108 6	0.6497	58 50	93.87	0.5616
170.18	128.3	0.7680	117 0	100.9	0 6042
255.27	150.9	0.9026	175.5	104 3	0.6244
340.36	172 3	1 031	234.0	106.9	0.6400

100 gms. liquid Ammonia dissolve 0.002 gm. $KBrO_3$ at 25°. (Hunt and Bončyk, 1933.)

POTASSIUM METHIONATE $K_2[CH_2.(SO_3)_2]$

100 gms. sat. solution of Potassium Methionate in Water contain 4.46 gms. $K_2[CH_2(SI_3)_2]$ at 25°. (Backer, 1929; Baker and Terpstra, 1929.)

POTASSIUM Chlor **METHIONATE** $K_2[CHCl(SO_3)_2]$

100 gms. sat. solution of Potassium Chlor Methionate in water contain 34.2 gms. $K_2[CHCl(SO_3)_2]$ at 25°. (Baker, 1930.)

POTASSIUM FORMATE HCOOK.

Determinations of the freezing-points of aqueous solutions of potassium formate made in a Beckmann apparatus, gave the following results.

t°.	—2.62.	—6.72.	—10.42.	—15.82.	—17.39.
Gms. HCOOK per 100 gms. sat. sol. . .	5.71	12.95	18.42	25.03	26.04

The solid phase was ice in all cases. (Sidgwick and Gentle, 1922.

SOLUBILITY OF POTASSIUM FORMATE AND OF THE ACID SALT IN WATER.

(Groschuff, 1903)

Solid Phase : HCOOK.

t°.	Gms HCOOK per 100 Gms. Solution.	Mols. HCOOK per 100 Mols. H_2O.
− 20	72.8	57.4
+ 18	76.8	71.0
50	80.7	89.8
90	86.8	141.0
120	92.0	247.0
140	96.0	511
157	100 0	∞

Solid Phase : HCOOK.HCOOH.

t°.	Gms. HCOOK.-HCOOH per 100 Gms. Solution.	Gms HCOOK per 100 Gms. Solution.	t°.	Gms HCOOK per 100 Gms. Solution.	Mols. HCOOH per 1 Mol. HCOOK.
0	60.4	39.0	0	35.3	3.21
25	69.8	45.1	19.5	38.2	2.96
50	79.2	51.2	39.3	40.8	2.65
80	90.7	58.6	60	44.0	2.33
			70	45.9	2 16
			90	52.1	1.68

Sp. Gr. of sat. solution at 18° = 1.573.

NOTE. — Since the acid salt is less soluble at ordinary temperatures than the neutral salt, it can be precipitated from the solution of the neutral salt by addition of aqueous formic acid. Proceeding in this way an impure product is obtained, giving solubility values (expressed in HCOOK) as shown in the last three columns above.

Freezing-point data for the system HCOOK + HCOOH are given by Kendall and Adler, 1921.

POTASSIUM ACETATE CH_3COOK.

Determinations of the freezing-points of aqueous solutions of potassium acetate made in a Beckmann apparatus gave the following results :

t°........................	−2.15.	−3.30.	−9.32.	−12.32.	−17.92.
Gms. CH_3COOK per 100 gms. sat. sol...	5.00	7.42	17.04	20.53	25.5

The solid phase was ice in all cases. (Sidgwick and Gentle, 1922.)

100 gms. aq. 86.5 % Glycerol ($d = 1.2326$) dissolve 77.4 gms. CH_3COOK at 20°.
» » 98.5 % » ($d = 1.2645$) » 65.5 » »

(Holm, 1921, 1922.)

Data for the freezing-points of mixtures of potassium acetate (m. pt. 295) and sodium acetate (m. pt. 320) are given by Baskof, 1915, 1917. The salts form solid solutions in all proportions and no eutectic point was obtained. The lowest f. pt., 233°, was found for a mixture containing 46 mol. per cent CH_3COONa.

Data for the freezing-points of mixtures of potassium acetate and lead acetate are given by Lehrman and Leifer, 1938.

POTASSIUM ACETATE $CH_3COOK.1\frac{1}{2}H_2O$.

SOLUBILITY IN WATER. (Abe, 1911.)

t°.	Gms. CH_3COOK per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. CH_3COOK per 100 Gms. H_2O	Solid Phase.
0.1	216.7	$2CH_3COOK.3H_2O$	41	327.7	$2CH_3COOK.3H_2O$
5	223.9	"	41.3 tr. pt.	...	" $+2CH_3COOK.H_2O$
10	233.9	"	42	329	$2CH_3COOK.H_2O$
15	243.1	"	45	332.2	"
20	255.6	"	50	337.3	"
25	269.4	"	60	350	"
30	283.8	"	70	364.8	"
35	301.8	"	80	380.1	"
38	314.2	"	90	396.3	"
40	323.3	"	96	406.5	"

SOLUBILITY OF POTASSIUM ACETATE IN AQ. ALCOHOL SOLUTIONS AT 25°. (Seidell, '10.)

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. CH_3COOK per 100 Gms. Solvent.	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. CH_3COOK per 100 Gms. Solvent.
0	1.417	219.6	70	1.156	118.3
20	1.363	219.6	80	1.085	87.6
40	1.302	192.4	90	0.990	52.9
50	1.260	171.8	95	0.922	34.2
60	1.210	147.5	100	0.850	16.3

SOLUBILITY OF POTASSIUM ACETATE IN ACETIC ACID, DETERMINED BY THE FREEZING-POINT METHOD.

(Davidson and McAllister, 1930.)

t°	Gm. Mols. CH_3COOK per 100 gm. mols. mixture	Solid Phase	t°	Gm. Mols. CH_3COOK per 100 gm. mols. mixture	Solid Phase
16.50	0.0	CH_3COOH	110.0	30.67	1.1
15.82	1.22	"	118.0	32.47	"
10.95	6.70	"	124.5	34.41	"
7.45	9.10	"	126.0	35.27	"
5.95	10.03	"	137.0	39.5	"
14.76	10.97	1.2	145.0	44.88	"
28.03	12.71	"	147.5	48.30	"
49.90	15.75	"	148.0	50.22	"
64.1	18.71	"	147.5	52.32	"
73.5	20.48	"	170	58.45	CH_3COOK
83.6	23.85	"	206	64.16	"
99.0	28.44	1.1	245	76.50	"
			292	100.00	"

1.2 = $CH_3COOK.2CH_3COOH$; 1.1 = $CH_3COOK.CH_3COOH$

The following results, differing from the above were obtained by Bakunin and Vitale, 1935.

t°	Gm. Mols. CH_3COOK per 100 gm. mols. mixture	Solid Phase	t°	Gm. Mols. CH_3COOK per 100 gm. mols. mixture	Solid Phase
16	0.0	CH_3COOH	134	42.88	2.1
9	5.23	"	138.6	50.06	"
3	10.33	"	147	58.05	CH_3COOK
0 Eutec.	—	" + 1.2	175	60.20	"
14	16.22	1.2	234	71.83	"
64	23.43	2.1	258	81.73	"
101	29.43	"	292	98.24	"
112	37.27	"	297	100.00	"

100 gms. methyl alcohol (CH_3OH) dissolve 24.24 gms. CH_3COOK at 15° and 53.54 gms. at 73.4° (= b. pt. of the sat. sol.). The salt gives extremely hygroscopic crystals of the alcoholate, $CH_3COOK.CH_3OH$. (Henstock, 1934.)

100 gms. liquid Ammonia dissolve 1.026 gm. CH_3COOK at -33.9°. (Johnson and Krumboltz, 1933.)

100 gms. liquid Sulfur-Dioxide dissolve 0.006 gm. CH_3COOK at 0°. (Jander and Ruppolt, 1937.)

POTASSIUM PROPIONATE $C_2H_5COOK.H_2O$

100 gms. methyl alcohol (CH_3OH) dissolve 39.0 gms. anhydrous potassium propionate at 15° and 55.33 gms. at 71.3° (= b. pt. of sat. sol.). (Henstock, 1934.)

POTASSIUM BUTYRATE C_3H_7COOK.

100 gms. water dissolve 296.8 gms. C_3H_7COOK, or 100 gms. sat. solution contain 74.8 gms. at 31.25°.

100 gms. of an aq. solution saturated with sugar and C_3H_7COOK contain 49.19 gms. sugar + 34.78 gms. C_3H_7COOK + 16.03 gms. H_2O at 31.25°.

(Köhler, 1897.)

100 gms. methyl alcohol (CH_3OH) dissolve 51.04 gms. n potassium butyrate, $CH_3CH_2CH_2COOK$, at 15° and 120.84 gms. at 70.9° (= b. pt. sat. sol.). (Henstock, 1934.)

POTASSIUM Iso BUTYRATE $(CH_3)_2CHCOOK$

EQUILIBRIUM IN THE SYSTEM POTASSIUM ISO BUTYRATE, ISO BUTYRIC ACID AND WATER AT 25°.

(Bury and Hends, 1939.)

Suitable mixtures were shaken in Hard glass vessels until analysis showed that equilibrium was established. Iso butyric acid was determined by titration and potassium iso butyrate by conversion into potassium chloride. The two liquid layers which were formed in all cases had the following compositions.

Upper Layer Gms. per 100 gms. sat. sol.		Lower Layer Gms. per 100 gms. sat. sol.		Upper Layer Gms. per 100 gms. sat. sol.		Lower Layer Gms. per 100 gms. sat. sol.	
$iC_4H_8O_2$	$iC_4H_7O_2K$	$iC_4H_8O_2$	$iC_4H_7O_2K$	$iC_4H_8O_2$	$iC_4H_7O_2K$	$iC_4H_8O_2$	$iC_4H_7O_2K$
57.26	0	24.0	0	51.20	0.20	30.17	0.32
57.08	0.02	24.23	0.09	49.81	0.23	30.99	0.33
56.90	0.05	25.09	0.18	49.00	0.24	31.21	0.34
55.54	0.08	26.43	0.23	47.91	0.26	31.80	0.34
54.76	0.10	27.14	0.25	46.89	0.28	32.56	0.34
53.81	0.13	27.72	0.27	45.72	0.29	34.02	0.35
53.17	0.16	28.00	0.28	44.54	0.30	35.21	0.36
52.50	0.18	29.03	0.29	43.48	0.32	37.62	0.36
51.72	0.19	29.69	0.30	42.00	0.34	39.57	0.37
51.11	0.20	30.08	0.32				

POTASSIUM TARTRATE (Mono) $KHC_4H_4O_6$, Cream of Tartar.

SOLUBILITY OF MONO POTASSIUM TARTRATE IN WATER.

(Alluard, 1865; Roelofsen, 1894; Blarez, 1891; at 20°, Magnanini, 1901; at 25°, Noyes and Clement, 1894.)

t°.	Gms. $KHC_4H_4O_6$ per 100 Gms. Solution.			t°.	Gms. $KHC_4H_4O_6$ per 100 Gms. Solution.		
0	0.30 (R.)	0.32 (A.)	0.35 (B.)	40	0.96	1.3	1.29
10	0.37	0.40	0.42	50	1.25	1.8	1.80
20	0.49	0.53 (M.)	0.60	60	...	2.4	...
25	0.58	0.654 (N. and C.)	0.74	80	...	4.4	...
30	0.69	0.9 (A.)	0.89	100	...	6.5	...

POTASSIUM TARTRATE (Mono) $(CHOH)_2COOH.COOK$ (Cream of Tartar).

SOLUBILITY OF MONO POTASSIUM TARTRATE IN WATER.

(Paul, (at 18°, 1917) 1926.)

NOTE. — A weighed amount of dried tartrate was shaken with a weighed amount of water a given time in a thermostat. The undissolved salt was filtered on a Gooch crucible, dried over phosphorus pentoxide and weighed. Furthermore the content of the solution was determined by titration with standard barium hydroxide solution.

C_4H

t°.	$d\frac{t°}{4}$ of sat. sol.	Gms. $KHC_4H_4O_6$ per 100 cc. sat. sol	t°.	$d\frac{t°}{4}$ of sat. sol.	Gms. $KHC_4H_4O_6$ per 100 gms. sat. sol.
0.....	1.00145	0.2653	18.....	1.00120	0.4896
5.....	1.00224	0.2975	20.....	1.00100	0.5337 (0.5415)(2)
10.....	1.00180	0.3663	25.....	1.00079	0.6412
14.....	1.00172	0.4301 (4.8)(1)	30.....	1.00026	0.7623

(1) This result is by Pierrat, 1921; (2) This result is by Moser and Ritschel, 1925.

Later very careful determinations by Carpenter and Mack, 1934, gave the following results:

t°	d. of sat. sol.	Gms. $KHC_4H_4O_6$ per 100 gms. sat. sol.	t°	d. of sat. sol.	Gms. $KHC_4H_4O_6$ per 100 gms. sat. sol.
0	1.0012	0.2305	15	1.0016	0.4338
5	1.0016	0.2870	20	1.0012	0.5323
10	1.0020	0.3579	25	1.0003	0.6412

SOLUBILITY OF MONO POTASSIUM TARTRATE IN AQUEOUS SOLUTIONS OF NEUTRAL DIPOTASSIUM TARTRATE AT 20°.

(Richert, 1930.)

Gm. Mols. per liter of sat. solution		Gm. Mols. per liter of sat. solution	
$K_2C_4H_4O_6$	$KHC_4H_4O_6$	$K_2C_4H_4O_6$	$KHC_4H_4O_6$
0.000	0.0284 (= 5.342 gms.)	0.00443	0.00667
0.000443	0.0218	0.00714	0.00540
0.000886	0.0176	0.0143	0.00360
0.00177	0.0124	0.0214	0.00280
0.00266	0.0096	0.0286	0.00264
0.00354	0.00805	0.0357	0.00260

SOLUBILITY OF MONO POTASSIUM TARTRATE IN AQUEOUS SOLUTIONS OF TARTARIC ACID AT 20°.

(Richert, 1930.)

Gm. Mols. per liter sat. solution	
$H_2C_4H_4O_6$	$KHC_4H_4O_6$
0.0030	0.0268
0.0055	0.0260
0.0105	0.0240
0.0335	0.0238
0.0485	0.0238

POTASSIUM Acid TARTRATE $KHC_4H_4O_6$

SOLUBILITY OF MONO POTASSIUM TARTRATE IN AQUEOUS SOLUTIONS OF NEUTRAL DI POTASSIUM TARTRATE AT SEVERAL TEMPERATURES.

(Carpenter and Mack, 1934.)

Gms. $K_2C_4H_4O_6$ per 100 gms. sat. sol.	Gms. $KHC_4H_4O_6$ per 100 gms. sat. solution at: 0°	5°	10°
0.00	0.2305 (1.0012)	0.2870 (1.0016)	0.3579 (1.0020)
0.025	0.2010 (1.0010)	0.2562 (1.0016)	0.3272 (1.0020)
0.050	0.1772 (1.0009)	0.2322 (1.0017)	0.3000 (1.0021)
0.100	0.1394 (1.0011)	0.1936 (1.0021)	0.2557 (1.0024)
0.200	0.0978 (1.0014)	0.1437 (1.0025)	0.1924 (1.0027)
0.300	0.0758 (1.0018)	0.1098 (1.0029)	0.1540 (1.0030)
0.400	0.0617 (1.0024)	0.0902 (1.0035)	0.1317 (1.0036)
0.500	0.0523 (1.0031)	0.0784 (1.0041)	0.1143 (1.0042)
0.600	0.0480 (1.0038)	0.0703 (1.0047)	0.1039 (1.0048)
0.700	0.0433 (1.0046)	0.0638 (1.0053)	0.0935 (1.0054)
0.800	0.0379 (1.0052)	0.0562 (1.0059)	0.0824 (1.0060)

Gms. $K_2C_4H_4O_6$ per 100 gms. sat. sol.	Gms. $KHC_4H_4O_6$ per 100 gms. sat. solution at: 15°	20°	25°
0.00	0.4338 (1.0014)	0.5323 (1.0012)	0.6412 (1.0003)
0.025	0.4050 (1.0017)	0.5010 (1.0012)	0.6120 (1.0003)
0.050	0.3793 (1.0017)	0.4737 (1.0013)	0.5894 (1.0004)
0.100	0.3307 (1.0018)	0.4228 (1.0014)	0.5424 (1.0006)
0.200	0.2651 (1.0021)	0.3492 (1.0016)	0.4560 (1.0008)
0.300	0.2186 (1.0025)	0.2939 (1.0020)	0.3898 (1.0011)
0.400	0.1890 (1.0028)	0.2532 (1.0021)	0.3428 (1.0015)
0.500	0.1652 (1.0031)	0.2208 (1.0023)	0.3060 (1.0020)
0.600	0.1492 (1.0037)	0.1977 (1.0025)	0.2773 (1.0022)
0.700	0.1357 (1.0041)	— —	0.2522 (1.0024)
0.800	0.1220 (1.0149	— —	0.2292 (1.0028)

The figures in parentheses are the densities of the saturated solutions.

SOLUBILITY OF MONO POTASSIUM TARTRATE IN AQUEOUS SOLUTIONS OF ACIDS AND OF SALTS.

(Warington — J. Chem. Soc. 28, 946, '75.)

In Hydrochloric Acid.

Conc. of HCl Gms. per 100 Gms. Sol.	Gms. $KHC_4H_4O_6$ per 100 Gms. Solvent. At 22°.	At 80°.
0	0.600	4.027
0.68	3.01	5.35
2.15	6.88	11.35
4.26	11.19	20.23
8.36	22.75	40.93
16.13	48.31	80.12

100 gms. H_2O dissolve 0.422 gms. bitartrate at 14°

In other Acids and in Salt Solutions at 14°.

Acid or Salt.	Gms. Acid or Salt per 100 cc. Sol.	Gms. $KHC_4H_4O_6$ per 100 cc. Sol.
Acetic Acid	0.81	0.422
Tartaric Acid	1.03	0.322
Citric Acid	0.84	0.546
Sulphuric Acid	0.685	1.701
Hydrochloric Acid	0.504	1.947
Nitric Acid	0.845	1.969
Potassium Acetate	1.387	0.744
Potassium Citrate	1.397	0.843

SOLUBILITY OF MONO POTASSIUM TARTRATE IN AQUEOUS SOLUTIONS OF TARTARIC ACID AT SEVERAL TEMPERATURES.

(Carpenter and Mack, 1934.)

Gms. $H_2C_4H_4O_6$ per 100 gms. sat. sol.	Gms. $KHC_4H_4O_6$ per 100 gms. sat. solution at: 0°	10°	25°
0.0	0.2305 (1.0012)	0.03579 (1.0020)	0.6412 (1.0003)
0.025	0.2162 (1.0013)	0.3457 (1.0020)	0.6220 (1.0003)
0.050	0.2075 (1.0013)	0.3352 (1.0021)	0.6063 (1.0004)
0.100	0.1962 (1.0014)	0.3205 (1.0021)	0.5842 (1.0005)
0.200	0.1842 (1.0016)	0.3003 (1.0026)	0.5558 (1.0008)
0.400	0.1680 (1.0024)	0.2715 (1.0033)	0.5243 (1.0014)
0.600	0.1600 (1.0035)	0.2502 (1.0042)	0.4981 (1.0021)
0.800	0.1503 (1.0047)	— —	0.4716 (1.0027)

The figures in parentheses are the densities of the saturated solutions.

SOLUBILITY OF MONO POTASSIUM TARTRATE ($KHC_4H_4O_6$) IN NORMAL SOLUTIONS OF ACIDS AT 20°.

(Ostwald; Huecke, 1884.)

Purified tartrate was added in excess to normal solutions of the acids, and, after shaking, clear 1 cc. portions of each solution were withdrawn and titrated with approximately 0.1 *n* $Ba(OH)_2$ solution; 1 cc. normal acid requiring 10.63 cc. of the $Ba(OH)_2$ solution.

C_4H

Acid.	Gms. Acid per 100 cc. Solvent.	cc. N/10 $Ba(OH)_2$ per 1 cc. Solution.	Gms. $KHC_4H_4O_6$ per 100 cc. Solution.	Acid.	Gms. Acid per 100 cc. Solvent.	cc. N/10 $Ba(OH)_2$ per 1 cc. Solution.	Gms $KHC_4H_4O_6$ per 100 cc. Solution.
HNO_3	6.31	5.77*	10.21	$C_2H_5SO_3H$	11.0	5.01*	8.87
HCl	3.65	5.32	9.42	$HO.(CH_2)_2SO_3H$	12.61	5.33	9.43
HBr	8.10	5.38	9.75	$C_6H_5SO_3H$	15.81	5.25	9.29
HI	12.80	5.43	9.61	$HCOOH$	4.60	0.45	0.80
H_2SO_4	4.90	3.97	7.03	CH_3COOH	6.00	0.27	0.48
HCH_3SO_4	11.21	5.58	12.44	$CH_2ClCOOH$	9.45	1.01	1.79
$HC_2H_5SO_4$	12.61	5.41	9.58	C_2H_5COOH	7.40	0.24	0.42
$HC_3H_7SO_4$	14.01	5.21	9.22	C_3H_7COOH	8.81	0.23	0.41

* The figures in this column show the amount of the $Ba(OH)_2$ solution in excess of that which would have been required by the normal acid solution alone in each case, viz., 10.63 cc. They, therefore, correspond to the amount of $KHC_4H_4O_6$ dissolved in 1 cc of each saturated solution, and when multiplied by 1.77 give the grams of $KHC_4H_4O_6$ per 100 cc. solution.

SOLUBILITY OF MONO POTASSIUM TARTRATE IN AQUEOUS SOLUTIONS OF VARIOUS SALTS AND ACIDS AT 13° TO 15°. (Klapproth, 1922.)

The method used for securing saturation consisted (A), in dissolving 1.0 gram of $KHC_4H_4O_6$ in hot water and adding the solution to the quantity of salt or acid necessary to yield the concentration in which it was desired to determine the solubility of the tartrate. The mixture was diluted to 100 cc., shaken frequently, allowed to cool to room temperature and stand at least one day. An alternate method (B) differed from the above only in that the 1.0 gram of tartrate was added directly without previously being dissolved by warming. Thus an attempt was made to approach equilibrium from above and from below without application of continuous agitation. The results by the two methods differ so greatly that it is certain saturation was not reached. Consequently, the figures have only a qualitative interest. They show, in general, that salts with a common ion reduce the solubility and acids or salts with no common ion increase it. The solubility was found to be least in a formic acid mixture, and it was concluded that this acid could be advantageously used to precipitate mono potassium tartrate from its aqueous solutions.

POTASSIUM Acid TARTRATE

SOLUBILITY OF MONO POTASSIUM TARTRATE ($KHC_4H_4O_6$) IN AQUEOUS SOLUTIONS OF ELECTROLYTES AT 25°.

(Noyes and Clement, 1894; Magnanini, 1901.)

Electrolyte.	Gm. Equiv. per Liter. Electrolyte.	Gm. Equiv. per Liter. $KHC_4H_4O_6$.	Gms. per Liter. Electrolyte.	Gms. per Liter. $KHC_4H_4O_6$.	Electrolyte.	Gm. Equiv. per Liter. Electrolyte.	Gm. Equiv. per Liter. $KHC_4H_4O_6$.	Gms. per Liter. Electrolyte.	Gms. per Liter. $KHC_4H_4O_6$.
KCl	0.025	0.0254	1.86	4.788	CH_3COOK	0.05	0.0410	4.91	7.718
"	0.05	0.0196	3.73	3.680	"	0.10	0.0504	9.82	9.486
"	0.10	0.0133	7.46	2.509	"	0.20	0.0634	19.63	11.930
"	0.20	0.0087	14.92	1.636	$KHSO_4$(20°)	0.01	0.0375	1.36	7.06
$KClO_3$	0.025	0.0256	3.06	4.821	"	0.02	0.0500	2.72	9.41
"	0.05	0.0197	6.13	3.716	"	0.10	0.1597	13.62	30.06
"	0.10	0.0138	12.26	2.601	KHC_2O_4* (20°)	0.01	0.0369	1.28	6.94
"	0.20	0.0097	24.52	1.728	"	0.02	0.0424	2.56	7.98
KBr	0.05	0.0192	5.95	3.699	"	0.10	0.1132	12.82	21.30
"	0.10	0.0134	11.91	2.517	HCl	0.013	0.0367	0.45	6.90
"	0.20	0.0087	23.82	1.629	"	0.025	0.0428	0.91	8.06
KI	0.05	0.0196	8.30	3.687	"	0.050	0.0580	1.82	11.09
"	0.10	0.0132	16.61	2.492	NaCl	0.05	0.0376	2.92	7.08
"	0.20	0.0086	33.22	1.619	"	0.10	0.0397	5.85	7.48
KNO_3	0.05	0.0195	5.06	3.676	"	0.20	0.0428	11.70	8.05
"	0.10	0.0136	10.12	2.551	$NaClO_3$	0.05	0.0382	5.32	7.18
"	0.20	0.0090	20.24	1.696	"	0.10	0.0405	10.65	7.63
K_2SO_4	0.05	0.0208	4.36	3.921	"	0.20	0.0446	21.30	8.40
"	0.10	0.0147	8.72	2.769					
"	0.20	0.0100	17.44	1.888					

* = acid potassium oxalate.

100 gms. Methyl Alcohol (CH_3OH) dissolve 0.6 gm. $KHC_4H_4O_6$ at 66°. (b.pt.). (Henstock, 1934.)

SOLUBILITY OF MONO POTASSIUM TARTRATE IN AQUEOUS ALCOHOL AT 25°.

(Seidell, 1910.)

Wt. % C_2H_5OH in Solvent	d_{25} of Sat. Sol.	Gms. $KHC_4H_4O_6$ per 100 Gms. Sat. Sol.	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $KHC_4H_4O_6$ per 100 Gms. Sat. Sol.
0	1.002	0.649	50	0.912	0.064
10	0.985	0.358	60	0.890	0.043
20	0.970	0.210	80	0.842	0.023
30	0.953	0.131	92.3	0.807	0.014
40	0.933	0.087	100	0.789	0.010

SOLUBILITY OF MONO POTASSIUM TARTRATE IN AQUEOUS SOLUTIONS OF ALCOHOL AT 14°. (Pierrat, 1921.)

Saturation was obtained by agitating the mixtures for several hours. The sat. solution was evaporated to dryness in a current of air and the residue dissolved in enough water to yield the original volume of the solution. The tartrate in this was determined by electrolytic conductivity.

Wt. per cent C_2H_5OH in solvent.	Gms. $KHC_4H_4O_6$ per 100 cc. sat. sol.	Wt. per cent C_2H_5OH in solvent.	Gms $KHC_4H_4O_6$ per 100 cc. sat. sol.
0.0 (= H_2O)	4.8	42.4	0.42
8.7	2.2	58.5	0.20
15.9	1.5	94.7	0.05
27.3	0.77		

SOLUBILITY OF MONO POTASSIUM TARTRATE IN AQUEOUS SOLUTIONS OF ALCOHOL AT 18°. (Paul, 1927, 1926.)

t°.	Gms. $KHC_4H_4O_6$ per 100cc. sat. solution in aq. C_2H_5OH of 5.0 gms. C_2H_5OH per 100cc. ($d_{\frac{20}{4}}$ = 0.98650)	 8.0 gms. C_2H_5OH per 100 cc. ($d_{\frac{20}{4}}$ = 0.98155)	 10.0 gms. C_2H_5OH per 100 cc. ($d_{\frac{20}{4}}$ = 0.97513)
0....	0.1746 (0.98998)	0.1375 (0.98247)	0.1248 (0.97805)
10....	0.2605 (0.98974)	0.2078 (0.98203)	0.1905 (0.97746)
18....	0.358	0.294	0.258
20....	0.3924 (0.98876)	0.3371 (0.98170)	0.3003 (0.97678)
25....	0.4747 (0.98785)	0.4045 (0.98141)	0.3662 (0.97546)
30....	0.5846 (0.98673)	0.4965 (0.98118)	0.4323 (0.97364)

The figures in parentheses show the $d_{\frac{t}{4}}$ of the saturated solutions.

The author also gives data for the p_H and the electrolytic conductivity of the saturated solutions.

POTASSIUM Acid TARTRATE $KHC_4H_4O_6$

SOLUBILITY OF MONO POTASSIUM TARTRATE IN AQUEOUS SOLUTIONS OF INVERT SUGAR (GLUCOSE + FRUCTOSE) AT 20°.

(Richert, 1930.)

C_4H

Percent Invert sugar by weight	Gm. Mols. $KHC_4H_4O_6$ per: 1000cc sat. solution	 1000 gms. sat. sol.
0	0.0284	0.0284
15	0.0276	0.0260
30	0.0264	0.0232
45	0.0240	0.0198
60	0.0200	0.0155
80	0.0124	0.0087

SOLUBILITY OF MONO POTASSIUM TARTRATE IN AQUEOUS SOLUTIONS OF SEVERAL SUGARS AT 20°.

(Carpenter and Kucera, 1934.)

Wt. Percent Sugar	Gms. $KHC_4H_4O_6$ per 100 gms. sat. solution in aqueous: d Glucose Solution		d Fructose Solution		Invert Sugar Solution		Sucrose Solution	
0	0.5323	(1.0012)	0.5323	(1.0012)	0.5323	(1.0012)	0.5323	(1.0012)
5	—	—	0.5180	(1.0210)	0.5171	(1.0209)	—	—
10	0.4924	(1.0405)	0.5037	(1.0414)	0.4979	(1.0411)	0.4715	(1.0409)
20	0.4442	(1.0824)	0.4637	(1.0843)	0.4570	(1.0837)	0.4237	(1.0835)
30	0.4010	(1.1272)	0.4269	(1.1303)	0.4152	(1.1296)	0.3707	(1.1293)
40	—	—	0.3833	(1.1796)	0.3700	(1.1788)	0.3114	(1.1784)

The figures in parentheses are densities of the saturated solutions.
The authors also give similar results for the temperatures 0°, 5°, 10° and 15°.

POTASSIUM TARTRATE $(K_2C_4H_4O_6)_2.H_2O$.

100 gms. H_2O dissolve 138 gms. $K_2C_4H_4O_6$ at 16.6°, Sp. Gr. of sat. sol. = 1.49.
(Greenish and Smith, 1901.)

POTASSIUM Sodium **TARTRATE**, $KNaC_4H_4O_6.3H_2O$ and $.4H_2O$ *r* and *d*.

SOLUBILITY OF THE POTASSIUM SODIUM SALT OF DEXTRO AND OF RACEMIC TARTARIC ACIDS IN WATER. (Brönsted, 1921, 1926.)

Salt of Racemic Acid.		Salt of Dextro Acid.				Salt of Mixture of *d* and *l* Acids.	
t° of Cryst.	Gms. $KNaC_4H_4O_6$ per 100 gms. H_2O.	t° of. Cryst.	Gms. $KNaC_4H_4O_6$ per 100 gms. H_2O.	t° of. Cryst.	Gms. $KNaC_4H_4O_6$ per 100 gms. H_2O.	t° of. Cryst.	Gms. $KNaC_4H_4O_6$ per 100 gms. H_2O.
−6.98...	42.7	−4.7.....	28.7	0.0...	32.0	−6.42...	39.3
−5.95...	36.5	−4.34....	26.0	9.7...	46.1	+9.7....	64.4
+9.7....	58.0	−3.38....	19.0	18.0...	62.9	29.5....	140.5
29.5....	92.3	−1.875...	10.2	29.5...	100.7		

EQUILIBRIUM IN THE SYSTEM POTASSIUM SODIUM TARTRATE SODIUM HYDROXIDE AND WATER AT 25°.

(Campbell and Campbell, 1932.)

Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.	
$KNaC_4H_4O_6$	NaOH	$KNaC_4H_4O_6$	NaOH
39.0	0.0	22.6	12.2
33.3	3.7	16.1	13.85
31.0	5.8	21.6	15.3
29.0	7.3	35.2	24.8
29.5	7.6	25.7	23.9
20.2	13.5		

The three sections of the solubility curve are considered to correspond respectively to hydrated Rochelle Salts, anhydrous Rochelle Salts and a solid complex which resembles a stiff gel.

POTASSIUM Sodium **TARTRATE**. $KNa.C_4H_4O_6.4H_2O$. (Rochelle or Seignette Salt.)

100 gms. sat. aq. solution contain 36.66 gms. $KNaC_4H_4O_6$ at 9.7° and 47.97 gms. at 29.5°. (van't Hoff and Goldschmidt, 1895.)

100 gms. H_2O dissolve 53.53 gms. $KNaC_4H_4O_6$ at 15°, Sp. Gr. of sol. = 1.2713. (Greenish & Smith, 1901.)

SOLUBILITY OF MIXTURES OF POTASSIUM TARTRATE AND OF SODIUM TARTRATE IN WATER AT SEVERAL TEMPERATURES.

(van Leeuwen, 1897.)

t°.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.	t°.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
	$K_2C_4H_4O_6$.	$Na_2C_4H_4O_6$.			$K_2C_4H_4O_6$.	$Na_2C_4H_4O_6$.	
18	19.2	16.5	$KNaC_4H_4O_6.4H_2O$	26.6	56	4.2	$KNaC_4H_4O_6.4H_2O+K_2T$
38	26.6	22.8	"	48.3	51.6	13.2	" "
20.9	11.8	28	" $+Na_2T$	59.7	44.5	25.3	K_2T+Na_2T
38	25.8	24.7	" "	80	39.7	34.7	" "
50	36.7	23.9	" "				

$K_2T = K_2C_4H_4O_6.\frac{1}{2}H_2O$. $Na_2T = Na_2C_4H_4O_6.2H_2O$.

SOLUBILITY OF SEVERAL POTASSIUM SALTS OF TARTARIC ACIDS IN WATER AT 20°.

(Schlossberg, 1900.)

Salt.	Formula.	Gms. Salt per 100 Gms. Sat. Sol.
Potassium Sodium Salt of Racemic Acid	$KNa(C_4H_4O_6).3H_2O$	62.84
Potassium Sodium Salt of *d* Tartaric Acid	$KNa(C_4H_4O_6).4H_2O$	63.50
Potassium Neutral Inactive Pyrotartrate	$K_2C_5H_6O_6.H_2O$	56.33
Potassium Neutral Dextropyrotartrate	$K_2C_5H_6O_6$	57.62

SOLUBILITY OF POTASSIUM SODIUM TARTRATE IN AQ. ALCOHOL SOLUTIONS AT 25°.
(Seidell, 1910.)

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $KNaC_4H_4O_6.4H_2O$ per 100 Gms. Solvent	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $KNaC_4H_4O_6.4H_2O$ per 100 Gms. Sat. Sol.
0	1.310	53.33	50	0.908	2.40
10	1.216	41.60	60	0.878	0.90
20	1.124	26.20	70	0.857	0.30
30	1.034	13.80	80	0.840	0.06
40	0.961	6	100	0.789	trace

POTASSIUM Dihydroxy**TARTRATES** $K_2C_4H_4O_8.H_2O$ and $KHC_4H_4O_8.H_2O$.

100 gms. H_2O dissolve 2.66 gms. $K_2C_4H_4O_8.H_2O$ at 0°. (Fenton, 1898.)
100 gms. H_2O dissolve 2.79 gms. $KHC_4H_4O_8.H_2O$ at 0°. "

F.-pt. data for mixtures of *d* and *l* dimethyl ester of potassium bitartrate and for mixtures of *d* and *l* diacetyl dimethylester of potassium bitartrate are given by Adriani (1900).

POTASSIUM Antimony **TARTRATE** $C_2H_2(OH)_2(COOK)(COOSbO).\frac{1}{2}H_2O$.

100 gms. water dissolve 5.9 gms. salt at room temp. (Squire and Caines, 1905.)
" " " 6.9 " " " 25°. (S and S. 1903.)
" " " 8 " " " 21°. (Aschan, 1913.)
" 95% HCOOH dissolve 82.7 gms. salt at 20.8°. (Aschan, 1913.)
" glycerol dissolve 5.5 gms. salt at 15.5°.

C_4H

SOLUBILITY OF ANTIMONY POTASSIUM TARTRATE IN AQ. ALCOHOL SOLUTIONS AT 25°.
(Seidell, 1910.)

Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $C_4H_4O_6.KSbO.\frac{1}{2}H_2O$ per 100 Gms. Sat. Sol	Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $C_4H_4O_6.KSbO.\frac{1}{2}H_2O$ per 100 Gms. Sat. Sol.
0	1.052	7.85	40	0.935	0.38
5	1.025	5.50	50	0.913	0.23
10	1.007	3.92	60	0.890	0.12
20	0.980	1.92	70	0.866	0.06
30	0.958	0.84	100	0.788	trace

POTASSIUM SUCCINATE $K_2C_4H_4O_4.3H_2O$

100 gms. Methyl Alcohol (CH_3OH) sat. with anhydrous potassium succinate dissolve 3.16 gms. $K_2C_4H_4O_4$ at 15° and 3.75 gms. at 66.6 (b.pt.). (Henstock, 1934.)

POTASSIUM URATE. $KHC_5H_2N_4O_3$

SOLUBILITY OF POTASSIUM URATE IN WATER. (Barkan, 1924.)

It was previously shown that sodium urate passes from a gelatin like colloidal form to a stable granular condition, and the author desired to learn if the potassium salt behaves likewise. Several different samples of potassium urate were prepared and used for solubility determinations. The solubility of each diminished with time of rotation. In general the diminution was from about 2.38 gms. per liter to 1.9 gms. per liter. The mean of all the determinations was :

2.13 gms. (= 10.35×10^{-3} gms. mols.) potassium urate per liter at 18°.

Several determinations of the solubility of the compound in the fresh colloidal form gave, as the highest value, 6.67 gms. (= $32.4.10^{-3}$ gm. mols.) potassium urate per liter at 18°.

POTASSIUM CITRATE $(CH_2)_2C(OH)(COOK)_3.H_2O$.

SOLUBILITY IN WATER.

(Average results of Seidell, 1910; Greenish and Smith, 1901; Köhler, 1897.)

t°.	Gms. $(CH_2)_2C(OH)(COOK)_3.H_2O$ per 100 Gms. Sat. Solution.	Gms. $(CH_2)_2C(OH)(COOK)_3.H_2O$ per 100 Gms. Water.
15	61.8	162
20	63.2	172
25	64.5	182 (d_{25} = 1.518)
30	66	194

100 gms. H_2O dissolve 198.3 gms. $(CH_2)_2COH(COOK)_3$ + 303.9 gms. cane sugar at 31.25°. (Köhler, 1897.)

SOLUBILITY OF POTASSIUM CITRATE IN AQUEOUS ETHYL ALCOHOL AT 25°.

(Seidell, 1910.)

When potassium citrate is added to aqueous alcohol of certain concentrations the mixture separates into two liquid layers. A series of determinations made by adding an excess of the salt to 10–15 cc. portions of several aq. alcohol mixtures at 25° gave the following results.

Wt. % C_2H_5OH in Solvent.		d_{25} of Sat. Solution.	Wt. % C_2H_5OH in Sat. Solution.	Gms. $(CH_2)_2COH(COOK)_3.H_2O$ per 100 Gms. Sat. Solution.
8.9	*a*	...	...	...
	b	1.4920	0	60
32	*a*	...	...	0.2
	b	1.4930	0	61.6
51	*a*	...	65.1	0.38
	b	..	...	62.5
70.2	*a*	0.8366	81	0.10
	b	...	...	62.3
81.4		0.8356	81.4	0.038
91.6		0.8139	91.6	0.016
99.9		0.7896	99.5	0.014

a = upper, alcohol rich layer. *b* = lower, water rich layer.

A series of determinations was also made by adding just enough potassium citrate to the alcohol solution to cause distinct clouding and then, after bringing to 25°, titrating with the aqueous alcohol mixture to disappearance of the clouding. The results were plotted and the following interpolated values obtained.

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Solution.	Gms. $(CH_2)_2COH(COOK)_3.H_2O$ per 100 Gms. Sat. Sol.	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Solution.	Gms. $(CH_2)_2COH(COOK)_3.H_2O$ per 100 Gms. Sat. Sol.
0	1.518	64.5	40	1.005	12.4
5	1.400	52.5	50	0.943	5.6
10	1.310	45.5	60	0.900	1.6
20	1.177	31.5	70	0.868	0.4
30	1.085	21.5	80	0.838	0.04

In one determination at 15°, made with alcohol of 59 Vol. per cent, 4.51 gms. $(CH_2)_2COH(COOK)_3.H_2O$ were required to just cause clouding.

100 gms. U.S.P. Glycerol $(CH_2OHCHOHCH_2OH)$ saturated with Potassium Citrate contain 28.2 gms. $(CH_2)_2C(OH)(COOK)_3.H_2O$ at 25°. (Schaellbach and Rosin, 1931.)

POTASSIUM PHENOLATES, $C_6H_5OK.2H_2O$, $C_6H_5OK.3C_6H_5OH$.

EQUILIBRIUM IN THE SYSTEM POTASSIUM HYDROXIDE, PHENOL AND WATER AT 25°.

(Van Meurs, 1916.)

Mols. per 100 mols. sat. sol.		Solid Phase.	Mols. per 100 mols. sat. sol.		Solid Phase.
C_6H_5OH.	KOH.		C_6H_5OH.	KOH.	
70.20	0.74	C_6H_5OH	25.93	17.15	$C_6H_5OK.2H_2O$
76.40	4.13	»	22.15	16.92	»
60.16	7.28	$C_6H_5OK.3C_6H_5OH$	14.95	15.48	»
51.27	8.32	»	8.84	15.39	»
46.38	9.11	»	5.57	15.14	»
33.79	11.18	»	0.92	16.04	»
29.70	17.13	»	0.04	26.04	»
31.69	19.05	»$+C_6H_5OK.2H_2O$	0.0	27.65	$KOH.2H_2O$

The two liquid layers which are formed at concentrations of KOH less than about 0.5 mol. % have the following compositions.

Aqueous layer.		Phenol layer.	
Mol. % C_6H_5OH.	Mol. % KOH.	Mol. % C_6H_5OH.	Mol. % KOH.
1.79	0.0	32.33	0.0
2.48	0.19	21.60	0.37
3.85	0.25	15.85	0.45

POTASSIUM PICRATE $C_6H_2(NO_2)_3OK$.

C_6H

1000 cc. sat. solution of potassium picrate in water contain 5.06 gms. $C_6H_2(NO_2)_3OK$ at 20°. (Moser and Ritschel, 1925.)

SOLUBILITY OF POTASSIUM PICRATE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL, METHYL ALCOHOL AND OF ACETONE AT 25°. (Fischer, 1914, 1918.)

The composition of the aqueous alcohol and acetone mixtures, which served as solvents, was accurately controlled by density determinations. Saturation was secured by constant agitation in a thermostat. The saturated solution was withdrawn by means of a graduated pipet and its dissolved picrate determined by evaporation and weighing the residue, or by a method of titration. The absolute alcohol was prepared by treatment with lime and distillation.

Vol. per cent C_2H_5OH in solvent.	Gms. $C_6H_2(NO_2)_3OK$ per 100 cc. sat. sol.	Vol. per cent C_2H_5OH in solvent.	Gms. $C_6H_2(NO_2)_3OK$ per 100 cc. sat. sol.	Vol. % CH_3OH in solvent.	Gms. $C_6H_2(NO_2)_3OK$ per 100 cc. sat. sol.	Vol. % Acetone in solvent.	Gms. $C_6H_2(NO_2)_3OK$ per 100 cc. sat. sol.
0.0 (=H_2O)	0.645	55	0.598	10	0.542	10	0.726
10	0.559	60	0.574	20	0.470	20	0.876
15	0.475	65	0.546	30	0.444	30	1.140
20	0.450	70	0.485	40	0.422	40	1.155
25	0.453	75	0.410	50	0.411	50	2.106
30	0.472	80	0.326	60	0.410	60	2.615
35	0.484	85	0.227	70	0.396	70	3.090
40	0.533	90	0.174	80	0.332	80	3.340
45	0.560	95	0.100	90	0.254	90	3.084
50	0.582	100	0.184 (?)	100	0.274	100	1.080

Data for the solubility of potassium picrate in aqueous solutions of ethyl alcohol, methyl alcohol and of acetone at 25° are given by Fisher, 1914.

POTASSIUM RESORCINOLATES $C_6H_4(OH)OK.2H_2O, C_6H_4(OK)_2.4H_2O$.

EQUILIBRIUM IN THE SYSTEM POTASSIUM HYDROXIDE, RESORCINOL AND WATER AT 30°. (Van Meurs, 1916.)

Mols. per 100 mols. sat. sol. $\frac{C_6H_4(OH)_2(m)}{2}$	Mols. per 100 mols. sat. sol. KOH.	Solid Phase.	Mols. per 100 mols. sat. sol. $\frac{C_6H_4(OH)_2(m)}{2}$	Mols. per 100 mols. sat. sol. KOH.	Solid Phase.
38.81	0.0	$C_6H_4(OH)_2(m)$	16.11	16.07	$C_6H_4(OK)_2.4H_2O$
46.80	3.26	»	11.58	16.44	»
57.30	6.85	»	6.68	17.71	»
69.06	10.13	»	1.45	22.71	»
50.27	16.95	$C_6H_4(OH)OK.2H_2O$	0.71	26.49	»
36.85	16.40	»	0.76	26.99	» + KOH(?)
33.00	16.63	»	0.74	29.95	» »
26.71	17.62	»	0.74	30.13	KOH(?)
25.64	17.84	» + $C_6H_4(OK)_2.4H_2O$	0.31	29.88	$KOH.H_2O$(?)
22.40	17.44	$C_6H_4(OK)_2.4H_2O$	0.17	29.70	»
18.29	16.64	»	0.0	28.80	$KOH.H_2O$

POTASSIUM GLUCONATE $KC_6H_{11}O_7$

100 cc sat. solution of Potassium Gluconate in water contain 50.85 gms. $KC_6H_{11}O_7$ at 25°. (May, Weisberg and Herrick, 1929.)

POTASSIUM BENZOATE $KC_7H_5O_2.3H_2O$.

SOLUBILITY IN WATER.

(Pajetta, 1906, 1907.)

t°.	17.5°	25°	33.3°	50°
Gms. $KC_7H_5O_2$ per 100 Gms. Solution	41.1	42.4	44	46.6

POTASSIUM BENZOATE C_6H_5COOK.

SOLUBILITY OF POTASSIUM BENZOATE IN WATER.

(Sidgwick and Ewbank, 1922.)

t°.	Gms. C_6H_5COOK per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. C_6H_5COOK per 100 gms. sat. sol.	Solid Phase.
— 0.86	5.04	Ice	41.0	44.92	C_6H_5COOK
— 2.14	9.70	»	81.0	50.99	»
— 4.29	16.23	»	97.5	53.50	»
— 7.31	24.23	»	131.0	58.42	»
+ 8.5	39.89	C_6H_5COOK	181.0	66.09	»
13.0	40.60	»			

100 gms. Methyl Alcohol (CH_3OH) dissolve 7.07 gms. C_6H_5COOK at 15° and 8.33 gms. at 66° (b.pt.). (Henstock, 1934.)

POTASSIUM Hydroxy BENZOATES *o*, *m* and *p* $C_6H_4OHCOOK$.

SOLUBILITY OF POTASSIUM ORTHO HYDROXY BENZOATE (= POTASSIUM SALICYLATE) IN WATER.

(Sidgwick and Ewbank, 1922.)

t°.	Gms. $C_6H_4OH.COOK(o)$ per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. $C_6H_4OH.COOK(o)$ per 100 gms. sat. sol.	Solid Phase.
—1.82	10.49	Ice	24.0	53.33	$C_6H_4OHCOOK.H_2O$
—3.47	18.82	»	28.5	55.82	»
—6.52	31.15	»	61.0	61.31	$C_6H_4OHCOOK$
—8.0	35.80	»	103.8	68.97	»
±0	44.08	$C_6H_4OHCOOK.H_2O$	108.5	70.20	»
9	49.19	»	138.2	74.80	»

SOLUBILITY OF POTASSIUM Meta Hydroxy Benzoate in Water.

t°.	Gms. $C_6H_4OH.COOK(m)$ per 100 gms. sat. sol.	Solid Phase.
— 2.41...	12.39	Ice
— 5.06...	22.25	»
— 8.59...	31.34	»
— 19.92...	49.39	»
+ 10.0....	59.04	$C_6H_4OH.COOK(m)$
33.5....	61.94	»
95.0....	69.60	»
136.8....	75.02	»

SOLUBILITY OF POTASSIUM Para Hydroxy Benzoate in Water.

t°.	Gms. $C_6H_4OH.COOK(p)$ per 100 gms. sat. sol.	Solid Phase.
— 1.43...	8.04	Ice
— 3.24...	15.55	»
+ 15.8....	29.91	$(p)C_6H_4OH.COOK.3H_2O$
25.8....	35.50	»
43.0....	45.71	»
64.4. ..	56.70	»
70.5....	59.34	»
86.8....	63.01	$(p)C_6H_4OH.COOK$
129.5....	64.95	»

POTASSIUM MANDELATE (Racemic) $C_6H_5.CHOH.COOK$

EQUILIBRIUM IN THE SYSTEM RACEMIC POTASSIUM MANDELATE, RACEMIC MANDELIC ACID AND WATER AT 25°.

(Ross and Morrison, 1933.)

C_8H

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$C_8H_8O_3$	$C_8H_7O_3K$		$C_8H_8O_3$	$C_8H_7O_3K$	
3.3	47.3	$[K(C_8H_7O_3)_2]H$	12.9	13.7	$[K(C_8H_7O_3)_4]H_3$
4.1	45.2	"	14.4	12.3	"
5.1	37.2	"	15.8	11.2	"
6.4	33.3	"	20.4	9.8	"
7.7	30.8	"	24.0	9.4	"
8.1	29.7	$[K(C_8H_7O_3)_3]H_2$	27.1	8.8	"
6.3	27.7	"	30.1	8.5	"
5.5	24.7	"	31.7	8.3	$C_8H_8O_3$
6.0	23.1	"	30.1	7.7	"
6.5	19.5	"	27.1	6.7	"
8.6	16.2	"	25.0	5.5	"
11.4	14.5	"	21.6	3.8	"
8.4	16.5	"	18.6	1.1	"
11.0	15.6	$[K(C_8H_7O_3)_4]H_3$	16.9	0.0	"
11.6	15.0	"			

POTASSIUM MANDELATE (Laevo) $C_6H_5CHOH.COOK$

EQUILIBRIUM IN THE SYSTEM (-) POTASSIUM MANDELATE (-) MANDELIC ACID AND WATER AT 25°.

(Ross, Morrison and Johnstone, 1937.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$C_8H_8O_3$	$C_8H_7O_3K$		$C_8H_8O_3$	$C_8H_7O_3K$	
9.7	46.4	$[K(C_8H_7O_3)_2]H$	30.9	17.7	$C_8H_8O_3$
34.4	38.5	"	12.1	6.0	"
42.7	37.3	"	10.5	3.2	"
39.8	27.2	" + $C_8H_8O_3$	10.1	1.4	"
			10.1	0.0	"

POTASSIUM PHTHALATE $C_6H_4(COOK)_2$

EQUILIBRIUM IN THE SYSTEM POTASSIUM PHTHALATE, PHTHALIC ACID AND WATER AT SEVERAL TEMPERATURES.

(Smith, 1931.)

Results at 0°

Gms. per 100 gms. sat. sol.		Solid Phase
$C_6H_4(COOH)_2$	$C_6H_4(COOK)_2$	
0.0	60.4	$C_6H_4(COOK)_2$
0.10	60.4	" + $C_6H_4(COOH)(COOK)$
0.11	48.89	$C_6H_4(COOH)COOK$
0.19	33.02	"
0.40	20.43	"
1.06	8.33	"
2.01	4.01	" + 1.4.4
1.74	2.79	1.4.4
1.55	2.12	" + $C_6H_4(COOH)_2$
0.89	1.00	$C_6H_4(COOH)_2$
0.30	—	"

Results at 25°

Gms. per 100 gms. sat. sol.		Solid Phase
$C_6H_4(COOH)_2$	$C_6H_4(COOK)_2$	
0.0	74.8	$C_6H_4(COOK)_2$
0.17	74.7	" + $C_6H_4(COOH)COOK$
0.27	60.97	$C_6H_4(COOH)COOK$
0.28	48.16	"
0.36	39.70	"
0.54	31.23	"
0.77	23.33	"
1.25	16.65	"
3.07	7.10	"
4.16	6.11	" + 1.4.4
3.93	5.41	1.4.4
3.77	4.80	" + $C_6H_4(COOH)_2$
3.44	4.12	$C_6H_4(COOH)_2$
2.61	2.87	"
1.72	1.47	"
0.75	0.0	"

Results at 35°

Gms. per 100 gms. sat. sol.		Solid Phase
$C_6H_4(COOH)_2$	$C_6H_4(COOK)_2$	
0.0	78.5	$C_6H_4(COOK)_2$
0.28	75.6	" + $C_6H_4(COOH)COOK$
0.27	68.51	$C_6H_4(COOH)COOK$
0.33	58.59	"
0.38	48.67	"
0.51	37.43	"
0.89	27.07	"
1.28	21.03	"
2.32	13.09	"
3.23	9.76	"
5.10	7.43	"
5.70	7.32	" + 1.1.4
5.53	6.64	1.1.4 + $C_6H_4(COOH)_2$
5.29	6.35	$C_6H_4(COOH)_2$
4.74	5.60	"
2.38	2.06	"
0.98	0.0	"

Results at 60°

Gms. per 100 gms. sat. sol.		Solid Phase
$C_6H_4(COOH)_2$	$C_6H_4(COOK)_2$	
0.0	78.9	$C_6H_4(COOK)_2$
0.40	79.0	" + $C_6H_4(COOH)COOK$
0.51	64.17	$C_6H_4(COOH)COOK$
0.80	49.07	"
2.15	29.66	"
4.94	16.57	"
8.50	12.59	"
14.14	13.00	" + $C_6H_4(COOH)_2$
7.68	5.97	$C_6H_4(COOH)_2$
2.58	0.00	"

1.4.4 = $C_6H_4(COOK)_2 \cdot 4C_6H_4(COOH)_2 \cdot 4H_2O$

The transition temperature above which this 1.4.4 double salt does not exist was found to be 36.68° and the composition of the saturated solution at this temperature was 6.14 percent $C_6H_4(COOH)_2$ and 7.65 percent $C_6H_4(COOK)_2$.

POTASSIUM Hydrogen PHTHALATE $KHC_8H_4O_4$.

100 gms. sat. solution of potassium hydrogen phthalate in water contain 10.23 gms. $KH\,C_8\,H_4\,O_4$ at 25°, 12.67 gms. at 35° and 36.12 gms. at the b. pt.

(Hendrixson, 1920.)

SOLUBILITY OF POTASSIUM PHTHALATE IN ALCOHOLS AT 20°.

(Handy and Hoyt, 1927.)

Solvent	Gms. $C_6H_4(COOK)_2$ per 100 cc solvent
Ethyl Alcohol (absolute)	0.0161
" " (95%)	0.0252
100 vols. " " " + 10 Vols. CH_3OH	0.0728
Methyl Alcohol (CH_3OH)	0.792

POTASSIUM PHENYL ACETATE $CH_2C_6H_5COOK$

Fusion-point data for mixtures of Potassium Phenyl acetate and Phenyl acetic acid, showing the formation of the compound $CH_2C_6H_5COOK$. $CH_2C_6H_5COOH$ are given by Bakunin and Vitale, 1935.

POTASSIUM Benzene SULFONATES

SOLUBILITY OF EACH SEPARATELY IN WATER AT 25°.

(Elgersma, 1929.)

C_8H

Compound	Formula	Gms. anhydrous compound per 100 gms. H_2O
Potassium o Nitro benzene sulfonate	$K[NO_2.C_6H_4.SO_3]$	9.63
" m " " " "	"	3.04
" p " " " "	" $.H_2O$	5.95
" o p Dinitro " " "	$K[(NO_2)_2.C_6H_3.SO_3]$	4.70
" 2 Nitro 4 Chlor " "	$K[NO_2.C_6H_3ClSO_3]$	0.87
" 2 " 5 " " "	"	1.59
" 3 " 6 " " "	"	2.83
" 2 " 4 Brom " "	$K[NO_2.C_6H_3Br\ SO_3]$	1.68

100 gms. sat. solution of Potassium m chloro benzene Sulfonate in water contain 3.12 gms. m $C_6H_4ClSO_3K$ at 18° and approximately 45.0 gms. at 98°.

100 gms. sat. solution of Potassium p chloro benzene sulfonate in water contain 0.73 gm. p $C_6H_4ClSO_3K$ at 18° and approximately 40.0 gms. at 98°. (Bollinger, 1928.)

100 gms. Methyl Alcohol sat. with Potassium Benzene Sulfonate contain 2.67 gms. $C_6H_5SO_3K$ at 15° and 9.67 gms. at 66.1 (b.pt.). (Henstock, 1934.)

100 gms. acetone dissolve 0.12 gm. $C_6H_5SO_3K$ at 15°. (Henstock, 1934.)

POTASSIUM Anthraquinone SULFONATES

SOLUBILITY OF EACH SEPARATELY IN WATER.

(Fierz-David, Krebsen and Anderau, 1927.)

Compound	Formula	t°	Gms. Cmpd. per 100 cc H_2O
Potassium Anthraquinone 1.5 Disulfonate	$K_2C_{14}H_6O_2(SO_3)_2$	18	0.7
" " " "	"	100	3.5
" " 1.8 "	$K_2C_{14}H_6O_2(SO_3)_2.2H_2O$	18	0.65
" " " "	"	100	2.2
" " 1.6 "	$K_2C_{14}H_6O_2(SO_3)_2.1\frac{1}{2}H_2O$	18	1.5
" " " "	"	100	14.3
" " 1.7 "	$K_2C_{14}H_6O_2(SO_3)_2.2H_2O$	18	4.3
" " " "	"	100	50.0
" " 1.5 Chloro Sulfonate	$KC_{14}H_6O_2ClSO_3.2H_2O$	18	0.4
" " 1.8 "	$KC_{14}H_6O_2ClSO_3.2H_2O$	18	0.42
" " " "	"	100	5.50
" " 1.6 "	$KC_{14}H_6O_2ClSO_3$	18	0.17
" " 1.7 "	$KC_{14}H_6O_2ClSO_3.1\frac{1}{2}H_2O$	18	2.0

POTASSIUM Naphthylamine **DiSULFONATES**, 2.6.8 and 2.5.7 $C_{10}H_5.(NH_2)(SO_3K)_2$.

POTASSIUM Acid Naphthylamine Di **SULFONATES**, 2.6.8 and 2.5.7 $C_{10}H_5(NH_2)(SO_3K)(SO_3H)$.

SOLUBILITY OF EACH SEPARATELY IN WATER AT 13°. (Braunschweig, 1922.)

	Compound.	Gms. cmpd. per 100 gms. sat. sol.
2.6.8	Potassium naphthylamine Disulfonate..........	51.6
2.5.7	» » »	63.9
2.6.8 Acid	» » »	2.47
2.5.7 »	» » »	2.58

POTASSIUM SULFONATES

SOLUBILITY OF EACH SEPARATELY IN WATER.

Compound	t°	Gms. Anhydrous Cmpd. per 100 Gms. H_2O	Authority
Potassium:			
Naphthalene Monosulfonate.½H_2O	25	8.48*	(Witt, 1915.)
" -2- Sulfonate	16.5	8.12	(Ephraim & Pfister, 1925.)
" 1.4 Chloro Sulfonate	18	0.73	(Ferrero and Bolliger, 1928.)
" 1.5 " "	18	3.12	" " " "
Naphthylamine 2.4.7 Sulfonate	20	29.3	(Frisch, 1930.)
" " "	80	66.3	" "
2 Phenanthrene Monosulfonate.½H_2O	20	0.273	(Sandquist, 1912.)
3 " " .0H_2O	20	0.342	" "
10 " " .1H_2O	20	0.84	" "
" 10 Chloro 3 or 6 Sulfonate	20	0.248	" 1917
9 Guaiacol Sulfonate (Thiocol)	15-20	16.6	(Squire & Caines, 1905.)

$C_{10}H$

d • = 1.0[illegible]

100cc. 90 vol.% alcohol dissolve 0.25 gm. thiocol at 15-20°. (Squire & Caines, 1905.)

POTASSIUM Cymene **SULFONATE** $KCH_3C_6H_4CH_2.CH_2CH_2.SO_3$

SOLUBILITY OF POTASSIUM CYMENE SULFONATE IN WATER.
(Hauslick, 1936.)

t°	Gm. Mols. Sulfonate per 100 gms. H_2O	t°	Gm. Mols. Sulfonate per 100 gms. H_2O
2.5	0.025	45	0.250
15.0	0.056	68	0.523
31.0	0.133	90	0.994

POTASSIUM CAMPHORATES

SOLUBILITY IN AQUEOUS SOLUTIONS OF *d* CAMPHORIC ACID AT 13.5–16° AND VICE VERSA.

(Jungfleisch and Landrieu, 1914.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
$C_8H_{14}(COOH)_2$.	$C_{10}H_{14}O_4K_2$.		$C_8H_{14}(COOH)_2$.	$C_{10}H_{14}O_4K_2$.	
0	66.65	$C_{10}H_{14}O_4K_2$	2.90	32.84	$C_{10}H_{15}O_4K.C_{10}H_{16}O_4$
0.90	69.69	$C_{10}H_{15}O_4K$	3.20	29.39	"
1	69	"	3.30	28.56	$C_{10}H_{15}O_4K.3C_{10}H_{16}O_4$
1.10	66.79	"	3.20	27.32	"
0.90	66.65	$C_{10}H_{15}O_4K.H_2O$	3.20	22.77	"
1.50	62.37	"	3.10	21.66	"
2.60	59.34	"	2.90	12.97	"
3.20	58.37	"	2.90	11.73	"
3.20	58.09	"	3.10	11.59	$dC_8H_{14}(COOH)_2$
3.20	52.71	$C_{10}H_{15}O_4K.C_{10}H_{16}O_4$	2.90	9.66	"
3.20	48.43	"	2.80	8.14	"
2.80	47.88	"	2.50	6.76	"
2.80	42.36	"	2.30	6.07	"
3	35.60	"	2	4.55	"
2.85	34.77	"	0.621	0	"

$C_{10}H_{14}O_4K_2$ = Dipotassium *d* camphorate. $C_{10}H_{15}O_4K.C_{10}H_{16}O_4$ = Monopotassium *d* dicamphorate.
$C_{10}H_{15}O_4K$ = Monopotassium *d* camphorate. $C_{10}H_{15}O_4K.3C_{10}H_{16}O_4$ = Monopotassium *d* tetracamphorate.

$C_{14}H$

POTASSIUM HELIANTHATE $KC_{14}H_{14}N_3SO_3.2H_2O$.

1000 cc. H_2O dissolve 4.368 gms. $KC_{14}H_{14}N_3SO_3.2H_2O$ at 20-25°.

(Stark and Dehn, 1918.)

POTASSIUM LIGNOCERATE. $C_{23}H_{47}COOH$.

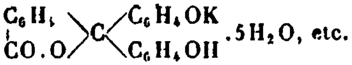
100 gms. aq. 91.53 wt. per cent ethyl alcohol dissolve 0.153 gm. potassium lignocerate at 25° and the solution has $d = 0.80935$. (Thomas and Yu, 1923.)

POTASSIUM Salt of CARYOPHYLLIN $KC_{30}H_{49}O_4.1^1/_2H_2O$.

100 gms. Ethyl alcohol dissolve 2.78 gms. of the salt at 20°.
» Methyl alcohol » 40.0 » » » (Dodge, 1918.)

POTASSIUM Salts of

PHENOLPHTALEIN



$\begin{matrix} C_6H_4 \\ | \\ CO.O \end{matrix} > C < \begin{matrix} C_6H_4OK \\ C_6H_4OH \end{matrix} .5H_2O$, etc.

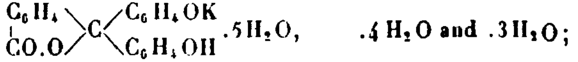
Equilibrium in the System Potassium Hydroxide, Phenolphthalein and Water at 25°. (Bassett and Bagnall, 1924.)

Note. — Saturation was obtained by constant rotation for not less than 3 days of mixtures of phenolphthalein and aqueous potassium hydroxide solutions of various strengths. Such concentrations were chosen that a liquid and a solid phase was obtained in all cases. Both the saturated solution and the solid phase was analyzed. No solid colored salt was obtained. The results are expressed in terms of phenolphthalein anhydride ($C_{20}H_{12}O_3$) potassium oxide (K_2O) and water.

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.			Gms. per 100 gms sat. sol.		
K_2O.	$C_{20}H_{12}O_3$.	Solid Phase.	K_2O.	$C_{20}H_{12}O_3$.	Solid Phase.	K_2O.	$C_{20}H_{12}O$.	Solid Phase.
4.96	13.86	P	17.31	39.01	P.K_2.8	29.50	2.03	P.K_3.8
7.49	24.20	»	17.15	44.90	P.K_3.4	24.74	10.70	P.K_3.7
8.25	25.06	P.K.5	16.50	40.74	»	30.90	1.14	»
8.97	27.75	»	16.98	39.22	»	31.65	0.76	»
12.43	38.74	»	16.60	37.06	»	34.32	0.06	»
13.22	39.91	»	17.72	33.24	P.K_3.9	36.24	–	»
11.26	33.60	P.K.4	19.84	27.47	»	39.10	–	»
14.14	41.59	»	21.57	22.11	»	39.57	–	P.K_3.6
13.19	40.34	P.K.3	17.80	35.67	»	42.14	–	»
15.11	44.31	»	19.68	30.90	»	43.62	–	P.K_3.5
15.77	45.76	P.K_2.10	22.91	19.47	P.K_3.8	45.60	–	»
15.88	44.66	»	24.74	10.70	»	46.49	–	P.K_3.4
16.44	43.50	P.K_2.9	25.64	8.15	»	47.44	–	»
15.92	43.80	P.K_2.8	28.27	3.10	»	45.44	–	» + KOH.2H_2O
16.62	42.62	»	28.98	2.69	»			

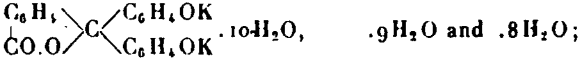
P = Phenolphtalein; P.K.5, P.K.4, P.K.3 = Mono potassium salt :

$C_{14}H$



$\begin{matrix} C_6H_4 \\ | \\ CO.O \end{matrix} > C < \begin{matrix} C_6H_4OK \\ C_6H_4OH \end{matrix} .5H_2O$, $.4H_2O$ and $.3H_2O$;

P.K_2.10, P.K_2.9, P.K_2.8 = Di potassium salt :



$\begin{matrix} C_6H_4 \\ | \\ CO.O \end{matrix} > C < \begin{matrix} C_6H_4OK \\ C_6H_4OK \end{matrix} .10H_2O$, $.9H_2O$ and $.8H_2O$;

P.K_3.4, P.K_3.9, .8, etc. = Tri potassium salt :

$CO_2K.C_6H_4.C.(C_6H_4OK)_2.OH.4H_2O$, $9H_2O$, $8H_2O$, etc.

POTASSIUM LAURATE $CH_3(CH_2)_{10}COOK$

100 gms. Water dissolve approx. 70.0 gms. $CH_3(CH_2)_{10}COOK$ at 25°.
" " Benzene " " 0.005 " " " "

Results are also given for the extraction of lauric acid from aqueous solutions of potassium laurate and of sodium laurate by means of benzene. (McBain and Eaton, 1928.)

The phase rule diagrams for equilibrium in the system potassium laurate + lauric acid + water, at temperatures between 100° and 370° are given by McBain and Field, 1933. Due to high viscosity, even at 90°, months may be required for the separation of the liquid phases. The existence of acid soaps is demonstrated by the separation of crystalline sediments from dilute solutions of soluble soap such as potassium laurate. At 370° the three components are almost but not quite soluble in all proportions.

POTASSIUM STEARATE $CH_3(CH_2)_{16}COOK$.

100 gms. aq. alcohol of $d\frac{25}{4} = 0.80935$ (= 91.53 wt. % C_2H_5OH) dissolve 0.633 gm. $CH_3(CH_2)_{16}COOK$ at 25°. (Thomas and Yu, 1923.)

SOLUBILITY OF POTASSIUM STEARATE AND OF POTASSIUM PALMITATE IN AQUEOUS ETHYL ALCOHOL AT 18°.

(Scheringa, 1939.)

Potassium Stearate		Potassium Palmitate	
Gms. C_2H_5OH per 100 gms. Solvent	Gms. $CH_3(CH_2)_{16}COOK$ per 100 gms. sat. sol.	Gms. C_2H_5OH per 100 gms. Solvent	Gms. $CH_3(CH_2)_{14}COOK$ per 100 gms. sat. sol.
49	4.4	49	45.0*
66	2.6	66	19.0
79.5	1.8	79.5	6.5
96	0.62	96	1.4

* This result uncertain on account of the colloidal character of the Solution.

POTASSIUM OLEATE $C_8H_{17}CH:CH(CH_2)_7COOK$.

100 gms. of aq. 91.53 wt. per cent C_2H_5OH dissolve 41.1 gms. $C_{18}H_{33}O_2K$ at 25° and the saturated solution has $d = 0.80935$. (Thomas and Yu, 1923.)

Results are given by McBain and Stewart, 1933, for equilibrium in the System Potassium Oleate + Oleic Acid, determined by observing the temperature of disappearance of the last crystal upon heating, and the first appearance of turbidity upon cooling known mixtures of the two components contained in sealed evacuated tubes. An acid soap of the composition, $C_8H_{17}CH:CH(CH_2)_7COOK.C_8H_{17}CH:CH(CH_2)_7COOH$ exists below its transition temp. of 47°.

CN

POTASSIUM CYANIDE KCN.

100 gms. H_2O dissolve 122.2 gms. KCN, or 100 gms. sat. solution contain 55 gms. KCN at 103.3°. (Griffiths.)

100 gms. abs. ethyl alcohol dissolve 0.87 gm. KCN at 19.5°.

100 gms. abs. methyl alcohol dissolve 4.91 gms. KCN at 19.5°. (de Bruyn, 1892.)

100 gms. glycerol dissolve 32 gms. KCN at 15.5°. (Ossendowski, 1907.)

100 gms. hydroxylamine dissolve 41 gms. KCN at 17.5°. (de Bruyn, 1892.)

100 gms. liquid ammonia (NH_3) dissolve 4.55 gms. KCN at -33.9° and the density of the sat. solution is 0.7034. (Johnson and Krumboltz, 1933.)

100 gms. liquid sulfur dioxide (SO_2) dissolve 0.017 gm. KCN at 0°. (Jander and Ruppolt, 1937.)

F.-pt. data for KCN + KCl, KCN + NaCN, KCN + AgCN, KCN + $Cu_2(CN)_2$ and for KCN + $Zn(CN)_2$ are given by Truthe (1912).

POTASSIUM CHROMOCYANIDE $K_3Cr(CN)_6$.

100 gms. H_2O dissolve 32.33 gms. $K_3Cr(CN)_6$ at 20°. (Moissan, 1885; Christensen, 1885.)

POTASSIUM CHROMITHIOCYANATE $K_3Cr(SCN)_6.4H_2O$.

100 gms. H_2O dissolve 139 gms. salt. (Karsten, 1864-5.)

SOLUBILITY OF POTASSIUM CYANIDE IN AQUEOUS SOLUTIONS OF NICKEL CYANIDE AT 25° AND VICE VERSA. (Corbet, 1926.)

Note. In the case of this and the following experiments by Bassett and Corbet the authors prepared the KCN from pure double salts in order to obtain it free of KOH. In order to prevent oxidation an atmosphere of coal gas previously passed through solutions of lead acetate and sodium hydroxide was maintained in the bottles. Both the liquid and the solid phases were analyzed.

Gms. per 100 gms. sat. sol.		Solid.	Gms. per 100 gms. sat. sol.		Solid.
KCN.	Ni(CN)$_2$.	Phase.	KCN.	Ni(CN)$_2$.	Phase.
39.85	1.00	KCN	23.97	10.82	$K_2Ni(CN)_4.H_2O$
38.79	1.88	»	23.14	10.34	»
37.64	4.69	»	16.82	14.29	»
*41.11	6.56	»	16.82	13.94	» + $Ni(CN)_2$
39.09	5.95	$KCN+K_2Ni(CN)_4.H_2O$	10.58	9.13	$Ni(CN)_2$
30.94	7.46	$K_2Ni(CN)_4.H_2O$	0.28	0.23	»

*Unstable equilibrium.

SOLUBILITY OF POTASSIUM CYANIDE IN AQUEOUS SOLUTIONS OF POTASSIUM HYDROXIDE AT 25°. (Basset and Corbet, 1924.)

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
KCN.	KOH*.	KCN + KOH.	KCN.	KOH*.	KCN + KOH.
41.56	0.11	41.67	34.72	7.39	42.11
41.67	0.69	42.36	33.58	8.96	42.54
38.92	3.3	42.22	26.39	16.29	42.68

*In terms of KCN. These results show that KOH decreases the solubility of KCN in water. Hence accurate results require that KCN free of KOH must be used for solubility determinations.

SOLUBILITY OF POTASSIUM CYANIDE IN AQUEOUS SOLUTIONS OF THALLIUM CYANIDE AT 25° AND VICE VERSA. (Bassett and Corbet, 1924.)

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
KCN.	TlCN.	Solid Phase	KCN.	TlCN.	Solid Phase.
41.7	0.0	KCN	34.36	4.90	TlCN
40.83	0.71	»	35.09	4.96	»
39.76	1.65	»	31.25	4.46	»
37.0	3.17	» + $KTl(CN)_2$	30.21	5.00	»
37.5	3.11	$KTl(CN)_2$	28.07	4.47	»
36.47	4.16	»	21.00	4.36	»
36.52	4.12	»	14.75	5.46	»
35.93	5.78	»	9.12	7.17	»
36.00	4.99	TlCN	0.51	16.20	»
35.27	4.98	»	0.34	16.12	»
34.45	4.91	»	0.00	16.51	»

SOLUBILITY OF POTASSIUM CYANIDE IN AQUEOUS SOLUTIONS OF ZINC CYANIDE AT 25° AND VICE VERSA. (Corbet, 1926.)

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
KCN.	$Zn(CN)_2$.	Solid Phase.	KCN.	$Zn(CN)_2$.	Solid Phase.
41.7	0.00	KCN	18.22	0.47	$K_2Zn(CN)_4$
41.15	trace	» + $K_2Zn(CN)_4$	14.17	1.50	»
39.04	trace	$K_2Zn(CN)_4$	7.65	5.75	»
37.15	0.12	»	6.64	5.86	»
34.46	0.17	»	6.77	6.97	» + $Zn(CN)_2$
32.65	0.20	»	3.81	3.33	$Zn(CN)_2$
23.56	0.67	»	2.50	2.30	»

POTASSIUM-ZINC CYANIDE $K_2Zn(CN)_4$.

100 cc. H_2O dissolve 11 gms. $K_2Zn(CN)_4$ at 20°. (Sharwood, 1903.)

POTASSIUM FERRICYANIDE $K_3Fe(CN)_6$

SOLUBILITY OF POTASSIUM FERRICYANIDE IN WATER. (Friend and Smirles, 1928.)

t°	d of sat. sol.	Gms. $K_3Fe(CN)_6$ per 100 gms.		t°	d of sat. sol.	Gms. $K_3Fe(CN)_6$ per 100 gms.	
		sat. sol.	H_2O			sat. sol.	H_2O
0.1	—	23.22	30.24	29.8	—	36.65	53.02
4.7	—	25.49	34.21	33.1	1.2045	—	—
7.8	1.1567	26.96	36.95	39.9	1.2115	37.22	59.27
15.7	1.1738	30.35	43.58	49.0	—	39.12	64.25
18.7	—	30.96	44.85	56.25	—	40.41	67.80
22.1	1.1872	32.08	47.22	58.0	1.2269	41.10	69.78
25.0	—	32.80	48.80	81.0	—	44.70	80.82
26.3	1.1928	33.66	50.74	99.0	—	47.60	90.83

The solid phase is $K_3Fe(CN)_6$ in all cases and there is no indication of a break in the solubility or density curve. The saturated solutions were prepared by continuous agitation for 6 hours and analyzed by a gravimetric determination of the Fe. The previous determinations of Wallace, 1855; Schiff, 1860 and Grube, 1916 are slightly lower than the present results.

One liter sat. sol. in 0.4687 *n* KOH contains 342.7 gms. $K_3Fe(CN)_6$ at 25°. (Grube, 1914.)
" " 0.9628 " " 302.3 " " " "
" " 1.949 " " 215.1 " " " "

100 cc. anhy. hydrazine dissolve 2 gms. $K_3Fe(CN)_6$ at room temp. (Welsh and Broderson, 1915.)

100 gms. methyl alcohol dissolve 0.31 gm. Potassium ferricyanide at the b. pt. (66°). (Henstock, 1934.)

POTASSIUM FERROCYANIDE $K_4Fe(CN)_6 \cdot 3H_2O$

SOLUBILITY OF POTASSIUM FERROCYANIDE IN WATER.

(Harkins & Pearce, 1916; Fabris, 1921, 1931, 1932; Vallance, 1922; Farrow, 1926; Bovalini and Fabris, 1933.)

The results of the above named investigators were plotted on cross section paper and from the average curve drawn through them the following values were read.

t°	d of sat. sol.	Gms. $K_4Fe(CN)_6$ per 100 gms. sat. sol.	Solid Phase	t°	d of sat. sol.	Gms. $K_4Fe(CN)_6$ per 100 gms. sat. sol.	Solid Phase
-0.24	—	1.25	Ice	50	1.2350	32.6	$K_4Fe(CN)_6 \cdot 3H_2O$
-0.62	—	4.0	"	65	1.2635	36.8	"
-1.09	—	8.0	"	70	—	38.2	"
-1.6 Eutec.		11.6	" + $K_4Fe(CN)_6 \cdot 3H_2O$	80	1.2854	40.1	"
				87.3	—	41.34	" + $K_4FeCN)_6$
0	—	12.5	$K_4Fe(CN)_6 \cdot 3H_2O$	94	—	41.99	$K_4Fe(CN)_6$
5	—	15.0	"	99.6	—	42.63	"
10	—	17.36	"	104.1	—	44.77	"
15	—	19.3	"	88.3	—	41.68*	$K_4Fe(CN)_6 \cdot 3H_2O$
20	—	22.0	"	90	—	42.24*	"
25	1.1731	24.0	"	94	—	43.91*	"
30	—	26.0	"	95.8	—	44.74*	"
35	1.2018	27.8	"				

* Metastable

SOLUBILITY OF POTASSIUM FERROCYANIDE IN WATER AT TEMPERATURES UP TO 25°.

(Vallance, 1927.)

The author first compared the available methods of estimating potassium ferrocyanide in solution and selected as most accurate, the method based upon decomposition of the dry salt with conc. H_2SO_4 and a little HNO_3, and finally dissolving in conc. HCl, diluting and precipitating the Fe with ammonia, filtering, igniting and weighing. The very careful solubility determinations give a curve in which there is a break at about 18°. No difference in the crystal form or composition, $K_4Fe(CN)_6 \cdot 3H_2O$ of the solid phase, above and below this point could be detected. The density curve of the saturated solutions also shows a slight change in direction above 17°. The dilatometric method shows a transition point at 17°.7°.

t°	d of sat. sol.	Gms. $K_4Fe(CN)_6$ per 100 gms. sat. sol.	t°	d of sat. sol.	Gms. $K_4Fe(CN)_6$ per 100 gms. sat. sol.
15	1.1378	19.52	19.0	1.1505	21.08
16	1.1415	20.00	20.0	1.1543	21.9
17	1.1455	21.00	22.5	1.1615	22.7
17.7	1.1471	25.64	25.0	1.1701	23.97

SOLUBILITY OF POTASSIUM FERROCYANIDE IN AQ. POTASSIUM HYDROXIDE SOLUTIONS AT 25° (Grube, 1914.)

Solvent.	Gms. $K_4Fe(CN)_6 \cdot 3H_2O$ per 1000 cc. Sat. Sol.	Solid Phase.	Solvent.	Gms. $K_4Fe(CN)_6 \cdot 3H_2O$ per 1000 cc. Sat. Sol.	Solid Phase.
0.09984 *n* KOH	308.5	$K_4Fe(CN)_6 \cdot 3H_2O$	0.9415 *n* KOH	184.8	$K_4Fe(CN)_6 \cdot 3H_2O$
0.2496 "	283.5	"	1.395 "	132.1	"
0.4963 "	247.1	"	1.883 "	86.12	"
0.7036 "	217.4	"			

SOLUBILITY OF MIXTURES OF POTASSIUM FERROCYANIDE AND FERRICYANIDE IN WATER AND IN AQ. POTASSIUM HYDROXIDE SOLUTIONS AT 25°. (Grube, 1914.)

Solvent.	Gms. per 1000 cc. Sat. Solution.		Solid Phase.
	$K_3Fe(CN)_6$.	$K_4Fe(CN)_6$.	
Water	338.1	79.02	$K_3Fe(CN)_6+K_4Fe(CN)_6.3H_2O$
0.4687 *n* KOH	309	66.64	" "
0.9628 "	275.3	55.19	" "
1.949 "	200.8	35.95	" "

SOLUBILITY OF POTASSIUM FERROCYANIDE IN AQUEOUS SOLUTIONS OF SODIUM FERROCYANIDE AT 25° AND VICE VERSA. (Harkins and Pearce, 1916.)

Mols. per 1000 Gms. H_2O.		Gms. $K_4Fe(CN)_6$ per 1000 Gms. H_2O.	d_{25} of Sat. Sol.	Mols. per 1000 Gms. H_2O.		Gms. $Na_4Fe(CN)_6$ per 1000 Gms. H_2O.	d_{25} of Sat. Sol.
$Na_4Fe(CN)_6$.	$K_4Fe(CN)_6$.			$K_4Fe(CN)_6$.	$Na_4Fe(CN)_6$.		
0	0.89459	329.5	1.09081	0	0.6818	205.25	1.0595
0.05072	0.88272	325.1	1.0990	0.1327	0.7056	214.47	1.0199
0.06633	0.88544	326	1.10039	0.1789	0.7213	219.23	1.0792
0.12306	0.88088	324.4	1.09350	0.2115	0.7253	220.44	1.1006
0.25972	0.89116	328.3	1.12796	0.2722	0.7610	231.29	1.1113
0.4900	0.91600	337.4	1.17241	0.3532	0.7814	237.49	1.1243
0.87034	0.99000	364.6	1.19700	0.5850	0.8652	262.97	1.1567
0.91060	1.01200	372.3	1.21190	0.6111	0.8712	264.79	1.1581
0.95879	1.05177	387.5	1.22673	0.6994	0.8984	273.05	1.1830
1.0438	1.1159	411	1.25789	1.0578	0.9588	291.40	1.2267

EQUILIBRIUM IN THE SYSTEM POTASSIUM FERROCYANIDE, POTASSIUM SULFATE AND WATER.

(Bovalini and Fabris, 1938.)

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms. sat. sol.		Solid Phase
	$K_4Fe(CN)_6$	K_2SO_4			$K_4Fe(CN)_6$	K_2SO_4	
-1.6	11.58	0.0	Ice + K.3	65	38.81	0.0	K.3
-2.05	9.07	4.62	" " + K_2SO_4	"	33.645	3.215	" + K_2SO_4
0	9.80	4.83	" "	"	0.0	16.0	K_2SO_4
0	12.48	0.0	"	74	38.75	0.0	K.3
0	0.0	6.82	K_2SO_4	"	36.20	3.295	" + K_2SO_4
30	25.94	0.0	K.3	"	0.0	16.92	K_2SO_4
"	24.17	0.902	"	85	40.72	0.0	K.3
"	22.97	2.231	"	"	38.715	2.975	" + K_2SO_4
"	22.23	3.902	" + K_2SO_4	"	0.0	18.11	K_2SO_4
"	16.45	5.535	K_2SO_4	86.3	39.03	2.80	K.3 + $K_4Fe(CN)_6$ + K_2SO_4
"	11.08	7.126	"				
"	8.54	7.818	"	90	41.38	0.0	$K_4Fe(CN)_6$
"	5.01	9.59	"	"	40.14	1.030	"
"	3.03	10.205	"	"	39.75	1.410	"
"	0.0	11.53	"	"	39.30	2.770	"
40	29.28	0.0	K.3	"	39.165	2.831	" + K_2SO_4
"	28.58	1.288	"	"	32.11	4.30	K_2SO_4
"	27.50	2.468	"	"	30.36	5.26	"
"	25.66	3.982	" + K_2SO_4	"	17.20	9.92	"
"	19.63	5.495	K_2SO_4	"	14.67	11.09	"
"	15.21	7.031	"	"	5.46	15.42	"
"	10.36	8.557	"	"	0.0	18.60	"
"	8.56	8.930	"	104.1(b.pt.)	44.77	0.0	$K_4Fe(CN)_6$
"	5.88	10.111	"	104.3 "	39.356	3.344	" + K_2SO_4
"	3.03	11.306	"	101.4	0	19.50	K_2SO_4
"	0.0	12.90	"				

K.3 = $K_4Fe(CN)_6 \cdot 3H_2O$

SOLUBILITY OF POTASSIUM FERROCYANIDE IN AQUEOUS SOLUTIONS OF AMMONIA AT 18°.

(Tettamanzi, 1935.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
NH_3	$K_4Fe(CN)_6$		NH_3	$K_4Fe(CN)_6$	
0.0	21.21	$K_4Fe(CN)_6 \cdot 3H_2O$	20.60	0.872	$K_4Fe(CN)_6 \cdot 3H_2O$
4.51	11.20	"	22.37	0.750	"
9.13	5.65	"	23.62	0.645	"
11.86	3.76	"	25.05	0.497	"
15.19	2.24	"	26.95	0.427	"
16.79	1.53	"	34.09	0.157	"
18.11	1.16	"			

100 gms. Methyl Alcohol dissolve 0.90 gm. Potassium ferrocyanide at the b. pt. (66°). (Henstock, 1934.)

EQUILIBRIUM IN THE SYSTEM POTASSIUM FERROCYANIDE, TERTIARY BUTYL ALCOHOL AND WATER AT 25°.

(Ginnings, Herring and Webb, 1933.)

The composition of the homogeneous mixture (plait point) of this system was found to be

4.3 percent $K_3Fe(CN)_6$ + 38.0 percent ter.$(CH_3)_3COH$ + 57.7 percent H_2O

The original results for the remaining points on the binodal curve are not given but only the values of a series of arbitrary constants calculated from them by means of empirical equations.

CN

SOLUBILITY OF POTASSIUM FERROCYANIDE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 20°.

(Dias de Rada and Bermejo, 1939.)

Vol. Percent C_2H_5OH in Solvent	Gms. $K_4Fe(CN)_6$ per 100 gms. sat. sol.	Vol. Percent C_2H_5OH in Solvent	Gms. $K_4Fe(CN)_6$ per 100 gms. sat. sol.
0 (= H_2O)	22.01	45	0.352
5	16.40	50	0.229
10	10.47	55	0.143
15	6.61	60	0.094
20	3.995	65	0.057
25	2.394	70	0.053
30	1.420	75	0.039
35	0.789	80	0.025
40	0.565	85	none

POTASSIUM CYANATE KCNO.

SOLUBILITY IN ALCOHOLIC MIXTURES.

(Erdmann, 1893.)

Solvent.	Gms. KCNO per Liter Solvent at b.-pt.
80 per cent Alcohol + 20 per cent Water	62
80 per cent Alcohol + 20 per cent Methyl Alcohol	76
80 per cent Alcohol + 10 per cent Acetone	82

100 gms. alcohol of $d_{15} = 0.799$ dissolve 0.16 gm. KCNO at 0° and 0.53 gm. at b. pt.

" " 80 % concentration dissolve 1.9 gms. KCNO at 0° and 6.2 gms. at b. pt.

" benzene dissolve 0.18 gm. KCNO at b. pt. (Cranston and Livingstone, 1926.)

100 gms. liquid Ammonia, NH_3, dissolve 1.7 gm. KCNO at 25°.

" cc. " " " " 1.02 " " " "

(Hunt, 1932.)

POTASSIUM Platino CYANIDE $K_2Pt(CN)_4.3H_2O$.

SOLUBILITY OF POTASSIUM PLATINO CYANIDE IN WATER. (Terrey and Jolly, 1923

Saturation secured by constant stirring in a thermostat.

t°	Gms. $K_2Pt(CN)_4$ per 100 gms. H_2O.	Solid Phase.	t°.	Gms. $K_2Pt(CN)_4$ per 100 gms. H_2O.	Solid Phase.
0.1	11.60	$K_2Pt(CN)_4.3H_2O$	45.0	95.43	$K_2Pt(CN)_4.3H_2O$
9.8	19.76	»	49.9	109.20	»
14.4	26.53	»	52.4 tr. pt.		»+$K_2Pt(CN)_4.2H_2O$
13.35 tr. pt.		»+$K_2Pt(CN)_4.3H_2O$	55.4	127.5	$K_2Pt(CN)_4.2H_2O$
16.38	28.63	$K_2Pt(CN)_4.3H_2O$	60.4	139.1	»
17.42	29.02	»	67.5	156.9	»
20.05	33.83	»	74.5 tr. pt.	175.2	»+$K_2Pt(CN)_4.H_2O$
22.65	37.73	»	78.2	173.2	$K_2Pt(CN)_4.H_2O$
25.0	41.93	»	83.6	178.3	»
35.0	64.16	»	87.2	184.0	»
39.75	78.23	»	95.0	210.0	»

The transition temperatures (tr. pt.) were determined by the dilatometric method.

POTASSIUM THIOCYANATE KCNS

CNS

SOLUBILITY OF POTASSIUM THIOCYANATE IN WATER.

(Up to 25°, Rudorff, 1869, 1872; Foote, 1903; Wassilijew, 1910, Occleshaw, 1931. At the higher temperatures, Kracek, 1936.)

The determinations of Kracek were made by observing the temperature of disappearance of the last crystal in mixtures of KCNS + H_2O contained in sealed tubes. A polymorphic inversion of KCNS occurs at 140.6°, hence the solubility curve has a break at that point.

t°	Gms. KCNS per 100 gms.		Solid Phase	t°	Gms. KCNS per 100 gms.		Solid Phase
	H_2O	sat. sol.			H_2O	sat. sol.	
-6.5	20.0	16.7	Ice	99.0	673.6	87.04	KCNS II
-9.55	30.0	23.1	"	108.4	802.9	88.94	"
-31.2	101.0	50.24	" + KCNS	116.8	956.2	90.53	"
0	177	63.9	KCNS II	124.6	1150.2	92.00	"
20	217	68.45	"	130.7	1346.2	93.07	"
25	239	70.50	"	140.6	1825.6	94.82	"
32.6	265.1	72.61	"	142.7	1957.7	95.13	KCNS I
47.3	317.05	76.03	"	149.4	2471.1	96.12	"
57.0	358.6	78.18	"	157.4	3599.6	97.29	"
66.7	408.45	80.34	"	169.2	9342.0	98.93	"
74.5	455.9	82.02	"	176.8	M. pt.		"
84.2	526.9	84.05	"				

Chretien and Hoffer, 1935, by means of the crystallization diagram, found metastable crystalline forms of KCNS having 1/2 and 4/5 mol. of H_2O at temperatures between the eutectic (-33.2°) and + 6.8°.

100 gms. liquid Sulfur Dioxide, SO_2, dissolve 4.87 gms. KCNS at 0°. (Jander and Ruppolt, 1937.)

SOLUBILITY OF POTASSIUM THIOCYANATE IN ACETONE, AMYL ALCOHOL, ETC.

(von Laszczynski, 1894.)

In Acetone. t°.	Gms. KSCN per 100 Gms. $(CH_3)_2CO$.	In Amyl Alcohol. t°.	Gms. KSCN per 100 Gms. $C_5H_{11}OH$.	In Ethyl Acetate. t°.	Gms. KSCN per 100 Gms. $CH_3COOC_2H_5$.	In Pyridine. t°.	Gms. KSCN per 100 Gms. C_5H_5N.
22	20.75	13	0.18	0	0.44	0	6.75
58	20.40	65	1.34	14	0.40	20	6.15
		100	2.14	79	0.20	58	4.97
		133.5	3.15			97	3.88
						115	3.21

EQUILIBRIUM IN THE SYSTEM POTASSIUM THIOCYANATE, TERTIARY BUTYL ALCOHOL AND WATER AT 25°.

(Ginnings, Herring and Webb, 1933.)

The composition of the homogeneous mixture (plait point) of this system was found to be:

37.9 percent KSCN + 19.3 percent ter.$(CH_3)_3COH$ + 42.8 percent H_2O

The original results for the remaining points on the binodal curve are not given but only the values of a series of arbitrary constants calculated from them by means of empirical equations.

CNS

SOLUBILITY OF POTASSIUM THIOCYANATE IN PYRIDINE, DETERMINED BY THE SYNTHETIC METHOD.

(Wagner and Zerner, 1911.)

t°.	Gms. KSCN per 100 Gms. Mixture.	Solid Phase.	t°.	Gms. KSCN per 100 Gms. Mixture.	Solid Phase.
−42	0	C_5H_5N	70–71	1.23	KSCN
−42.1	0.5	"	116–117	0.89	"
−42.4	1.33	"	172.7	at this temperature two liquid layers appear and do not become homogeneous up to 200°.	
−42.8	2.4	"			
−43.3 Eutec.	3.1	" +KSCN			
about +10	2.2	KSCN	173.8 m. pt.	100	KSCN

100 gms. anhydrous acetonitrile dissolve 11.31 gms. KSCN at 18°.

(Naumann and Schier, 1914.)

Fusion-point data for mixtures of KSCN + NaSCN and KSCN + RbSCN are given by Wrzesnewsky (1912).

DISTRIBUTION OF POTASSIUM THIOCYANATE AT 17° BETWEEN WATER AND AMYL ALCOHOL. (Wosnessensky, 1925.)

Millimols. KSCN per liter of H₂O layer (C_1).	Millimols. KSCN per liter of Alcohol layer (C_2).	$\frac{C_1}{C_2^{0.7}}$.	Millimols. KSCN per liter of H₂O layer (C_1).	Millimols. KSCN per liter of Alcohol layer (C_2).	$\frac{C_1}{C_2^{0.7}}$.
155.40	2.329	88	640.235	17.379	86
338.82	7.090	86	1075.221	31.506	86
410.753	9.333	86			

POTASSIUM CARBONATE $K_2CO_3.1\frac{1}{2}H_2O$

SOLUBILITY OF POTASSIUM CARBONATE IN WATER.

(Mulder, 1864; de Coppet, 1872; Meyerhoffer, 1905; Kremann and Zitek, 1909; de Waal, 1910; Osaka, 1910-12; Bain, 1927; Hill and Miller, Jr., 1927; Hill, 1930, 1930(a)).

t^o	Gms. K_2CO_3 per 100 gms. sat. sol.	Solid Phase	t^o	Gms. K_2CO_3 per 100 gms. sat. sol.	Solid Phase
-10	21.3	Ice	40	53.9	$K_2CO_3.1\frac{1}{2}H_2O$
-20	31.	"	50	54.8	"
-30	36.9	"	60	55.9	"
-36.5	39.6	" + $K_2CO_3.6H_2O$	70	57.1	"
- 6.2 tr.pt.	50.9	$K_2CO_3.6H_2O + K_2CO_3.1\frac{1}{2}H_2O$	80	58.3	"
0	51.25	$K_2CO_3.1\frac{1}{2}H_2O$	90	59.6	"
+10	51.9	"	100	60.9	"
20	52.5	"	110	62.5	"
25	52.85	"	120	64.4	"
30	53.2	"	130	66.2	"

The density of the sat. solution at 5° = 1.543, at 25° = 1.559 and at 35° = 1.560. Other determinations not in good agreement with the above are given by Engel, 1888; Köhler, 1897; Greenish and Smith, 1901; Rubitzov, 1918; Blasdale, 1923; Iljinski, 1924; Starkowa, 1931; and Appleby and Leishman, 1932. The last named investigators present evidence, based upon analyses of the wet solid phases in contact with the liquid layers formed in the system $K_2CO_3 + NH_3 + H_2O$ at 0° and at 25°, that the stable hydrate is $K_2CO_3.2H_2O$ and not $K_2CO_3 1\frac{1}{2}H_2O$.

CO

Determinations of the equilibrium in aqueous solutions of potassium carbonate and bicarbonate in concentrations up to 2.5 gm. mol. per liter, in relation to the partial pressure of CO_2 in the gas phase in contact with the solution, are given by Walker, Bray & Johnston, 1927.

POTASSIUM BICARBONATE $KHCO_3$

SOLUBILITY OF POTASSIUM BICARBONATE IN WATER.

(Diblets, 1874; Engel, 1888; Greenish and Smith, 1901; de Forcrand, 1909; Foerster, Brosche and Norberg-Schulz, 1924; Hill and Hill, 1927; Oglesby, 1929; Hill, 1930(a); Starkowa, 1931 and Paris and Mondain-Monval, 1938.)

The results of the above named investigators varied very slightly from the smoothed curve from which the following values were read.

t^o	d. of sat. sol.	Gms. $KHCO_3$ per 100 gms. sat. sol.	Solid Phase	t^o	d. of sat. sol.	Gms. $KHCO_3$ per 100 gms. sat. sol.	Solid Phase
-0.70	—	2.17	Ice	20	1.178	25.0	$KHCO_3$
-2.16	—	5.77	"	25	1.188	26.6	"
-3.21	—	9.98	"	30	1.199	28.1	"
-3.90	—	12.60	"	40	1.217	31.3	"
-5.43 Eutec.	—	16.95	" + $KHCO_3$	50	—	34.2	"
0	1.130	18.6	$KHCO_3$	60	—	37.5	"
+10	1.154	21.8	"	70	—	40.6	"

SOLUBILITY OF POTASSIUM CARBONATE AND OF POTASSIUM BICARBONATE EACH SEPARATELY IN WATER.

(Takahashi, 1927.)

Results for Potassium Carbonate

t°	d. of sat. sol.	Gms. K_2CO_3 per 100 gms. sat. sol.	Solid Phase
−11	1.533	50.45	$K_2CO_3 \cdot 2H_2O$
− 5	1.5445	50.93	"
0	1.546	51.35	"
+5	1.5475	51.60	"
10	1.549	51.90	"
30	1.557	53.60	"
50	1.570	55.73	"
70	1.590	58.13	"

Results for Potassium Bicarbonate

t°	d. of sat. sol.	Gms. $KHCO_3$ per 100 gms. sat. sol.	Solid Phase
0	1.1329	18.41	$KHCO_3$
10	1.1544	21.53	"
20.5	1.1772	25.23	"
30	1.2004	28.52	"
40	1.2196	32.24	"
50	1.2439	36.04	"
60	1.2711	39.65	"
70	1.3005	43.37	"

In the case of the Bicarbonate results the solutions were under a pressure of 1 atmosphere of CO_2.

SOLUBILITY OF POTASSIUM CARBONATE AND OF BICARBONATE IN WATER IN CONTACT WITH ATMOSPHERES CONTAINING VARYING PERCENTAGES OF CARBON DIOXIDE.

(Takahashi, 1927.)

Results at 50°

Percent CO_2 in Atmospheres	d. of sat. sol.	Gms. per 100 gms. sat. sol. K_2O	Gms. per 100 gms. sat. sol. CO_2	Solid Phase
0	1.570	38.00	17.78	$K_2CO_3 \cdot 2H_2O$
16	1.569	37.90	18.07	"
18	1.570	37.43	17.90	" + $KHCO_3$
20	1.512	35.81	17.27	$KHCO_3$
22	1.494	31.79	15.80	"
50	1.401	27.25	14.60	"
60	1.352	23.32	14.20	"
80	1.282	19.54	14.10	"
99.5	1.241	16.95	14.62	"

Results at 70°

Percent CO_2 in Atmospheres	d. of sat. sol.	Gms. per 100 gms. sat. sol. K_2O	Gms. per 100 gms. sat. sol. CO_2	Solid Phase
0	1.590	39.65	18.48	$K_2CO_3 \cdot 2H_2O$
22	1.588	39.34	19.41	" + $KHCO_3$
26	1.575	39.02	19.16	" "
50	1.550	36.36	18.44	$KHCO_3$
55	1.430	29.47	16.85	"
60	1.315	25.99	16.37	"
80	1.335	22.65	16.18	"
99.5	1.301	20.45	16.87	"

SOLUBILITY OF POTASSIUM CARBONATE IN AQUEOUS SOLUTIONS OF POTASSIUM BICARBONATE AND VICE VERSA AT SEVERAL TEMPERATURES.

(Hill, 1930(a).)

d. of sat. sol.	Gms. per 100 gms. sat. sol. K_2CO_3	$KHCO_3$	Solid Phase
Results at 5°			
1.543	51.53	0.0	K.1½
1.555	50.59	1.72	" + 1.2.1½
—	50.03	1.77	1.2.1½
1.543	49.91	1.90	"
1.542	49.65	1.96	" + $KHCO_3$
1.509	46.38	2.55	$KHCO_3$
1.137	0.0	20.15	"
Results at 25°.			
1.559	52.77	0.0	K.1½
1.563	51.23	2.64	"+ 1.2.1½
1.562	50.77	2.85	1.2.1½
1.554	50.28	3.02	"
1.549	49.77	3.22	"
1.545	49.48	3.33	" + $KHCO_3$
1.538	48.14	3.56	$KHCO_3$
1.485	42.82	4.67	"
1.402*	34.71	7.35	"
1.316	23.36	12.19	"
1.272	16.98	15.45	"
1.228	10.00	19.31	"
1.187	0.0	26.78	"

d. of sat. sol.	Gms. per 100 gms. sat. sol. K_2CO_3	$KHCO_3$	Solid Phase
Results at 35°			
1.560	53.56	0.0	K.1½
1.573	51.68	3.26	" + 1.2.1½
1.563	50.99	3.48	1.2.1½
1.564	50.58	3.62	"
1.556	50.00	3.92	"
1.556	49.51	4.27	" + $KHCO_3$
1.548	48.93	4.27	$KHCO_3$
1.441	37.73	7.50	"
1.329	23.04	14.21	"
1.252	10.04	22.10	"
1.208	0.97	28.82	"
1.200	0.0	29.60	"
Results at 50°			
—	54.8	0.0	K.1½
1.584	52.85	3.83	"+ 1.2.1½
1.581	51.97	4.40	1.2.1½
1.569	50.92	4.97	"
1.565	49.65	5.77	" + $KHCO_3$
—	0.0	34.2	$KHCO_3$

K.1½ = $K_2CO_3.1\frac{1}{2}H_2O$; 1.2.1½ = $K_2CO_3.2KHCO_3.1\frac{1}{2}H_2O$.

Results for the 42° isotherm for this system are given by Starkowa, 1931, but the author failed to find the double salt $K_2CO_3.2KHCO_3.1\frac{1}{2}H_2O$. The earlier results of Engel, 1888, at 0°, for this system are also probably inaccurate since his value for K_2CO_3 in water varies so greatly from that of all other investigators.

SOLUBILITY OF POTASSIUM CARBONATE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AND OF POTASSIUM HYDROXIDE AT 30°. (de Waal, 1910.)

Results for K_2CO_3 + KCl.

Gms. per 100 Gms. Sat. Sol. K_2CO_3.	KCl.	Solid Phase.
53.27	0	$K_2CO_3.1\frac{1}{2}H_2O$
52.22	1.03	" +KCl
51.66	1.07	KCl
1.64	26.22	"
0	28.01	"

Results for K_2CO_3 + KOH.

Gms. per 100 Gms. Sat. Sol. K_2CO_3.	KOH.	Solid Phase.
53.27	0	$K_2CO_3.1\frac{1}{2}H_2O$
2.50	53.77	"
2.05	55.14	" +KOH.2H_2O
0	55.75	KOH.2H_2O

SOLUBILITY OF POTASSIUM CARBONATE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORATE AND VICE VERSA AT 24°.2 AND AT 40°. (Iljinsky, 1924.)

NOTE. — Saturation was secured by active shaking at constant temperature. The attainment of equilibrium was controlled by successive density determinations and by analyses. In most cases the time required was 3 to 5 hours. For the triple points and those corresponding to double salts, several days were required. The solid phases were identified by analysis.

d of sat. sol.	Gms. per 100 gms. H_2O. $KClO_3$.	K_2CO_3.	Solid Phase.
	Results at 24°.2.		
1.550	0.0	112.6	$K_2CO_3.2H_2O$
–	0.35	111.6	»+$KClO_3$
–	0.5	97.5	$KClO_3$
–	0.35	96.8	»
1.500	0.55	95.2	»
1.362	1.10	58.3	»
1.362	1.15	56.5	–
1.302	1.60	44.7	»
1.220	2.20	31.3	»
1.218	2.40	29.3	»
	Results at 24°.2.		
–	2.90	23.4	$KClO_3$
1.180	3.00	22.3	»
1.100	4.50	10.1	»
1.045	8.10	0.0	»
	Results at 40°.		
1.558	0.0	119.3	$K_2CO_3.2H_2O$
1.539	2.2	109.8	»+$KClO_3$
1.316	2.1	42.2	$KClO_3$
1.195	5.5	24.4	»
1.073	14.2	0.0	»

EQUILIBRIUM IN THE SYSTEM POTASSIUM CARBONATE, POTASSIUM CHLORATE, SODIUM CARBONATE, SODIUM CHLORATE AND WATER AT 24°.2. (Iljinski, 1924.)

See note above

d of sat. sol.	Gms. per 100 gms. H_2O K_2CO_3.	$KClO_3$.	Na_2CO_3.	$NaClO_3$.	Solid Phase
–	0.0	1.5	22.0	68.9	$NaClO_3+Na_2CO_3.7H_2O$
–	0.0	2.6	22.2	66.9	» +$KClO_3$
1.383	0.0	0.0	24.6	46.2	$Na_2CO_3.10H_2O+Na_2CO_3.7H_2O$
–	0.0	2.5	24.5	45.0	» » +$KClO_3$
1.398	27.7	0.7	33.6	0.0	» +$Na_2CO_3.K_2CO_3.6H_2O+KClO_3$
1.516	89.9	0.6	7.7	0.0	$K_2CO_3.2H_2O+Na_2CO_3.K_2CO_3.6H_2O+KClO_3$
1.510	90.7	0.5	6.7	0.0	» +$KClO_3$
1.530	92.8	0.4	6.0	0.0	» »
1.528	100.7	0.8	1.3	0.0	» »
1.552	111.6	0.3	0.0	0.0	» »
–	0.0	2.6	22.2	66.9	$NaClO_3$ + » +$Na_2CO_3.7H_2O$
1.442	0.0	5.1	6.6	88.2	» »
1.389	0.0	5.9	3.8	90.6	» »
1.443	0.0	5.1	1.5	95.7	» »
1.450	0.0	4.6	1.4	96.0	» »
1.432	0.0	4.2	0.0	96.6	» »
–	0.0	2.5	24.5	45.0	$Na_2CO_3.10H_2O$+ » +$Na_2CO_3.7H_2O$
1.332	0.0	3.2	26.0	29.1	» »
–	0.0	7.2	30.7	0.0	» »
1.398	27.7	0.7	33.6	0.0	» » +$Na_2CO_3.K_2CO_3.6H_2O$
1.433	54.1	0.6	15.2	0.0	» + »
1.516	89.9	0.6	7.7	0.0	$K_2CO_3.2H_2O$+ » + »
–	0.0	2.6	22.2	66.9	$NaClO_3$ + » +$Na_2CO_3.7H_2O$
–	0.0	2.5	24.5	45.0	$Na_2CO_3.10H_2O$+ » » .

EQUILIBRIUM IN THE SYSTEM POTASSIUM BICARBONATE POTASSIUM CHLORIDE AND WATER.

(Faris and Mondain-Monval, 1938.)

In order to have an excess of CO_2 present, the authors used, for preparing the saturated solutions, water previously saturated at about 2° with CO_2, instead of pure water. Saturation was thus affected under 1 to 2 atmospheres pressure of CO_2.

Results at 10°

d. of sat. sol.	Gms. per 100 gms. H_2O KCl	Gms. per 100 gms. H_2O $KHCO_3$	Solid Phase
1.154	0.0	27.78	$KHCO_3$
1.164	9.08	20.87	"
1.175	15.08	17.82	"
1.195	23.93	13.75	"
1.204	27.45	12.55	" + KCl
1.181	29.54	5.17	KCl
1.164	31.12	0.0	"

Results at 20°

d. of sat. sol.	Gms. per 100 gms. H_2O KCl	Gms. per 100 gms. H_2O $KHCO_3$	Solid Phase
1.177	0.0	33.19	$KHCO_3$
1.184	10.05	25.34	"
1.180	15.33	22.03	"
1.198	20.14	19.35	"
1.207	24.31	17.33	"

Results at 20° (con.)

d. of sat. sol.	Gms. per 100 gms. H_2O KCl	Gms. per 100 gms. H_2O $KHCO_3$	Solid Phase
1.218	29.69	15.22	$KHCO_3$ + KCl
1.204	31.11	10.08	KCl
1.180	32.00	5.12	"
1.174	34.35	0.0	"

Results at 29.85°

d. of sat. sol.	Gms. per 100 gms. H_2O KCl	Gms. per 100 gms. H_2O $KHCO_3$	Solid Phase
1.197	0.0	39.23	$KHCO_3$
1.234	31.30	18.24	" + KCl
1.181	37.08	0.0	KCl

Results at 40°

d. of sat. sol.	Gms. per 100 gms. H_2O KCl	Gms. per 100 gms. H_2O $KHCO_3$	Solid Phase
1.217	0.0	45.51	$KHCO_3$
1.249	33.03	22.00	" + KCl
1.189	40.15	0.0	KCl

EQUILIBRIUM IN THE SYSTEM POTASSIUM CARBONATE, SODIUM CARBONATE, POTASSIUM CHLORIDE, SODIUM CHLORIDE AND WATER AT 25°.

(Blasdale, 1923.)

Gms. per 100 gms. H_2O K_2CO_3.	Gms. per 100 gms. H_2O K_2Cl_2.	Gms. per 100 gms. H_2O Na_2CO_3.	Gms. per 100 gms. H_2O Na_2Cl_2.	Solid Phase.
113.57	0.0	0.0	0.0	$K_2CO_3\ ^3/_2 H_2O$
104.18	0.0	10.89	0.0	» + $NaKCO_3.6H_2O$
30.48	0.0	35.57	0.0	$Na_2CO_3.7H_2O$ + »
18.96	0.0	35.63	0.0	» + $Na_2CO_3.10H_2O$
0.0	0.0	25.67	23.51	NaCl + »
0.0	16.29	0.0	29.88	» + KCl
110.68	2.07	0.0	0.0	$K_2CO_3\ ^3/_2 H_2O$ + »
0.0	13.78	27.45	15.81	$Na_2CO_3.10H_2O$ + » + NaCl
25.79	0.0	27.04	10.59	» + » + $Na_2CO_3.7H_2O$
29.78	0.0	27.86	8.55	$NaKCO_3.6H_2O$ + » + »
102.50	1.83	11.02	0.0	» + » + $K_2CO_3\ ^3/_2 H_2O$
36.29	0.0	27.82	0.0	»
33.64	9.78	25.79	0.0	» + KCl
0.0	22.08	38.65	0.0	$Na_2CO_3.10H_2O$ + »

100 gms. H_2O dissolve 10.76 gms. K_2CO_3 + 2.66 gms. KNO_3 at 10° when both salts are present in excess. (Kremann and Zitek, 1909.)

100 gms. H_2O dissolve 10.53 gms. K_2CO_3 + 6.12 gms. Na_2CO_3 at 10° when both salts are present in excess (Kremann and Zitek, 1909). See also Potassium Sodium Carbonate.

Data for aqueous solutions of $K_2CO_3 + KNO_3 + Na_2CO_3 + NaNO_3$, simultaneously saturated with two or more of the salts at 10° and at 25°, are also given by Kremann and Zitek (1909).

Data for the reciprocal salt pairs $K_2CO_3 + BaSO_4 \rightleftarrows K_2SO_4 + BaCO_3$ at 25°, 80° and 100° are given by Meyerhoffer (1905).

An aqueous solution, simultaneously saturated with $K_2CO_3.2H_2O$, K_2SO_4 and $BaCO_3$, contains 53.1 gms. K_2CO_3 + 0.023 gm. K_2SO_4 at 25°. (Meyerhoffer, 1905.)

EQUILIBRIUM IN THE SYSTEM POTASSIUM CARBONATE AMMONIA AND WATER.

(Appleby and Leishman, 1932.)

Two liquid layers are formed at concentrations of ammonia above 2.5 percent. The concentrations are expressed in gms. per 100 gms. sat. solution.

t°	Aqueous Layer			Ammoniacal Layer			Solid Phase
	d. of sat. sol.	NH_3	K_2CO_3	d. of sat. sol.	NH_3	K_2CO_3	
0	1.539	0.0	50.69	—	—	—	$K_2CO_3.2H_2O$
"	1.517	1.06	49.37	—	—	—	"
"	1.507	1.57	48.84	—	—	—	"
"	1.483	2.51	47.42	—	—	—	"
"	1.475	2.52	47.13	0.901	32.07	2.72	"
"	1.421	3.26	42.54	0.921	27.41	2.99	
"	1.371	3.70	39.44	0.946	24.59	3.73	
"	1.340	4.41	35.95	0.968	22.02	5.84	
"	1.240	6.91	28.92	1.038	16.17	12.44	
"	1.109	12.09	18.51	1.109	12.09	18.51	(critical solution)
"	—	—	—	—	42.9	2.3	$K_2CO_3.2H_2O$
18.05	1.550	0.0	51.72	—	—	—	"
"	1.455	2.88	46.50	0.894	30.48	4.76	"
"	1.407	2.75	43.6	0.917	27.24	5.98	
"	1.404	2.83	42.78	0.919	26.75	6.15	
"	1.351	4.14	39.31	0.950	23.08	8.87	
"	1.104	12.74	21.05	1.104	12.74	21.05	(critical solution)
"	—	—	—	—	61.95	2.10	$K_2CO_3.2H_2O$
25.06	1.556	0.0	51.47	—	—	—	"
"	—	0.550	50.91	—	—	—	"
"	—	1.004	50.91	—	—	—	"
"	—	1.286	50.30	—	—	—	"
"	—	1.842	49.77	—	—	—	"
"	—	2.885	48.79	—	—	—	"
"	—	3.450	47.00	—	30.85	4.83	"
"	—	4.79	40.69	—	25.81	7.48	
"	—	6.04	36.36	—	21.98	10.85	
"	—	8.19	30.94	—	8.19	30.94	(critical solution)

Experiments indicate that the upper critical solution temperature is probably above 155°. It was also found that the vapor pressure of the two liquid layers in contact with $K_2CO_3.2H_2O$ becomes greater than atmospheric at about 22.5°.

Solubility of Potassium Carbonate in Aqueous Solutions of Potassium Sulfate at 25° and Vice Versa.

(Hill and Moskowitz, 1929.)

d. of sat. sol.	Gms. per 100 gms. sat. sol. K_2SO_4	Gms. per 100 gms. sat. sol. K_2CO_3	Solid Phase	d. of sat.	Gms. per 100 gms. sat. sol. K_2SO_4	Gms. per 100 gms. sat. sol. K_2CO_3	Solid Phase
1.557	0.0	52.8	$K_2CO_3\cdot1\frac{1}{2}H_2O$	1.230	1.5	23.2	K_2SO_4
1.557	0.03	52.8	" + K_2SO_4	1.170	2.8	16.4	"
1.506	0.03	48.0	K_2SO_4	1.122	4.9	9.4	"
1.465	0.08	45.1	"	1.103	6.5	5.5	"
1.348	0.3	35.0	"	1.083	10.7	0.0	"

POTASSIUM Magnesium CARBONATE $K_2Mg(CO_3)_2\cdot4H_2O$.

Solubility of Potassium Magnesium Carbonate in Aqueous Solutions of Potassium Chloride at 17°.

(Kalla, 1936.)

Gm. Mols. per 1000 gms. H_2O KCl	Gm. Mols. per 1000 gms. H_2O $K_2Mg(CO_3)_2$	Solid Phase
0.274	0.0381	$K_2Mg(CO_3)_2\cdot4H_2O$
0.790	0.0352	"
1.490	0.0268	"
2.365	0.0191	"
3.38	0.0139	

CO

Solubility of Potassium Carbonate in Aqueous Solutions of Sodium Carbonate and Vice Versa at Several Temperatures.

(Iljinsky, 1924.)

Gms. per 100 gms. H_2O K_2CO_3.	Gms. per 100 gms. H_2O Na_2CO_3.	Solid Phase.
	Results at —6°.	
84.4	0.0	$K_2CO_3.2H_2O$
54.0	6.9	» + $K_2CO_3.Na_2CO_3.2\frac{1}{2}H_2O$
38.1	6.7	K_2CO_3 $Na_2CO_3.2\frac{1}{2}H_2O$
25.4	11.7	» + Na_2CO_3 $10H_2O$
	Results at +10°.	
108.4	0.0	K_2CO_3 $2H_2O$
105.3	6.1	$K_2CO_3.Na_2CO_3.6H_2O$
50.0	10.8	»
35.4	17.6	Na_2CO_3 $10H_2O$
0.0	12.0	»
	Results at 24°.2.	
112.6	0.0	$K_2CO_3.2H_2O$
110.1	2.5	»
108.5	9.5	»
107.4	11.2	» + $K_2CO_3.Na_2CO_3$ $6H_2O$
98.3	13.8	$K_2CO_3.Na_2CO_3.6H_2O$
92.1	13.0	»
48.4	18.7	»
34.5	27.4	»
28.3	33.1	»

d of sat. sol	Gms. per 100 gms. H_2O K_2CO_3.	Gms. per 100 gms. H_2O Na_2CO_3.	Solid Phase
–	24.3	36.3	K_2CO_3 Na_2CO_3 $6H_2O$
–	24.0	38.0	» + $Na_2CO_3.10H_2O$
–	22.7	37.0	$Na_2CO_3.10H_2O$
–	15.0	35.4	»
–	0.0	28.5	»
		Results at 40°.	
1.558	119.3	0.0	K_2CO_3 $2H_2O$
1.556	110.0	8.4	»
–	107.0	11.2	» + $K_2CO_3.Na_2CO_3.6H_2O$
1.544	101.0	11.3	K_2CO_3 $Na_2CO_3.6H_2O$
1.527	87.0	16.3	»
1.500	82.6	16.2	»
1.445	48.5	27.2	»
1.400	32.2	33.1	»
1.389	26.7	35.5	»
1.385	25.9	35.7	»
1.381	23.8	36.5	»
–	21.0	41.0	» + $Na_2CO_3.H_2O$
1.356	15.2	43.1	$Na_2CO_3.H_2O$
1.360	10.0	44.6	»
–	0.0	49.0	»

Additional determinations upon this system are given by Kremann and Zitek, 1909, and by Osaka, 1910-11. These authors in common with Iljinski, 1924, report the formation of a hydrated double carbonate of potassium and sodium. The following later very careful determinations of Hill and Miller, Jr., 1927, show that at no temperature between 20° and 50° is a hydrated double carbonate formed, but that the material which exists in contact with the saturated solutions is a hydrated solid solution, the composition of which can vary over a considerable range. Due to the slowness with which equilibrium is reached, in all cases in which solid solution is formed, the authors found it necessary to prepare the mixtures in a special manner which would reduce the length of time required for attainment of the internal equilibrium of the solid solution or anhydrous double compound. The saturated solutions were analyzed by evaporation to dryness and estimation of the H_2O by loss in weight. The total carbonates were determined by titration and from this result and the known weight of the mixed carbonates the percentage of each was calculated. The results are recorded in percentage of H_2O and Na_2CO_3. In the following table the K_2CO_3 values have been obtained by subtracting the sum of H_2O + Na_2SO_4 from 100.

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	K_2CO_3	Na_2CO_3	
	Results at 20°		
—	52.6	0.0	K.1½
—	49.9	3.0	" + S
1.545	49.0	3.6	S
1.541	48.2	3.6	"
1.417	43.6	7.6	"
1.373	17.4	19.0	"
1.375	15.3	21.1*	"
1.372	13.9	22.5*	"
1.371	17.2	19.2	" + N.10
1.352	16.0	18.7	N.10
—	0.0	17.8	"
	Results at 25°°		
—	52.8	0.0	K.1½
1.561	51.5	2.8	"
1.555	48.4	5.0	" + S
1.551	47.5	4.9	S
1.552	45.7	5.3	"
—	39.4	6.4	"
—	37.1	7.2	"
1.471	29.5	11.6	"
1.471	26.5	13.6	"
1.406	26.2	13.7	"
1.404	21.0	17.9	"
1.399	16.4	22.1	"
1.395	15.8	22.7	" + N.7
—	14.1	23.2	N.7
1.404	12.6	23.3	"
1.368	12.5	23.3	" + N.10
	Results at 25° (con.)		
1.368	10.1	24.3*	N.7
1.369	9.3	24.3*	"
1.335	4.4	26.1*	"
1.317	10.8	22.9	N.10
—	6.1	22.0	"
1.263	2.6	22.4	"
—	0.0	22.5	"
	Results at 30°		
—	53.2	6.0	K.1½
1.561	50.2	3.5	"
1.561	49.9	4.0	" + KN
1.554	49.0	4.7	KN
1.558	48.0	5.4	"
1.553	47.9	5.3	"
1.551	46.2	6.6	"
1.547	45.8	6.8	" + N.1
1.545	45.1	7.3	N.1
1.543	44.85	7.3	N.1 + S
1.530	44.1	7.3	S
1.451	33.4	11.1	"
1.422	23.0	18.5	"
1.419	22.1	19.1	" + N.1
1.414	21.2	19.6	N.1
1.398	16.2	22.6	"
1.390	13.5	24.5	"
1.378	10.2	26.6	" + N.7
1.354	6.7	27.8	N.7
1.330	4.0	28.6	" + N.10
—	0.0	28.0	N.10

K.1½ = $K_2CO_3 \cdot 1\frac{1}{2}H_2O$; S = Solid Solution $(Na_2,K_2)CO_3 \cdot 6H_2O$, the mol. ratio $K_2CO_3:Na_2CO_3$ varies from 1:0.88 to 1:2.07; N.10 = $Na_2CO_3 \cdot 10H_2O$; N.7 = $Na_2CO_3 \cdot 7H_2O$; N.1 = $Na_2CO_3 \cdot H_2O$; KN = $K_2CO_3 \cdot Na_2CO_3$.

SOLUBILITY OF POTASSIUM CARBONATE IN AQUEOUS SOLUTIONS OF SODIUM CARBONATE AND VICE VERSA AT VARIOUS TEMPERATURES (Con.).

(Hill and Miller, Jr., 1927.)

Results at 33°

d. of sat. sol.	Gms. per 100 gms. sat. sol. K_2CO_3	Na_2CO_3	Solid Phase
—	53.2	0.0	K.1½
—	49.8	4.3	" + KN
1.555	47.5	5.7	KN
—	45.1	6.7	" + N.1
1.510	40.7	8.9	N.1
1.498	38.0	10.0	"
1.479	37.0	10.6	" + S
1.454	35.5	11.5	S
1.455	34.2	12.0	"
1.454	32.9	12.8	" + N.1
1.457	30.6	14.0	N.1
1.440	27.8	15.6	"
1.377	13.8	24.0	"
1.354	4.7	29.9	" + N7
—	0.0	31.6	N.7

Results at 36°

d. of sat. sol.	Gms. per 100 gms. sat. sol. K_2CO_3	Na_2CO_3	Solid Phase
—	53.6	0.0	K.1½
—	50.9	3.5	"
1.545	50.4	4.0	" + KN
1.552	48.7	4.9	KN
—	46.5	5.7	"
1.532	45.4	7.2	" + N.1
1.503	39.5	9.6	N.1
1.461	32.4	12.9	"
1.421	23.4	18.2	"
1.392	17.6	21.5	"
—	0.0	33.2	"

Results at 50°

d. of sat. sol.	Gms. per 100 gms. sat. sol. K_2CO_3	Na_2CO_3	Solid Phase
—	54.8	0.0	K.1½
1.574	52.3	3.3	" + KN
1.530	44.5	8.0	KN + N.1
1.523	42.6	8.5	N.1
—	0.0	32.2	"

K.1½ = $K_2CO_3.1\frac{1}{2}H_2O$; S = Solid Solution $(Na_2,K_2)CO_3.6H_2O$, the mol. ratio $K_2CO_3:Na_2CO_3$ varies from 1:0.88 to 1:2.07; N.10 = $Na_2CO_3.10H_2O$; N.7 = $Na_2CO_3.7H_2O$; Na1 = $Na_2CO_3H_2O$; KN = $K_2CO_3.Na_2CO_3$.

Results for the quintuple points are also given.

SOLUBILITY OF POTASSIUM CARBONATE IN AQUEOUS SOLUTIONS OF SODIUM CARBONATE AND VICE VERSA AT 40°.

(Bain, 1927.)

Great care was exercised in securing equilibrium. The combined potassium and sodium was determined by weighing as chlorides. The potassium was determined as perchlorate. The existance of $Na_2CO_3.3H_2O$ was demonstrated and its transition point to $Na_2CO_3.H_2O$ found to be 39.8°.

d. of sat. sol.	Gms. per 100 gms. sat. sol. K_2CO_3	Na_2CO_3	Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol. K_2CO_3	Na_2CO_3	Solid Phase
—	53.9	0.0	K.1½	1.447	21.6	17.8	N.1
1.582	51.9	2.7	"	1.387	12.9	24.0	" + N.3
1.581	50.7	3.8	" + KN	1.374	9.1	26.6*	N.1
1.586	48.1	5.6	KN	1.366	6.2	28.5*	"
1.563	45.8	6.8	"	1.341	12.2	21.6	N.3
1.562	44.4	7.2	" + N.1	1.441	8.4	19.0	"
1.550	42.8	7.2	N.1	1.290	7.4	21.6	"
1.508	37.1	9.5	"	1.291	6.6	22.5	"
1.496	31.1	13.6	"	1.272	4.8	22.1	"
1.451	27.1	15.5	"	1.292	3.7	25.8	"
1.424	24.3	16.7	"	1.328	2.3	30.0	"
				1.326	1.8	31.1	"
				—	0.0	32.8	"

K.1½ = $K_2CO_3.1\frac{1}{2}H_2O$; KN = $K_2CO_3.Na_2CO_3$; N.1 = $Na_2CO_3.H_2O$; Na.3 = $Na_2CO_3.3H_2O$.

POTASSIUM CARBONATE

Data for equilibrium in the system,

$K_2CO_3 + 2NaHCO_3 \rightleftarrows 2KHCO_3 + Na_2CO_3$ in water at 25°, are given by Hill and Smith, 1929.

The authors first give the previously determined data for the four 3 component systems; $K_2CO_3 + Na_2CO_3 + H_2O$, $K_2CO_3 + KHCO_3 + H_2O$, $KHCO_3 + NaHCO_3 + H_2O$ and $Na_2CO_3 + NaHCO_3 + H_2O$, calculated to gram mols. per 1000 gm. mols. H_2O. They then report their results for saturated solutions each composed of water and three of the above four compounds-and in contact with two or three of the several solid phases which exist at 25°. The results show the location of 14 curves representing the solubility equilibrium existing with two solid phases, and of seven isothermal invariant points at which the solution is in equilibrium with 3 solid phases. A new tetragene salt was found, having the formula $K_2CO_3.NaHCO_3.2H_2O$ and not occurring in any of the 3 component systems.

In a later paper Hill, 1930 gives results for double salt formation among the carbonates and bicarbonates of potassium and sodium at 25° and at 35°. The partial isotherms show that the double salt $K_2CO_3.2KHCO_3.1\frac{1}{2}H_2O$ and the tetragone salt $K_2CO_3.NaHCO_3.2H_2O$ both exist at these two temperatures.

POTASSIUM Bi CARBONATE

SOLUBILITY OF POTASSIUM BICARBONATE IN AQUEOUS SOLUTIONS OF SODIUM BICARBONATE AND VICE VERSA.

(Oglesby, 1929.)

CO

Carbon dioxide was bubbled through the solutions prior to the period of saturation and afterwards an atmosphere of CO_2 was maintained above the surface of the solutions. The analyses were made by titrating the total alkali with HCl and determining the K by the perchloric acid method.

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$NaHCO_3$	$KHCO_3$	
	Results at 20°		
1.1777	0.00	24.98	$KHCO_3$
1.1830	1.38	24.32	"
1.1897	2.84	23.58	"
1.1966	4.37	22.89	" + $NaHCO_3$
1.1803	4.58	20.48	$NaHCO_3$
1.1637	4.88	17.98	"
1.1519	5.16	16.15	"
1.1309	5.73	12.72	"
1.0954	7.05	6.45	"
1.0625	8.72	0.00	"
	Results at 25°		
1.1882	0.00	26.78	$KHCO_3$
1.1927	1.12	26.13	"
1.1977	2.39	25.56	"
1.1998	2.72	25.27	"
1.2042	3.74	24.93	"
1.2087	4.63	24.46	" + $NaHCO_3$
	Results at 25° (Con.)		
1.1903	4.94	21.89	$NaHCO_3$
1.1732	5.14	19.39	"
1.1547	5.62	16.46	"
1.1282	6.38	12.10	"
1.1035	7.41	7.63	"
1.0857	8.20	4.23	"
1.0648	9.34	0.00	"
	Results at 30°		
1.1988	0.0	28.52	$KHCO_3$
1.2077	2.06	27.43	"
1.2145	3.58	26.66	"
1.2189	4.83	26.01	" + $NaHCO_3$
1.1887	5.47	21.40	$NaHCO_3$
1.1543	6.23	16.08	"
1.1196	7.34	10.22	"
1.0973	8.22	6.18	"
1.0673	9.95	0.0	"

EQUILIBRIUM IN THE SYSTEM POTASSIUM CARBONATE, SODIUM CARBONATE, POTASSIUM SULFATE, SODIUM SULFATE AND WATER AT 25°.

(Blasdale, 1923.)

Gms. per 100 gms. H_2O.				
K_2CO_3.	Na_2CO_3.	K_2SO_4.	Na_2SO_4.	Solid Phase.
0.0	27.44	0.0	24.06	$Na_2CO_3.10H_2O + Na_2SO_4.10H_2O$
0.0	0.0	9.34	30.98	$K_3Na(SO_4)_2$ + »
0.0	0.0	13.31	6.86	» + K_2SO_4
3.58	26.09	0.0	25.46	» + $Na_2CO_3.10H_2O + Na_2SO_4.10H_2O$
7.37	33.74	6.30	0.0	» + » + K_2SO_4
18.50	35.63	1.45	0.0	$Na_2CO_3.7H_2O$ + » + »
27.07	35.35	0.0	1.01	» + $KNaCO_3.6H_2O$ + »
103.72	10.83	1.36	0.0	$K_2CO_3.3/2H_2O$ + » + »
35.71	27.38	0.97	0.0	$KNaCO_3.6H_2O + K_2SO_4$
0.0	41.65	9.40	3.31	$Na_2CO_3.10H_2O + K_3Na(SO_4)_2$

100 gms. Aq. 86.5 % Glycerol ($d = 1.2326$) dissolve 40.5 gms. K_2CO_3 at 20°.
» 98.5 % » ($d = 1.2645$) » 39.4 » »

(Holm. 1921-1922.)

CO

EQUILIBRIUM IN THE SYSTEM POTASSIUM CARBONATE, METHYL ALCOHOL, WATER AT 23°-26°.

(Frankforter and Frary, 1913.)

The authors give the data for the binodal curve and the quadruple points but tie lines, other than for the quadruple points, were not determined.

Gms. per 100 Gms. Homogeneous Liquid.			Gms. per 100 Gms. Homogeneous Liquid.		
K_2CO_3.	CH_3OH.	H_2O	K_2CO_3.	CH_3OH.	H_2O.
6.32	75.85	17.83*	21.61	33.43	44.96
6.91	63.13	29.97	23.15	31.26	45.60
8.07	59.26	32.67	28.25	23.82	47.94
10.17	52.64	35.33	30.72	20.57	48.71
12.03	49.97	37.99	32.92	17.27	49.80
14.24	45.74	40.02	40.65	9.26	50.09
16.48	41.76	41.76	43.95	6.96	49.09
18.89	37.76	43.36	45.89	6.42	47.69
			49.05	6.1	44.88†

* Upper quad. point. † Lower quad. point.

The following results for the solubility of K_2CO_3 in concentrations of aq. CH_3OH above and below those yielding liquid layers are also given.

Gms. per 100 Gms. Sat. Sol.		Gms. per 100 Gms. Sat. Sol.	
CH_3OH.	K_2CO_3.	CH_3OH.	K_2CO_3.
1.03	51.39	85	2.05
2.22	50.33	89.2	1.56
6.1	49.05 (Lower quad. pt.)	91	1.98
Two Liquid Layers Formed Here.		93.6	2.72
75.85	6.32 (Upper quad pt).	94.3	5.7 (Abs. CH_3OH).

Data for the binodal curves for this system at 17° and at 35° are given by de Bruyn (1900).

This author also gives the following data for the composition of the conjugated liquids in equilibrium with solid potassium carbonate (quadruple points) at various temperatures.

t°.	Gms per 100 Gms Upper Layer			Gms per 100 Gms Lower Layer.		
	K_2CO_3.	CH_3OH.	H_2O.	K_2CO_3	CH_3OH	H_2O
−30	21.7	42.2	36.1	...	..	...
−20	13.8	52.1	34.1	...	...	...
−20	12.4	...	....	44.2	8.2	47.6
0	7.6	66.3	26.1	46.3	6.7	47
0	7.4	...	..	46.6	6.6	46.8
+17	6.2	69.6	24.2	48.3	5.7	46
35	5	72.9	22.1	51	4.3	44.7

EQUILIBRIUM IN THE SYSTEM POTASSIUM CARBONATE, POTASSIUM DIPROPYL MALONATE AND WATER AT 25°.

(M'David, 1909–10)

A series of mixtures of $K_2CO_3 + KC_{11}H_{19}O_4 + H_2O$ were prepared and thoroughly mixed. They were placed in a thermostat at 25° and the two layers which separated in each case, were analyzed.

Gms. per 100 Gms Upper Layer.			Gms. per 100 Gms. Lower Layer.		
K_2CO_3.	$KC_{11}H_{19}O_4$.	H_2O	K_2CO_3.	$KC_{11}H_{19}O_4$.	H_2O
4.05	65.1	30.85	42.6	0.4	57
4.9	59.8	35.3	40.7	0.4	58.9
5.6	53.5	40.9	35	0.5	64.5
7.2	50.5	42.3	33.5	0.9	65.0
8.7	39.2	52.1	28.9	0.7	70.4
11	34.6	54.4	26.8	0.8	72.4
14.5	23.5	62	24.8	3	72.2
17	18.6	64.4	23.1	6.05	70.85
18.6	15	66.4	21.7	8.7	69.6

CO

Several determinations at 2° and at 56° are also given.

EQUILIBRIUM IN THE SYSTEM POTASSIUM CARBONATE, ETHYL ALCOHOL AND WATER AT 23°–26°. (Frankforter and Frary, 1913)

NOTE.—The binodal curve for the system was very carefully determined and tie lines were located by estimations of K_2CO_3 in specially prepared conjugated liquids. The original results have been plotted and the following data for the conjugated layers read from the curve:

Alcohol Rich Layer (Upper)			Water Rich Layer (Lower.)		
Gms per 100 Gms. Solution			Gms per 100 Gms Solution		
K_2CO_3	C_2H_5OH	H_2O.	K_2CO_3	C_2H_5OH	H_2O
0.095	90.65	9.255†	53.6	0.28.	46.12†
0.241	72.7	27.059	39.11	1	59.89
1.72	53.5	44.78	29.62	4	66.38
4.03	42.6	53.37	25.7	6.4	67.9
6.30	35.5	58.2	21.08	11	67.92
8.29	31	60.71	19.15	13.2	67.65
10.35	27	62.65	18.18	14.7	67.12
14.2	20.5	65.3	14.2	20.5	65.3*

* Plait point. † Quad point

The authors give a complete summary of previous investigations of this system by de Bruyn (1899, 1900); Bell (1905); Cuno (1908–09).

Data for the conjugated liquid layers obtained in the system potassium carbonate, ethyl alcohol and water at 17° and at 35° are given by de Bruyn (1900) and at 20°, 40° and 60° by Cuno (1908).

COMPOSITION OF THE CONJUGATED LIQUIDS WHICH ARE IN EQUILIBRIUM WITH SOLID POTASSIUM CARBONATE (QUADRUPLE POINTS) AT VARIOUS TEMPERATURES.

(de Bruyn, 1900.)

t°.	Gms. per 100 Gms. Upper Layer.			Gms. per 100 Gms. Lower Layer.		
	K_2CO_3.	C_2H_5OH.	H_2O.	K_2CO_3.	C_2H_5OH	H_2O.
−18	0.03	90.3	9.7	51.2	0.2	48.6
0	0.04	91.9	8.1	51.3	0.2	48.5
+17	0.06	91.5	8.4	52.1	0.2	47.7
35	0.07	90.9	9	53.4	0.2	46.4
50	0.09	91.8	8.1	55.3	0.2	44.5
75	0.12	91.4	8.5	57.9	0.2	41.9

EQUILIBRIUM IN THE SYSTEM POTASSIUM CARBONATE, ACETONE, WATER AT 20°.

(Frankforter and Cohen, 1914.)

The binodal curve was very carefully determined and, in addition, data for the quadruple points (solid K_2CO_3) and five tie lines were located. These data were plotted and the following interpolated values for the conjugated liquids read from the curve.

CO

Gms. per 100 Gms. Upper Layer.			Gms. per 100 Gms. Lower Layer.		
K_2CO_3.	$(CH_3)_2CO$.	H_2O	K_2CO_3.	$(CH_3)_2CO$.	H_2O.
0.0024	96.4	3.5+†	52.4	trace	47.6†
0.039	64	35.96	32.63	1.2	66.17
0.712	55.3	43.99	24.4	3.7	71.9
1.36	48.5	50.14	22.91	4.7	72.39
4.57	34	61.43	16.92	10.2	72.88
6.97	27.5	65.53	14.77	13	72.23
10.5	20	69.5*	10.5	20	69.5

* Plait point. † Quad. points.

Additional results for the binodal curve at 24°–25°, agreeing satisfactorily with the above, are given by Leaming, 1925(?). This author mentions that the effect of temperature upon the results is slight.

EQUILIBRIUM IN THE SYSTEM POTASSIUM CARBONATE, NORMAL PROPYL ALCOHOL AND WATER AT 22°–26°.

(Frankforter and Frary, 1913.)

The authors give the data for the binodal curve and the quadruple points but tie lines were not located.

Gms. per 100 Gms. Homogeneous Liquid.			Gms. per 100 Gms. Homogeneous Liquid.		
K_2CO_3.	C_3H_7OH.	H_2O.	K_2CO_3.	C_3H_7OH.	H_2O.
52.9	0.02	47.08*	7.45	9.30	83.25
46.98	0.12	52.91	5.97	11.07	82.96
39	0.20	60.80	4.73	12.71	82.56
34.58	0.20	65.15	3.86	14.60	81.54
30.43	0.45	69.12	3.11	17.17	79.71
26.51	0.78	72.71	2.42	24.71	72.87
22.81	1.32	75.87	1.91	34.90	63.19
19.08	2.31	78.62	1.71	39	59.29
16.35	3.24	80.41	1.33	45.57	53.09
13.47	4.41	82.12	0.948	51.56	47.49
10.99	6.24	82.77	0.387	64.20	35.41
8.55	8.31	83.14	0.017	95.83	4.153†

* Lower quad. point. † Upper quad. point.

EQUILIBRIUM IN THE SYSTEM POTASSIUM CARBONATE, ISOPROPYL ALCOHOL AND WATER AT 20°.

(Frankforter and Temple, 1915.)

NOTE. — The results for the binodal curve in this and the following system are reported in terms of gms. per 100 gms. solvent (water + alcohol) instead of gms. per 100 gms. of homogeneous liquid (K_2CO_3 + water + alcohol.)

Gms. per 100 Gms. Alcohol + Water.			Gms. per 100 Gms. Alcohol + Water.		
K_2CO_3.	Alcohol.	Water.	K_2CO_3.	Alcohol.	Water.
44.844	2.911	97.089	15.021	19.445	80.555
36.137	4.783	95.217	13.244	23.919	76.081
28.879	7.349	92.651	6.065	45.397	54.603
24.152	9.159	90.841	3.933	53.265	46.735
17.665	14.395	85.605	2.954	57.294	42.706

EQUILIBRIUM IN THE SYSTEM POTASSIUM CARBONATE ISO PROPYL ALCOHOL AND WATER AT 25°.

(Ginnings and Chen, 1931.)

The binodal curve, a tie line and the plait point were carefully determined.

Gms. per 100 gms. of the three constituents			Gms. per 100 gms. of the three constituents	
K_2CO_3	$CH_3CHOHCH_3$		K_2CO_3	$CH_3CHOHCH_3$
0.10	69.60*		13.86	10.10
2.80	42.20		19.83	4.42
6.04	28.40		25.50	1.93
6.2	27.8	PP	33.20	0.65
9.65	17.25		52.67	0.23*

CO

* Tie line which shows the composition of each of two liquid layers in contact with each other. The one being the upper, rich in iso propyl alcohol and the other, the lower, rich in K_2CO_3.

PP is the plait point which shows the composition at that point on the binodal curve where the two layers merge into a homogeneous liquid.

EQUILIBRIUM IN THE SYSTEM POTASSIUM CARBONATE, ALLYL ALCOHOL AND WATER AT 20°.

(Frankforter and Temple, 1915.)

Gms. per 100 Gms. Alcohol + Water.			Gms. per 100 Gms. Alcohol + Water.		
K_2CO_3.	Alcohol.	Water.	K_2CO_3.	Alcohol.	Water.
47.746	2.103	97.897	8.239	30.677	69.323
33.200	5.267	94.733	5.521	39.337	60.663
23.486	9.309	90.691	2.020	54.487	45.513
16.354	15.037	84.963	1.015	62.610	37.390
11.331	22.454	77.546	0.0853	81.228	18.772

The binodal curve for this system at 25° has also been determined by Ginnings and Dees, 1935, but the authors do not give their experimental results but only a series of arbitrary constants calculated from them by means of an empirical equation. From these the conclusion is drawn that allyl alcohol seems to be more difficult to salt out than either iso propyl or normal propyl alcohol.

EQUILIBRIUM IN THE SYSTEM POTASSIUM CARBONATE, TERTIARY BUTYL ALCOHOL AND WATER AT 30°.

(Ginnings and Robbins, 1930.)

The points on the binodal curve were determined by observing the appearance or disappearance of clouding in a mixture of weighed amounts of salt and one of the liquids, upon addition of a weighed amount of the other. The conjugated points were found by preparing mixtures which yielded two liquid layers and analyzing each for salt content. The plait point, P.P., was found by plotting. The following results are those given in the authors' table under the column heading K_2SO_4 which was evidently intended for K_2CO_3.

Gms. per 100 gms. $K_2CO_3 + (CH_3)_3COH + H_2O$		Gms. per 100 gms. $K_2CO_3 + (CH_3)_3COH + H_2O$		Conjugation Point Data	
K_2CO_3	$(CH_3)_3COH$	K_2CO_3	$(CH_3)_3COH$	Wt. percent $(CH_3)_3COH$ in butanol rich phase	Wt. percent K_2CO_3 in salt rich phase
0.7	57.8	9.8	9.1	69	34.2
1.8	39.3	11.4	7.5	62	24.4
3.1	26.9	13.3	5.9	53	14.8
4.8	18.9	15.4	4.5	27	3.2P.P.
5.1	17.7	17.0	3.5		
5.8	16.1	26.7	0.9		
7.2	12.8	34.2	0.4		

CO

In a later paper by Ginnings, Herring and Webb, 1933, the values given for the plait point, P.P., are respectively,
2.3 percent K_2CO_3 and 36.3 percent $(CH_3)_3COH$ instead of 3.2 and 2.7 as shown above.

The binodal curve and plait point of the system

$$K_2CO_3 + \text{Pyridine} + H_2O \text{ at } 25^\circ$$

has been determined by Ginnings, Webb and Hinohara, 1933., but the authors do not give their experimental results but only the values of a series of constants calculated from them by means of empirical equations.

Data for equilibrium in the system composed of

$$K_2CO_3 + PbCO_3 + K_2CrO_4 + PbCrO_4 + H_2O \text{ at } 25^\circ$$

are given by Goldblum and Stoffella, 1910.

100 cc. anhydrous hydrazine dissolve 1 gm. K_2CO_3 at room temp. (Welsh and Broderson, 1915.)

100 gms. aqueous solution simultaneously sat. with K_2CO_3 and cane sugar at 31.25° contain 22.24 gms. K_2CO_3 and 56 gms. sugar. (Köhler, 1897.)

Freezing-point data for mixtures of $K_2CO_3 + KCl$ and $K_2CO_3 + NaCl$ (Sackur, 1911–12). $K_2CO_3 + K_2SO_4$ (Amadori, 1912; Le Chatelier, 1894); $K_2CO_3 + Na_2CO_3$ (Le Chatelier, 1894). (Le Chatelier, 1894.)

POTASSIUM URANYL CARBONATE $2K_2CO_3.(UO_2)CO_3$.

100 gms. H_2O dissolve 7.4 gms. salt at 15°. (Ebelmen, 1852.)

POTASSIUM OXALATE $K_2C_2O_4.H_2O$.

FREEZING-POINTS OF AQUEOUS SOLUTIONS OF POTASSIUM OXALATE.

(Klein and Svanberg, 1920.)

t°.	−0.346.	−1.060.	−2.084
Gms. $K_2C_2O_4$ per 100 cc. solution	1.271	4.177	8.355

SOLUBILITY OF POTASSIUM OXALATE IN WATER. (Woskressenskaja, 1926.)

Saturation was secured by constant stirring for 2 to 4 hours, and repeating the determinations after stirring another 1 1/2 hours. Below 0° the determinations were made by the freezing-point method.

t°.	Gms. $K_2C_2O_4$ per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. $K_2C_2O_4$ per 100 gms. sat. sol.	Solid Phase.
− 0.0	0.0	Ice	20	25.95 (25.89)	$K_2C_2O_4.H_2O$
− 0.6	2.4	»	25	27.40	»
− 1.4	5.14	»	30	28.70	»
− 3.0	10.47	»	40	31.2	»
− 4.0	14.10	»	50	33.5	»
− 5.05	17.12	»	60	35.6	»
− 5.75	18.83	»	70	37.8	»
− 6.34 Eutec.	20.00	» + $K_2C_2O_4.H_2O$	80	40.2	»
± 0	20.28	$K_2C_2O_4.H_2O$	90	42.0	»
10	23.20	»	100	44.5	»
16	24.81	»	107	45.9	»

The result in parenthesis is given by Trifonov, 1924, 1925.

SOLUBILITY OF MIXTURES OF POTASSIUM OXALATE AND OXALIC ACID IN WATER AT 25°.

COO

(Foote and Andrew, 1905.)

Gms. per 100 Gms. Solution.		Mols. per 100 Mols. H_2O.		Solid Phase.
$H_2C_2O_4$.	$K_2C_2O_4$.	$H_2C_2O_4$.	$K_2C_2O_4$.	
10.2	...	2.274	...	$H_2C_2O_4.2H_2O$
10.31	0.04	2.302	0.005	$H_2C_2O_4.2H_2O+H_3K(C_2O_4)_2.2H_2O$
9.26	0.13	2.046	0.016	Double salt $H_3K(C_2O_4)_2.2H_2O$
3.39	0.63	0.707	0.071	
2.06	4.26	0.440	0.495	$H_3K(C_2O_4).2H_2O+HKC_2O_4$
1.16	11.50	0.266	1.427	Double salt HKC_2O_4
0.99	16.93	0.240	2.235	
0.85	21.08	0.221	2.928	$HKC_2O_4+H_2K_4(C_2O_4)_3.2H_2O$
0.82	21.49	0.211	2.998	Double salt $H_2K_4(C_2O_4)_3.2H_2O$
0.64	23.52	0.169	3.361	
0.57	24.88	0.153	3.617	
0.43	27.52	0.122	4.14	$H_2K_4(C_2O_4)_3.2H_2O+K_2C_2O_4.H_2O$
...	27.40	...	4.09	$K_2C_2O_4.H_2O$

SOLUBILITY OF POTASSIUM TETROXALATE, $KH_3(C_2O_4)_2.2H_2O$, IN WATER.

(Koppel and Cahn, 1908.)

t°.	Gms. $KH_3(C_2O_4)_2$ per 100 Gms. H_2O.	Solid Phase.
−0.25 cryohydrate	0.99	$KH_3(C_2O_4)_2.2H_2O$
0	1.27	"
30	4.30	"
60	11.95	"
103.5 b. pt.	72.17	"

100 gms. methyl alcohol dissolve 2.07 gms. $KH_3(C_2O_4)_2$ at 15° and 1.55 gms. at the b. pt., 66.4°.

100 gms. acetone dissolve 2.44 gms. $KH(C_2O_4)_2$ at 15°. (Hexstock, 1934.)

EQUILIBRIUM IN THE SYSTEM POTASSIUM OXALATE, OXALIC ACID, WATER AT 0°, 30° AND 60°.

(Koppel and Cahn, 1908.)

COO

Results at 0°. Gms. per 100 Gms. Sat. Sol.		Results at 30°. Gms. per 100 Gms. Sat. Sol.		Results at 60°. Gms. per 100 Gms. Sat. Sol.		Solid Phase in Each Case.
C_2O_3.	K_2O.	C_2O_4.	K_2O.	C_2O_3.	K_2O.	
2.73	...	9.97	...	24.75	...	$H_2C_2O_4.2H_2O$
2.91	0.226*	10.15	0.10	...	...	"
2.985	0.342*	...	...	...	...	"
2.827	0.125	10.23	0.34	25.70	0.46	" $+KH_3(C_2O_4)_2.2H_2O$
2.345	0.145	...	...	...	...	" "
1.471	0.195	7.28	0.33	25.80	0.54	$KH_3(C_2O_4)_2.2H_2O$
0.823	0.240	4	0.41	22.06	0.58	"
0.799	0.454	3.08	0.50	20.17	0.67	"
1.173	0.785	2.38	1.002	14.25	0.90	"
1.381	0.962	2.98	1.79	9.82	1.48	"
1.545	1.155	...	...	6.95	2.244	"
1.666	1.273	4.24	2.76	9.17	5.60	" $+KHC_2O_4$
1.754	1.479	4.26	3.38	8.81	6.37	KHC_2O_4
2.627	2.858	5.44	5.43	10.17	10	"
3.772	4.422	6.66	7.27	12.36	13.40	"
4.292	5.161	8.64	10.05	14.10	16	"
4.975	6.088	10.03	12.01	15.35	17.80	"
5.652	7	10.80	12.94	16.07	18.89	" $+(K_2C_2O_4)_2H_2C_2O_4.2H_2O$
6.27	7.87	11.47	14.13	16.51	19.59	$(K_2C_2O_4)_2H_2C_2O_4.2H_2O$
7.63	9.72	12.16	15.11	16.80	20.10	"
8.66	11.14	12.32	15.37	16.95	20.34	"
9.055	11.58	12.90	16.23	17.14	20.70	" $+K_2C_2O_4.H_2O$
8.826	11.52	12.36	16.14	16.71	20.41	$K_2C_2O_4.H_2O$
5.215	12.33	8.52	15.03	15.94	20.11	"
2.23	14.80	4.53	15.55	15.06	19.66	"
1.245	16.82	1.87	18.17	8.82	19.25	"
0.871	18.4	0.74	22.32	2.04	23.09	"
0.511	20.91	...	...	0.434	29	"
0.325	23.30	...	...	0.365	31.40	"
0	41.3†	0	46.79	0	51.34	$KOH.H_2O$

* Supersaturated. † About.

EQUILIBRIUM IN THE SYSTEM POTASSIUM OXALATE, OXALIC ACID, WATER AT 25°.

(Hartley, Drugman, Vlieland and Bourdillon, 1913.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
C_2O_3.	K_2O.		C_2O_3.	K_2O.	
8.29	0	$H_2C_2O_4.2H_2O$	3.070	2.052	$KH_3(C_2O_4)_2.2H_2O$
8.278	0.045	" $+KH_3(C_2O_4)_2.2H_2O$	3.450	2.300	" $+KHC_2O_4$
7.412	0.064	$KH_3(C_2O_4)_2.2H_2O$	3.793	3.109	KHC_2O_4
2.827	0.238	"	5.457	5.019	"
2.007	0.346	"	9.816	11.06	" $+2K_2C_2O_4.H_2C_2O_4.2H_2O$
1.734	0.567	"	12.365	15.71	$2K_2C_2O_4.H_2C_2O_4.2H_2O + K_2C_2O_4.H_2O$
2.675	1.714	"	11.85	15.51	$K_2C_2O_4.H_2O$

Similar data at 15° for the above system are given by Jungfleisch and Landrieu (1914a).

SOLUBILITIES IN THE SYSTEM POTASSIUM OXALATE, OXALIC ACID, WATER AT THE CRYOHYDRIC POINTS.

(Koppel and Cahn, 1908.)

(Temp. of Equilibrium of Solution with Ice.)

t° of Ice Separation.	Gms. per 100 Gms. Sat. Sol.		Solid Phase, Ice+:	t° of Ice Separation.	Gms. per 100 Gms. Sat. Sol.		Solid Phase, Ice+:
	C_2O_3.	K_2O.			C_2O_3.	K_2O.	
−0.95	2.641	...	$H_2C_2O_4.2H_2O$	− 4.45	6.902	8.820	$(K_2C_2O_4)_2.H_2C_2O_4.2H_2O$
−0.90	2.720	0.0466	“ $+KH_3(C_2O_4)_2.2H_2O$	− 5.20	7.616	9.74	“
−0.52	1.672	0.0602	$KH_3(C_2O_4)_2.2H_2O$	− 5.32	7.696	9.84	“
−0.25	0.643	0.210	“	− 5.97	8.51	11.01	“ $+K_2C_2O_4.H_2O$
−0.58	1.229	0.823	“	− 6.55	6.742	10.45	$K_2C_2O_4.H_2O$
−0.78	1.648	1.234	“ $+KHC_2O_4$	− 8.10	4.999	10.86	“
−1.50	2.707	2.950	KHC_2O_4	−10.30	3.358	11.76	“
−2.10	3.687	4.363	“	−13.60	1.854	13.08	“
−2.78	4.576	5.50	“	−17.40	1.200	14.55	“
−3.45	5.681	7.05	“ $+(K_2C_2O_4)_2.H_2C_2O_4.2H_2O$	−23.80	0.606	16.89	“

SOLUBILITIES IN THE SYSTEM POTASSIUM OXALATE, OXALIC ACID, WATER AT THE BOILING POINTS.

(Koppel and Cahn, 1908.)

t° of B. pt.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.	t° of B. pt.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
	C_2O_3.	K_2O.			C_2O_3.	K_2O.	
105.5	39.84	5.25	$KH_3(C_2O_4)_2.2H_2O$	102.8	19.10	18.25	KHC_2O_4
104.9	36.95	5.83	“	103.25	21.11	21.71	“
104.3	32.75	5.97	“	107.7	25.19	27.91	“ $+K_2C_2O_4.H_2O$
103.4	27.64	9.12	“	106.35	22.04	26.45	$K_2C_2O_4.H_2O$
102.9	27.46	11.43	“ $+KHC_2O_4$	106.2*	19.17	25.02	“
102.5	23.36	10.50	KHC_2O_4	108.25	12.73	27.69	“
102.4	18.81	12.29	“	111.8	5.35	30.40	“

COO

From the preceding tables the following results for the solubilities of the pure oxalates in water are obtained.

SOLUBILITY OF POTASSIUM OXALATE, $K_2C_2O_4.H_2O$ IN WATER.

t°.	Gms. per 100 Gms. Sat. Sol.			Solid Phase.	t°.	Gms. per 100 Gms. Sat. Sol.			Solid Phase.
	C_2O_3 +	K_2O =	$K_2C_2O_4$.			C_2O_3 +	K_2O =	$K_2C_2O_4$.	
− 0.78	1.31	1.71	3.02	Ice	30	12.36	16.14	28.50	$K_2C_2O_4.H_2O$
− 1.49	2.48	3.20	5.68	“	40	13.20	17.22	30.44	“
− 2.50	3.99	5.20	9.195	“	50	14.14	18.46	32.60	“
− 3.22	5.15	6.705	11.855	“	60	15.06	19.66	34.72	“
− 5.88	8.429	11.01	19.43	“ $+K_2C_2O_4.H_2O$	70	15.94	20.81	36.75	“
0	8.83	11.52	20.35	$K_2C_2O_4.H_2O$	80	16.86	22.02	38.875	“
+10	10.48	13.69	24.17	“	90.2	17.73	23.14	40.90	“
20	11.57	15.11	26.675	“	106.2*	19.17	25.02	44.19	“

* b. pt.

100 gms. sat. aq. sol. contain 20.62 gms. $K_2C_2O_4$ at 0°, *d* = 1.161. (Engel, 1888.)

The results of Hartley, Drugman, Vlieland and Bourdillon (1913) and of Colani (1916), for the solubility of neutral potassium oxalate in water, agree satisfactorily with the above.

SOLUBILITY OF POTASSIUM BIOXALATE, KHC_2O_4, IN WATER.

(Koppel and Cahn, 1908.)

t°.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
	C_2O_3.	K_2O.	
60	8.75	6.50	KHC_2O_4
102.4 b. pt.	18.81	12.29	“

The KHC_2O_4 is decomposed to the less soluble tetroxalate at temperatures below 50°.

POTASSIUM Cobalti **OXALATES**, laevo, $K_3[Co(C_2O_4)_3].H_2O$ and racemic $K_3[Co(C_2O_4)_3]3\,^1/_2H_2O$.

Solubility of Each Separately in Water.

(Jaeger and Thomas, 1918, 1919.)

t°.	Gms. racemic salt per 100 gms. H_2O.	t°	Gms. laevo salt. per 100 gms. H_2O.
0	34.50	20	37.40
14	36.84	22	37.60

By plotting these results the transition temperature is found to be 13.2°.

Solubility of Mixtures of Potassium Oxalate and Other Salts in Water. (Colani, 1916.)

Results at 15°. Gms. per 100 Gms. Sat. Sol.	Results at 50°. Gms. per 100 Gms. Sat. Sol.	Solid Phase in Each Case.
10.03 $K_2C_2O_4$ + 19.19 KCl	15.18 $K_2C_2O_4$ + 20.26 KCl	$K_2C_2O_4.H_2O$ + KCl
23.55 " + 1.82 K_2SO_4	31.06 " + 1.99 K_2SO_4	" + K_2SO_4
20.39 " + 11.60 KNO_3 (19°)	19.63 " + 28.29 KNO_3	" + KNO_3

100 gms. aqueous solution, simultaneously saturated with potassium and sodium oxalates, contain 26.15 gms. $K_2C_2O_4$ + 2.44 gms. $Na_2C_2O_4$ at 25°. (Foote and Andrew, 1905).

COO

Solubility of Mixtures of Ammonium Oxalate and of Potassium Oxalate in Water. (Rivett and O'Conner, 1919.)

Results at 25°.

d of sat. sol.	Gms. per 100 gms. sat. sol. $K_2C_2O_4$.	Gms. per 100 gms. sat. sol. $(NH_4)_2C_2O_4$.	Solid Phase.
1.021	0.00	5.01	$(NH_4)_2C_2O_4.H_2O$
1.040	2.67	4.72	Solid solution of $K_2C_2O_4.H_2O$ in $(NH_4)_2C_2O_4.H_2O$ (I).
1.068	6.51	4.38	
1.108	12.10	4.01	
1.128	15.37	3.68	
1.166	19.39	3.32	
1.204	24.3	2.90	
1.217	25.9	2.75	(I) + (II)
1.216	26.3	1.83	Solid solution of $(NH_4)_2C_2O_4.H_2O$ in $K_2C_2O_4.H_2O$ (II)
1.216	26.8	0.85	
1.215	27.2	0.0	

Results at 50°.

d of sat. sol.	Gms. per 100 gms. sat. sol. $K_2C_2O_4$.	Gms. per 100 gms. sat. sol. $(NH_4)_2C_2O_4$.	Solid Phase.
1.034	0.0	9.63	$(NH_4)_2C_2O_4.H_2O$
1.080	7.99	8.40	Solid solution of $K_2C_2O_4.H_2O$ in $(NH_4)_2C_2O_4.H_2O$ (I)
1.136	16.20	7.10	
1.154	17.99	6.79	
1.187	22.4	6.10	
1.203	24.4	5.75	
1.254	30.4	4.78	(I) + (II)
1.251	31.0	3.34	Solid solution of $(NH_4)_2C_2O_4.H_2O$ in $K_2C_2O_4.H_2O$ (II)
1.252	31.5	2.64	
1.252	33.1	0.0	$K_2C_2O_4.H_2O$

No evidence was obtained of the existence of a double salt. The proportion of the two salts in the solid phases varies with the composition of the solution and the evidence is definite that mixed crystals of the two salts are formed.

Solubility of Potassium Oxalate in Aqueous Solutions of Sodium Oxalate and Vice Versa at 25°. (Rivett and O'Conner, 1919.)

d of sat. sol.	Gms. per 100 gms sat. sol. $K_2C_2O_4$.	Gms. per 100 gms sat. sol. $Na_2C_2O_4$.	Solid Phase.	*d* of sat. sol.	Gms. per 100 gms. sat. sol. $K_2C_2O_4$.	Gms. per 100 gms. sat. sol. $Na_2C_2O_4$.	Solid Phase.
1.215	27.2	0.0	$K_2C_2O_4.H_2O$	1.178	19.6	3.21	$Na_2C_2O_4$
1.218	26.8	0.77	»	1.135	14.4	3.21	»
1.223	26.3	1.71	»	1.084	8.10	3.40	»
1.226	26.2	2.17	»	1.057	3.99	3.71	»
1.228	26.1	2.50	» + $Na_2C_2O_4$	1.026	0.00	3.71	»

EQUILIBRIUM IN THE SYSTEM POTASSIUM OXALATE, NICKEL OXALATE AND WATER AT 30°.

(Vosburg, Israel and Birch, 1938.)

The period of rotation was a week or more and special precautions were necessary to insure that the right solid phase was present. The oxalate content of the samples was determined by permanganate titration and the nickel content either by dimethyl glyoxime or cyanide titration

Gms. per 100 gms. sat. sol. $K_2C_2O_4$	Gms. per 100 gms. sat. sol. NiC_2O_4	Solid Phase
2.26	0.08	SS
3.77	0.55	"
5.67	0.57	"
8.40	1.38	"
11.08	2.55	"
12.44	3.53	" + $K_2Ni(C_2O_4)_2.xH_2O$
14.22	3.80	$K_2Ni(C_2O_4)_2.xH_2O$
16.74	3.28	"
18.77	3.48	"
19.95	3.84	"
20.62	3.87	"
22.12	4.02	"
23.24	4.55	$K_2Ni(C_2O_4)_2.xH_2O$
25.82	4.67	"
26.83	4.93	"
26.94	5.13	"
27.11	5.20	"
30.55	5.85	"
34.08	7.39	"
33.03	6.64	" + $K_2C_2O_4.H_2O$
33.31	6.81	" "
33.57	6.37	" "
31.07	3.34	$K_2C_2O_4.H_2O$
32.51	5.56	"

SS = Solid solutions of potassium and nickel oxalates. Analyses showed that water of crystallization in the double compound was most probably $4H_2O$.

POTASSIUM Telluric Acid **OXALATE** $K_2[H_6TeO_6.C_2O_4]$.

SOLUBILITY IN WATER. (Rosenheim and Weinheber, 1910–11.)

t°	0°	20°	30°	40°	50°
Gms. $K_2[H_6TeO_6.C_2O_4]$ per 100 gms. H_2O	2.67	5.36	6.82	9.07	12.35

EQUILIBRIUM IN THE SYSTEM POTASSIUM OXALATE, ZINC OXALATE AND WATER AT 25°.

(Metler and Vosburgh, 1933.)

Gms. per 100 gms. sat. sol. $K_2C_2O_4$	Gms. per 100 gms. sat. sol. ZnC_2O_4	Solid Phase
34.09	11.11	$K_2C_2O_4.H_2O$ + 1.1.7
29.07	9.70	1.1.7
23.74	8.36	"
21.17	7.63	"
16.71	6.46	"
15.64	6.20	"
15.19	6.06	" + $ZnC_2O_4.2H_2O$
14.26	5.80*	"
10.28	4.42*	"
13.71	4.86	$ZnC_2O_4.2H_2O$
11.73	3.85	"
10.45	3.11	"
9.44	2.59	"
7.73	1.76	"
5.72	1.01	"
4.57	0.69	"
3.80	0.38	"
3.31	0.29	"

* = Metastable, 1.1.7 = $K_2Zn(C_2O_4)_2.7H_2O$.

EQUILIBRIUM IN THE SYSTEM POTASSIUM OXALATE ZINC OXALATE AND WATER AT 35°.

(Metler, 1934.)

Gms. per 100 gms. sat. sol.		Solid Phase
$K_2C_2O_4$	ZnC_2O_4	
35.96	12.66	$K_2C_2O_4.H_2O$ + 1.1
35.66	12.78	1.1
34.56	12.77	"
32.54	13.02	"
30.07	13.17	"
28.33	13.41	"
26.91	13.68	"
25.28	13.70	" + $ZnC_2O_4.2H_2O$
23.99	12.65	$ZnC_2O_4.2H_2O$
21.48	10.69	"
19.11	8.94	"
17.72	7.84	"
13.13	4.82	"
10.62	3.32	"
8.14	2.08	"
5.38	0.96	"
2.14	0.17	"

1.1 = $K_2Zn(C_2O_4)_2$

Evidence was also obtained for the metastable existence of the compound $K_2Zn_2(C_2O_4)_3.12H_2O$ and the composition of several metastable solutions in contact with this compound are given.

COO

EQUILIBRIUM IN THE SYSTEM POTASSIUM OXALATE, ZIRCONYL OXALATE AND WATER AT 35°.

(Boulanger, 1936.)

Tabular results are given for the temperatures 19°, 35° and 52°. Those at 19° yield a very irregular curve. Those at 35° & 52° although giving somewhat better curves probably do not represent equilibrium conditions. The following values taken from the 35° curve indicate roughly the general nature of the system.

Gms. per 100 gms. sat. sol.		Solid Phase
$K_2C_2O_4$	$ZrOC_2O_4$	
12.0	trace	$K_2C_2O_4.H_2O$
8.0	0.06	"
7.0	0.25	"
6.5	0.30	1.1.1.4(?)
5.0	0.28	"
4.0	0.34	"
3.5	0.42	"
3.0	0.80	"
2.9	1.10	1.1.1.4(?)
2.8	1.24	?
2.5	1.20	?
2.0	0.92	$ZrC_2O_4.4H_2O$
1.5	0.72	"
1.0	0.60	"
0.5	0.48	."

1.1.1.4 = $K_2C_2O_4.ZrO.C_2O_4.H_2C_2O_4.4H_2O$(?).

POTASSIUM CHLORIDE KCl.

SOLUBILITY IN WATER.

(Average curve from the results of Meusser — Z. anorg. Chem. 44, 79, '05; at 31.25°, Köhler — Z. Ver. Zuckerind. 47, 447, '97; Andrae — J. pr. Chem. [2] 29, 456, '84; Gerardin — Ann. chim. phys. [4] 5, 137, '65; de Coppet *Ibid* [5] 30, 411, '83; Etard *Ibid*. [7] 2, 526, '94; Mulder; above 100°, Tilden and Shenstone — Proc. Roy. Soc. (Lond.) 35, 345, '83.)

t°.	Gms KCl per 100 Gms.		t°.	Gms. KCl per 100 Gms.		t°.	Gms. KCl per 100 Gms.	
	Solution.	Water.		Solution	Water.		Solution.	Water.
−9	19.3	23.9	40	28.6	40.0	147	41.5	70.8
−4.5	20.6	25.9	50	29.9	42.6	180	43.7	77.5
0	21.6	27.6	60	31.3	45.5		Solid Phase Ice	
5	22.7	29.3	70	32.6	48.3	−9	19.3	23.9
10	23.7	31.0	80	33.8	51.1	−8	17.7	21.5
15	24.5	32.4	90	35.1	54.0	−8	16.7	20.0
20	25 4	34.0	100	36.2	56.7	−7	14.9	17.5
25	26.2	35.5	130	39.8	66.0	−6	13.6	15.7
30	27.1	37.0				−5.5	12.5	14.3

Sp. Gr. of solution sat. at 0 = °1.150; at 15° = 1.172.

The following determinations of the solubility of potassium chloride in water, made with exceptional care, are reported by Berkeley (1904).

t°.	d of Sat. Sol.	Gms. KCl per 100 Gms. H_2O.	t°.	d of Sat. Sol.	Gms. KCl per 100 Gms. H_2O.
0.70	1.1540	28.29	74.80	1.2032	49.58
19.55	1.1738	34.37	89.45	1.2069	53.38
32.80	1.1839	38.32	108 (b. pt.)	1.2118	58.11
59.85	1.1980	45.84			

Cl

The following values for the Solubility of Potassium Chloride in Water were read from an average curve drawn through the more recent determinations of: Foote, 1927; Wright, 1927; Scott and Frazier, 1927; Malquori, 1927, 1928a; Flottmann, 1928; Cornec and Krombach, 1932; Lannung, 1934 and Hering, 1936. The values above 100° are the averages of the determinations of Cornec and Krombach, 1932; Achumow and Wassilijew, 1932, and Benrath, Gjedebo, Schiffers and Wunderlich, 1937.

t°	d. of sat. sol.	Gms. KCl per 100 gms. sat. sol.	t°	d. of sat. sol.	Gms. KCl per 100 gms. sat. sol.
-10.7	(Eutec.)	19.54	120	—	37.5
0	1.154	21.92	130	1.235	38.4
+ 5	—	22.9	140	—	39.3
10	—	23.8	150	1.254	40.2
15	—	24.7	160	—	41.1
20	1.174	25.5	170	1.276	42.0
25	1.1778	26.4	180	—	43.0
30	1.182	27.1	200	1.317	44.7
40	1.189	28.6	225	—	47.0
50	1.194	30.0	250	—	49.3
60	1.199	31.4	275	—	51.6
70	1.203	32.7	300	—	54.0
80	1.205	33.9	350	—	58.6
90	—	35.0	400	—	63.5
100	1.210	36.0	454	—	69.0

Freezing-points of Aqueous Solutions of Potassium Chloride.

(Barnes and Maass, 1930.)

The determinations sere made with the greatest possible accuracy. The temperatures of freezing are the averages of the point at which the first crystal of ice appeared and that at which the last crystal disappeared.

t^0	Gms. KCl per 100 gms. sat. sol.	Solid Phase	t^0	Gms. KCl per 100 gms. sat. sol.	Solid Phase
-2.24	4.95	Ice	-10.31	19.02	Ice
-4.60	9.48	"	-10.72 Eutec.	19.93	" + KCl
-6.88	13.70	"	+25.22	26.41	KCl

The Solubility of Potassium Chloride in Deuterium Water and in Ordinary Water.

(Shearman and Menzies, 1937.)

The deuterium water had a content of 98.2% D_2O and a density relative to that of ordinary water, of 1.1059. The results are reported in moles of KCl per 1000 gms. of water (= 55.51 moles H_2O) and in 1111.7 gms. of deuterium water (= 55.51 moles D_2O). The same 0.4086 gm. of KCl was employed in both solvents and the amount of deuterium water was 1.39 gm.
Cl The actual measurements were graphed and the following values for round temperatures obtained.

t^0	Moles KCl per 55.51 moles:		t^0	Moles KCl per 55.51 moles:	
	H_2O	D_2O		H_2O	D_2O
0	3.78	3.16	80	6.80	6.52
10	4.20	3.68	100	7.51	7.25
20	4.61	4.16	120	8.21	7.97
25	4.80	4.38	140	8.89	8.67
30	5.00	4.59	160	9.57	9.36
40	5.37	5.01	180	10.24	10.06
60	6.09	5.79			

Freezing-Points of Aqueous Solutions of Potassium Chloride.

(Klein and Svanberg, 1920, Rodebush, 1918.)

t	Gms. KCl per 100 cc. sat. sol		t°	Gms. KCl per 100 gms. H_2O.	t°.	Gms. KCl per 100 gms. H_2O
0.34....	0.7456	(K and S)	-3.07 ..	7.09	- 9.84.......	22.69
-0.858...	1.864	»	-4.66...	10.77	-10.34.......	23.80
-1.681...	3.728	»	-7.51...	17.38	-10.66 (eutec.).	24.60

Data for equilibrium in the system potassium chloride + arsenic trioxide + water are given by Schreinemakers and de Baat, 1915.

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 0°

(Jeannel — Compt. rend. 103, 381, '86; Engel — Ann. chim. phys. [6] 13, 377, '88.)

Milligram Mols. per 10 cc.		Grams per 100 cc. Solution.		Sp Gr. of Solutions.
KCl.	HCl.	KCl.	HCl.	
34.5	0.0	25.73	0.0	1.159
30.41	3.9	22.69	1.42	1.152
27.95	6.6	20.84	2.41	1.150
27.5	7.1	20.51	2.59	1.147
23.75	11.1	17.71	4.05	1.137
16.0	23.0	11.93	8.39	1.111
10.0	34.0	7.46	12.40	1.105
7.5	41.0	5.60	14.95	1.105
2.0	65.5	1.49	23.88	1.121
2.4	148.8 (sat.)	1.52	54.26	1.224

100 cc. saturated HCl solution dissolve 1.9 gms. KCl at 17°. (Ditte, 1881.)

100 gms. sat. aq. HCl solution dissolve 1.9 gms. KCl at 20°. (Stoltzenberg, 1912.)

F.-pt. data for mixtures of KCl and HCl are given by Dernby (1918).

SOLUBILITY OF MIXTURES OF POTASSIUM CHLORIDE AND OF SODIUM CHLORIDE IN AQUEOUS HYDROCHLORIC ACID SOLUTIONS AT 25°.

(Hicks, 1915.)

Gms. per 100 Gms. Sat. Solutions.		
HCl.	NaCl.	KCl.
0	19.95	10.90
8.61	10.65	7.58
17.16	3.56	3.80
20.65	2.03	2.86
32.78	0.18	1.27

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 0° AND AT 25°.

(Armstrong, Eyre, Hussey and Paddinson, 1907; Armstrong and Eyre, 1910–11.)

Solvent, Gms. HCl per 1000 Gms. H_2O.	Gms. KCl per 100 Gms. Sat. Sol.	
	At 0°.	At 25°.
0	22.11	26.45
9.11	20.93	25.17
18.22	19.71	24.07
36.45	17.26	21.74
109.35	...	13.47
182.25	...	6.93

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROBROMIC ACID AND OF HYDROCHLORIC ACID AT 25°. (Herz, 1911–12.)

In Aq. HBr.

Millimols per 10 cc.		Gms. per Liter.	
HBr.	KCl.	HBr.	KCl.
0	42.72	0	318.5
6.61	37.80	53.5	281.9
34.15	19.57	276.4	146

In Aq. HCl.

Millimols per 10 cc.		Gms. per Liter.	
HCl.	KCl.	HCl.	KCl.
5.66	37.49	20.64	279.6
10.20	33.79	37.19	252
15.91	28.68	57.98	213.9
20.94	24.74	76.35	146.6
32.52	17.39	118.6	129.6

Solubility of Potassium Chloride in Aqueous Solutions of Hydrochloric Acid at 25°.

Results of Malquori, 1928(c)		Results of Ingham, 1928					
Gms. per 100 gms. sat. sol.		d $\frac{25}{4}$ of sat. sol.	Gm. Mols. per 1000 cc sat. sol.		d $\frac{25}{4}$ of sat. sol.	Gm. Mols. per 1000 cc sat. sol.	
HCl	KCl		HCl	KCl		HCl	KCl
0.0	26.31	1.1781	0.0	4.199	1.1169	5.672	0.607
3.31	20.93	1.1671	0.464	3.748	1.1272	7.144	0.309
6.15	15.87	1.1564	0.990	3.288	1.1423	8.433	0.267
10.31	10.28	1.1467	1.492	2.887	1.1713	10.68	0.215
15.07	6.51	1.1419	1.833	2.604	1.1855	11.74	0.20
23.15	2.70	1.1272	2.743	1.951	1.1863	11.81	0.22
28.05	1.87	1.1191	3.570	1.449	1.2009	12.96	0.24
31.83	1.19	1.1169	4.008	1.227			
40.98	0.15	1.1150	4.665	0.963			

Equilibrium in the System Potassium Chloride, Potassium Nitrate, Hydrochloric Acid, Nitric Acids and Water.

(Epstein and Kosterina, 1939.)

Cl

Gm. Mols. per 1000 gm. mols. H_2O				Solid Phase
$H^{\cdot}$	$K^{\cdot}$	Cl'	NO_3'	
	Results at -20°			
110	14.2	106.7	17.5	KCl + KNO_3
130	10.4	117.8	22.5	" "
150	7.6	127.3	30.3	" "
170	5.1	134.7	40.4	" "
190	4.8	141.2	53.6	" "
210	6.7	147.0	69.7	" "
220	8.7	149.2	79.5	" "
	Results at 0°			
110	20.5	104.0	26.5	" "
130	17.4	104.7	32.7	" "
150	15.1	123.1	42.0	" "
170	14.2	129.7	54.5	" "
190	14.6	134.1	70.5	" "
210	16.7	136.7	90.0	" "
220	20.0	137.5	102.5	" "
	Results at 21.5°			
110	39.5	104.5	45.0	" "
130	33.6	111.6	52.0	" "
150	30.8	117.7	63.1	" "
170	30.0	122.5	77.5	" "
190	31.0	126.0	95.0	" "
210	34.7	128.2	116.5	" "
220	38.7	128.7	130.0	" "

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROGEN PEROXIDE AT 25°.

(Akerlof and Turck, 1935.)

Composition of aq. solvent in:		Gm. Mols. KCl dissolved per 1000 gms. solvent	Composition of aq. solvent in:		Gm. Mols. KCl dissolved per 1000 gms. solvent
Wt. percent H_2O_2	Mol. Fraction H_2O_2		Wt. percent H_2O_2	Mol. Fraction H_2O_2	
0.0	0.0	4.826	21.19	0.1270	5.263
5.30	0.0288	4.835	26.24	0.1585	5.362
10.73	0.0599	4.974	31.43	0.1955	5.534
15.72	0.0899	5.093			

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORATE AND VICE VERSA.

(Fleck, 1937.)

Results at 0°

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	KCl	$KClO_3$	
1.153	21.90	0.0	KCl
1.157	21.16	0.71	" + $KClO_3$
1.121	16.21	0.82	$KClO_3$
1.068	8.47	1.09	"
1.022	0.0	3.05	"

Results at 20°

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	KCl	$KClO_3$	
1.176	25.70	0.0	KCl
1.183	25.17	0.89	"
1.184	24.60	1.55	" + $KClO_3$
(1.177	25.0	1.56	" ")
1.153	20.26	1.75	$KClO_3$
1.106	13.47	2.44	"
1.070	7.44	3.74	"
1.051	2.84	5.18	"
1.044	0.0	6.78	"

Results at 30°

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	KCl	$KClO_3$	
1.182	27.30	0.0	KCl
1.190	26.64	0.87	"
1.198	25.81	2.29	" + $KClO_3$
1.140	17.86	3.12	$KClO_3$
1.108	13.06	3.82	"
1.097	11.03	4.38	"
1.088	9.45	4.82	"
—	4.67	6.62	"
1.058	0.0	9.24	"

Results at 40°

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	KCl	$KClO_3$	
1.188	28.75	0.0	KCl
1.196	27.74	1.54	"
1.206	26.49	3.15	" + $KClO_3$
1.165	20.66	3.88	$KClO_3$
1.148	18.43	4.30	"
1.116	13.16	5.44	"
1.106	10.76	6.39	"
1.098	8.71	7.25	"
1.092	7.66	7.64	"
1.084	4.60	9.20	"
1.074	0.0	11.65	"

Results at 50°

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	KCl	$KClO_3$	
1.194	30.18	0.0	KCl
1.207	28.24	3.27	"
1.214	27.45	4.46	" + $KClO_3$
(1.211	28.3	4.32	" "
1.155	18.53	5.76	$KClO_3$
1.147	17.55	6.01	"
1.105	8.51	9.66	"
1.088	0.0	14.76	"

Results at 75°

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	KCl	$KClO_3$	
(1.244	29.30	8.08	KCl + $KClO_3$)

The three determinations in parentheses are by Donald, 1937.

A series of determinations for this system at 20 are reported by DiCapua and Scaletti, 1927, but differ considerably from the above results and are probably incorrect. These authors also give results for the equilibrium in the system $KCl + NaClO_3 \rightleftharpoons NaCl + KClO_3$ at 20°.

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHROMATE, DICHROMATE AND PERMANGANATE AT 25°.

(Herz and Niebenthal, 1909.)

Results for aqueous solutions of:

Potassium Chromate				Potassium Dichromate		Potassium Permanganate	
Gm. Mols. per liter		Gm. Mols. per liter		Gm. Mols. per liter		Gm. Mols. per liter	
K_2CrO_4/e	KCl	K_2CrO_4/e	KCl	$K_2Cr_2O_7/e$	KCl	$KMnO_4/5$	KCl
0.0	4.19	1.73	3.61	0.04	4.15	0.0	4.19
0.4	4.01	2.11	3.47	0.08	4.12	0.05	4.02
0.8	3.87	2.57	3.33	0.16	4.10	0.11	4.04
1.28	3.74	+ 4.69	2.69	+0.28	4.05	+ 0.40	4.00

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM IODIDE AT 25° AND VICE VERSA.

(Amadori and Pampanini, 1911.)

Gms. per 100 Gms. H_2O.		Gms. per 100 Gms. H_2O.	
KCl.	KI.	KCl.	KI.
0	149.26	19.64	68.22
4.06	144.03	23.75	43.89
7.63	137.79	29.56	23.83
11.36	132.60	31.38	14.83
11.74	133.90	33.68	7
15.10	105.91	36.12	0

Cl

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM IODIDE AND VICE VERSA AT SEVERAL TEMPERATURES.

(Harris and Christiansen, 1934.)

Results at 20°			Results at 30°			Results at 40°		
Gms. per 100cc sat. solution		Solid Phase	Gms. per 100 cc sat. solution		Solid Phase	Gms. per 100cc sat. solution		Solid Phase
KCl	KI		KCl	KI		KCl	KI	
29.74	0.0	KCl	31.88	0.0	KCl	33.98	0.0	KCl
6.69	90.7	" + KI	7.84	92.9	" + KI	7.86	95.9	" + KI
5.05	92.3	KI	5.53	96.8	KI	5.55	97.9	KI
3.47	95.3	"	4.21	98.0	"	4.39	101.2	"
1.82	97.4	"	2.03	100.4	"	2.04	104.5	"
0.0	100.3	"	0.78	103.2	"	0.0	107.2	"

SOLUBILITY OF MIXTURES OF POTASSIUM CHLORIDE AND POTASSIUM IODIDE IN WATER.

(Etard — Ann. chim. phys. [7] 3, 275, '94.)

t°.	Grams per 100 Gms. Solution.		t°.	Grams per 100 Gms. Solution.	
	KCl.	KI.		KCl.	KI.
0	3.7	50.5	100	6.2	61.0
20	4.2	53.0	140	7.3	63.7
40	4.7	55.3	180	8.3	65.5
60	5.2	57.5	220	9.4	66.3
80	5.7	59.4	245	10.0	66.5

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE, AND OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE, AT SEVERAL TEMPERATURES.

(Touren, 1900; Bodländer, 1891; Nicol, 1891; Soch, 1898.)

KCl in Aq. KNO_3 Solutions at:

14.5° (T.).		25.2° (T.).		20°, etc. (N.).	
Gms. per Liter Solution.		Gms. per Liter Solution.		Gms. per 1000 Gms. H_2O.	
KNO_3.	KCl	KNO_3.	KCl.	KNO_3.	KCl.
0	288.3	0	311.8	0	345.2
20.64	284.2	13.76	306.6	56.18	342.15
32.18	282.1	32.18	303.6	168.54	334.39
62.23	276.8	91.26	293.2	at 25° (S)	
82.77	273.5	122.7	287.2	225.8	341.3
115.9	270.7	141.4	284.2	at 80° (S)	
119.1	268.3	182.7	276	1175	402
123.4	267.2				

KNO_3 in Aq. KCl Solutions at:

14.5°.		25.2°.		20°.	
Gms. per Liter Solution.		Gms. per Liter Solution.		Gms. per 1000 Gms. H_2O.	
KCl.	KNO_3.	KCl.	KNO_3.	KCl.	KNO_3.
0	225.4	0	325.5	0	311.1
13.58	219.8	19.39	312.3	82.9	256.8
31.63	208.2	49.22	288.7	165.8	221.7
65.64	185.2	100.7	254	248.7	202
132.6	159.5	155.2	224.4	310.8	501.6
164.4	153.3	207.3	203.9		
196.5	144	226.8	196.9		
236.9	137.1				

C1

In the case of the results by Touren, constant temperature and agitation were employed.

KNO_3 in Aq. KCl at 20.5° (B.).

Gms. per 100 cc. Solution.		Sp. Gr of Solutions.
KCl.	KNO_3.	
0	27.68	1.1625
4.72	24.39	1.1700
7.74	22.44	1.1765
12.23	20.23	1.1895
15.15	18.96	1.1983
19.61	17.67	1.2150
22.17	17.11	1.2265
24.96	16.79	1.2400

KCl in Aq. KNO_3 at 17.5° (B.).

Gms. per 100 cc. Solution.		Sp. Gr. of Solutions.
KNO_3.	KCl.	
0	29.39	1.1730
6.58	27.50	1.1980
8.88	27.34	1.2100
12.48	26.53	1.2250
14.83	25.98	1.2360
15.22	25.96	1.2390
15.49	25.95	1.2388
15.33	26.24	1.2410

In the case of the above results by Bodländer, a saturated aqueous solution of potassium chloride was prepared and weighed amounts of potassium nitrate were added to measured volumes of it. The mixtures were warmed and then allowed to cool to the indicated temperature and frequently shaken during 24 hours.

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM IODATE AND VICE VERSA.

(Hill and Ricci, 1931.)

d. of sat. sol.	Gms. per 100 gms. sat. sol. KIO_3	Gms. per 100 gms. sat. sol. KCl	Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol. KIO_3	Gms. per 100 gms. sat. sol. KCl	Solid Phase
	Results at 5°				Results at 25° (Con.)		
1.155	0.0	22.84	KCl	1.073	4.29	5.93	KIO_3
1.170	1.44	22.64	" + KIO_3	1.066	5.83	2.78	"
1.147	1.50	19.56	KIO_3	1.071	8.45	0.0	"
1.089	1.79	10.13	"				
1.044	2.91	3.03	"		Results at 50°		
1.043	5.16	0.0	"	—	0.0	30.03	KCl
				—	1.77	29.40	"
	Results at 25°			—	3.07	29.08	" + KIO_3
1.179	0.0	26.36	KCl	—	3.74	23.17	KIO_3
1.197	2.10	25.82	" + KIO_3	—	4.71	15.64	"
1.153	2.40	19.64	KIO_3	—	7.42	6.83	"
1.109	3.01	12.37	"	—	13.21	0.0	-

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE AT 0° AND AT 25°.

(Armstrong and Eyre, 1910-11)

Cl

Solvent, Gms. KNO_3 per 1000 Gms. H_2O.	Gms. KCl Dissolved per 100 Gms. Sat. Solution at: 0°.	25°.
0	22.10	26.73
25.27	21.71	26.26
50.55	21.25	25.61
101.11	20.70	24.58
151.66	...	23.57

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE AND VICE VERSA.

(Leather and Mukerji, 1913.)

Results at 30°.			Results at 40°.			Results at 91°.			
Sp. Gr. Sat. Sol.	Gms. per 100 Gms. H_2O. KCl.	KNO_3.	Sp. Gr. Sat. Sol.	Gms. per 100 Gms. H_2O. KCl.	KNO_3.	Sp. Gr. Sat. Sol.	Gms per 100 Gms. H_2O. KCl.	KNO_3.	Solid Phase in Each Case.
1.186	37.58	0	1.194	40.60	0	1.222	53.58	0	KCl
1.219	36.72	8.05	1.252	39.11	16.86	1.344	47.85	52.75	"
1.251	36.10	19.36	1.305	37.08	35.45	1.486	43.30	114.6	"
1.281	35.42	26.83	1.319	37.49	39.71	1.552	39.90	162.9	" $+KNO_3$
1.258	28.71	29.19	1.312	32.22	41.52	1.544	33.25	165.6	KNO_3
1.241	19.35	32.34	1.297	22.63	46.31	1.545	15.56	181.1	"
1.225	9.44	38.10	1.279	11.58	52.66	1.552	0	202.8	"

Results are also given for 20°.

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE AND VICE VERSA AT 30°.

(Barbaudy, 1923.)

Gms. per 100 gms. sat. sol. KCl.	KNO_3	Solid Phase.	Gms. per 100 gms. sat. sol. KCl.	KNO_3.	Solid Phase
27.2	0.0	KCl	21.3	16.8	KNO_3
23.43	11.63	"	20.25	17.25	"
22.78	13.42	"	10.48	22.0	"
22.18	16.39	"	5.48	26.36	"
21.9	16.65	" $+KNO_3$	0.0	31.4	"

Data for equilibrium in the system potassium chloride + potassium oxalate + water at 20° are given by Trifnov, 1924-1925.

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE AND VICE VERSA AT 18.5°.

(Holluta and Mautner, 1927.)

To standard solutions of one of the salts an excess of the other salt was added and the mixtures heated to 60° and then cooled and shaken at 18.5° until equilibrium was attained. A given volume of the saturated solution was evaporated to dryness and from the weight of the residue, the concentration of the original aq. solvent and the densities of the original solvent and the final saturated solution, the weight of each salt present in 1000cc of the saturated solution was calculated. The results thus obtained agreed satisfactorily with calculations based upon chloride determinations.

Gm. Mols. KNO_3 per liter aq. solvent	d. of sat. sol.	Gms. per 1000 cc sat. solution	
		KNO_3	KCl
0.0	1.1738	0.0	298.50
0.2	1.1820	17.74	294.84
0.4	1.1899	35.46	292.32
0.6	1.1985	53.28	288.86
1.0	1.2147	88.86	283.16
1.5	1.2348	133.66	274.62
1.6671	1.2415	148.84	271.24

Gm. Mols. KCl per liter aq. solvent	d. of sat. sol.	Gms. per 1000 cc sat. solution	
		KCl	KNO_3
0.0	1.1560	0.0	265.92
0.2	1.1573	13.36	254.64
0.4	1.1598	26.80	245.84
0.6	1.1621	40.38	235.66
1.0	1.1682	67.76	218.96
2.0261	1.1887	139.16	184.74
3.0025	1.2141	207.94	163.74
3.8975	1.2415	271.24	148.82

Cl

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE AND VICE VERSA AT 25°.

(Nikalajew, 1929.)

Gms. per 100 gms. sat. sol.		Solid Phase
KCl	KNO_3	
26.5	0.0	KCl
25.05	4.30	"
23.75	7.92	"
22.95	11.41	"
21.94	14.72	" + KNO_3

Gms. per 100 gms. sat. sol.		Solid Phase
KCl	KNO_3	
15.64	17.20	KNO_3
10.65	19.82	"
6.74	22.30	"
4.50	24.02	"
0.0	27.86	"

Results are also given for the effect upon the above equilibrium of the presence of varying concentrations of HCl and of KOH.

The following values for the simultaneous solubility of KCl + KNO_3 in water at other temperatures than 25° are also given by Nikalajew, 1929.

t°	Gms. per 100 gms. sat. sol.		Solid Phase
	KCl	KNO_3	
0.2	20.44	6.38	KCl + KNO_3
17.0	22.23	11.00	" "
40.0	21.28	21.98	" "

t°	Gms. per 100 gms. sat. sol.		Solid Phase
	KCl	KNO_3	
60	18.56	34.12	KCl + KNO_3
80	15.47	46.29	" "
100	14.96	53.88	" "

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE AND VICE VERSA AT SEVERAL TEMPERATURES.

(Hering, 1928.)

d. of sat. sol.	Gms. per 100 gms. H_2O		Solid Phase
	KCl	KNO_3	
	Results at 0°		
—	27.9	0.0	KCl
—	27.7	8.72	" + KNO_3
—	0.0	13.3	KNO_3
	Results at 25°		
1.179	35.9	0.0	KCl
1.238	34.8	16.3	"
1.261	34.5	23.0	" + KNO_3
1.256	32.8	23.3	KNO_3
1.213	15.9	28.0	"
1.197	8.0	32.2	"
1.189	0.0	38.3	"
	Results at 50°		
1.194	42.4	0.0	KCl
1.350	38.2	54.1	" + KNO_3
1.333	23.7	61.3	KNO_3
1.329	11.9	71.5	"
1.332	0.0	85.7	"

d. of sat. sol.	Gms. per 100 gms. H_2O		Solid Phase
	KCl	KNO_3	
	Results at 75°		
1.203	49.6	0.0	KCl
1.252	47.5	16.8	"
1.316	45.3	40.6	"
1.388	42.5	72.7	"
1.457	39.4	111.0	" + KNO_3
1.454	25.0	122.0	KNO_3
1.457	10.2	139.0	"
1.462	0.0	153.0	"
	Results at 100°		
1.211	55.5	0.0	KCl
1.365	49.3	65.0	"
1.479	43.5	132.0	"
1.568	42.1	204.0	" + KNO_3
1.565	31.0	209.0	KNO_3
1.565	15.2	224.0	"
1.569	0.0	244.0	"

Additional results for this system at 0°, 20°, 40°, 60°, 80°, 100° and 320° in terms of the number of gm. mols. H_2O required to dissolve 100 gm. mols. of the two salts of determined molecular ratio, are given by Jänecke, 1928.

SOLUBILITY OF POTASSIUM CHLORIDE, POTASSIUM NITRATE AND POTASSIUM SULFATE IN WATER AT SEVERAL TEMPERATURES.

(Hering, 1928.)

t°	d. of sat. sol.	Gms. per 100 gms. H_2O			Solid Phase
		KCl	KNO_3	K_2SO_4	
0	—	27.4	8.8	1.15	KCl + KNO_3 + K_2SO_4
25	1.212	34.9	7.42	1.45	KCl + K_2SO_4
"	1.236	34.5	14.4	1.41	" "
"	1.266	34.2	23.1	1.40	" " + KNO_3
50	1.353	37.6	53.6	1.57	" " "
75	1.258	46.6	16.7	2.08	" "
"	1.322	44.4	40.8	1.93	" "
"	1.393	41.8	72.9	1.80	" "
"	1.461	39.1	110.3	1.77	" " + KNO_3
100	1.573	39.8	204.0	1.86	" " "

The following values for this system are given by Kritschensky and Goldmann, 1933.

25	—	35.23	23.84	0.70	KCl + KNO_3
"	—	35.82	12.48	1.45	" + K_2SO_4
"	—	31.22	21.66	1.38	" " + KNO_3
"	—	12.57	29.77	2.66	KNO_3 + K_2SO_4

EQUILIBRIUM IN SYSTEMS COMPOSED OF POTASSIUM AND SODIUM CHLORIDES NITRATES AND SULFATES.

Complete experimental data, including densities, in the form of tabular results and diagrams for these complex systems at temperatures between 0° and 90° are given by Cornec and Krombach, 1929, and Cornec, Krombach and Spack, 1930. These authors have made use, when necessary, of the results for the ternary and quarternary systems previously reported from their own laboratory and by other workers, including, Chretien, 1929, Cornec and Hering, 1925-7, Cornec and Krombach, 1929, Meyerhoffer and Saunders, 1899, d'Ans, 1915 and Blasdale, 1918.

Equilibrium in the Reciprocal Salt Pair $KCl + NH_4NO_3 \rightleftarrows KNO_3 + NH_4Cl$ at -10° and -15°.

((Kritschewsky and Goldmann, 1934.)

These results supplement the previous determinations of Jänecke, 1928, at 0-80° and Aronawa and Lunskaja, 1933, at 100°.

Results at -15°				Results at -10°				
Gm. Mols. per 1000 gms. H_2O				Gm. Mols. per 1000 gms. H_2O				Solid Phase
KCl	NH_4Cl	KNO_3	NH_4NO_3	KCl	NH_4Cl	KNO_3	NH_4NO_3	
1.64	4.11	—	—	1.60	4.15	—	—	$KCl + NH_4Cl$
—	3.79	—	7.67	—	3.99	—	9.16	$NH_4Cl + NH_4NO_3$
—	—	0.892	10.33	—	—	1.04	11.96	KNO_3 + "
—	—	—	—	2.45	1.91	—	—	KCl
—	—	—	—	0.661	4.63	—	—	NH_4Cl
—	—	—	—	1.38	4.48	0.502	—	" + KCl
0.976	4.35	0.774	—	1.14	4.59	0.921	—	" + " + KNO_3
—	3.90	0.890	8.28	—	3.99	0.900	9.49	$NH_4Cl + NH_4NO_3$ + "

C1

SOLUBILITY DATA FOR THE RECIPROCAL SALT PAIRS $KCl+NaNO_3 \rightleftarrows NaCl+KNO_3$ AT 5°, 25°, 50° AND 100°.

(Reinders, 1914, 1915; see also Uyeda, 1909-10.)

Results at 25°.				Results at 50°.				
Gms. per 100 Gms. H_2O.				Gms. per 100 Gms. H_2O.				Solid Phase in Each Case.
NaCl.	KCl.	$NaNO_3$.	KNO_3	NaCl.	KCl.	$NaNO_3$.	KNO_3.	
36.04	...	...	...	36.72	...	...	...	NaCl
32.28	10	...	...	...	...	...	...	"
30.27	16.45	...	...	28.35	23.09	...	...	NaCl+KCl
12	26.78	...	...	...	42.80	...	...	KCl
...	35.54	...	10	...	41.39	...	24.05	"
...	34.92	...	22.79	...	38.75	...	52.54	$KCl+KNO_3$
...	10	...	31.48	...	...	...	85.10	KNO_3
...	...	10	37.49	...	...	...	...	"
...	...	60	41.87	...	...	...	...	"
...	...	100.9	46 15	...	...	134.9	90.2	KNO_3+NaNO_3
...	...	96 06	20	...	...	114.1	...	$NaNO_3$
10	...	77.46	...	...	...	...	...	"
23.62	...	58 01	...	20.5	...	84.8	...	$NaNO_3+NaCl$
33.90	...	10	...	28.4	...	43.9	...	NaCl
24.82	22.2	15.4	...	34	13.4	...	24.3	NaCl+KCl
21.36	20	..	32.9	12.7	25.4	...	58.6	$KCl+KNO_3$
24.5	...	61.3	17.2	...	...	...	...	KNO_3+NaNO_3
7	...	82.1	43.15	19.2	...	104.1	27.2	$NaNO_3+NaCl$
23.8	...	64	41.2	12.2	...	110.7	82.2	$NaCl+NaNO_3+KNO_3$
4.5	...	...	40.3	59.9	...	6.1	70.9	$NaCl+KCl+KNO_3$

Results at 5°.				Results at 100°.				
31.50	10.4	...	...	27.3	36.2	...	...	NaCl+KCl
...	29.84	...	10.14	...	41.6	...	199	$KCl+KNO_3$
...	...	82.10	18.1	...	...	233.6	218	KNO_3+NaNO_3
27.6	...	41.7	...	19.2	...	158	...	$NaNO_3+NaCl$

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM HYDROXIDE AT VARIOUS TEMPERATURES. (von Antropoff, 1924.)

Gms. KOH per 100 gms. sat. sol.	Gms. KCl per 100 gms. sat. solution at -21°3.	-11°1.	0°.	10°.	20°.	30°.
5	–	15.4(1.180)	17.6(1.185)	19.2(1.184)	20.8(1.180)	22.2(1.182)
10	–	11.7(1.189)	13.5(1.194)	15.0(1.203)	16.4(1.201)	17.9(1.204)
15	7.9(1.204)	8.8(1.206)	9.9(1.219)	11.3(1.227)	12.3(1.226)	13.6(1.230)
20	5.6(1.239)	6.3(1.238)	7.2(1.249)	8.0(1.256)	8.8(1.252)	10.2(1.258)
25	3.6(1.280)	4.2(1.278)	4.9(1.283)	5.4(1.285)	6.2(1.283)	7.4(1.289)
30	2.2(1.326)	2.6(1.323)	3.0(1.322)	3.6(1.324)	4.2(1.318)	5.0(1.323)
35	1.2(1.376)	1.5(1.372)	1.8(1.370)	2.2(1.366)	2.6(1.362)	3.2(1.364)
40	0.7(1.430)	0.9(1.425)	1.0(1.419)	1.3(1.415)	1.5(1.411)	1.8(1.409)
45	0.4(1.486)	0.5(1.478)	0.6(1.471)	0.7(1.469)	0.9(1.465)	1.1(1.460)
50	–	–	–	0.5(1.525)	0.6(1.521)	0.8(1.515)
55	–	–	–	–	–	0.5(1.571)

Gms. KOH per 100 gms. sat. sol.	Gms. KCl per 100 gms. sat. solution at 50°.	70°.	90°.	120°.	150°.	180°.
5	24.7 (1.186)	27.3 (1.196)	29.7 (1.214)	33.0	36.0	38.3
10	20.2 (1.208)	22.7 (1.220)	24.8 (1.231)	27.9	30.8	33.1
15	16.0 (1.236)	18.4 (1.243)	20.0 (1.250)	22.9	25.8	28.1
20	12.3 (1.263)	14.4 (1.270)	15.9 (1.272)	18.0	21.2	23.5
25	9.1 (1.293)	10.8 (1.299)	12.1 (1.298)	14.5	17.0	19.1
30	6.3 (1.324)	7.7 (1.330)	9.1 (1.330)	11.3	13.8	15.3
35	4.1 (1.358)	5.3 (1.364)	6.6 (1.367)	8.8	10.5	12.1
40	2.5 (1.404)	3.7 (1.404)	4.5 (1.408)	6.7	8.0	9.3
45	1.6 (1.458)	2.5 (1.451)	3.1 (1.451)	5.0	6.0	7.1
50	1.1 (1.511)	1.7 (1.505)	2.2 (1.500)	3.3	4.4	5 5
55	0.9 (1.568)	1.1 (1.566)	1.8 (1.556)	2.5	3.4	4.7
60	–	–	1.4 (1.618)	2.0	2.7	4.0
65	–	–	–	1.7	2.5	3.9
70	–	–	–	–	2.7	–

The figures in parentheses are the densities of the saturated solutions.

SIMULTANEOUS SOLUBILITY OF POTASSIUM CHLORIDE AND POTASSIUM HYDROXIDE AT THE EUTECTIC TEMPERATURES. (von Antropoff, 1924.)

Eutec. temp.	Gms. per 100 gms. sat. sol. KOH.	KCl.	Solid Phase.	Eutec. temp.	Gms. per 100 gms. sat. sol. KOH.	KCl.	Solid Phase.
—21.30	11.23	9.69	KCl + Ice	±0	48.93	0.44	$KOH.2H_2O$+KCl
—17.35	10.62	10.24	»	10	50.69	0.45	» »
—11.0	–	19.74	»	20	52.83	0.55	» »
—67.2	30.73	0.23	$KOH.4H_2O$(?)+Ice	30	55.28	0.47	» »
—65.2	30.83	–	» »	50	58.09	0.67	$KOH.H_2O$+ »
—65.6	29.62	–	» »	70	59.63	0.91	» »
—64.3	30.59	0.43	» »+KCl	90	61.75	1.25	» »
—21.3	46.6	0.38	$KOH.2H_2O$+KCl	120	65.31	1.70	» »
—11.1	47.45	0.38	» »	150	73.57	2.87	KOH+ »

Solubility of Potassium Chloride in Aqueous Solutions of Potassium Hydroxide at 20°. (Brönstod, 1920 *a*.)

Gm. mols. per liter.		Gm. mols. per liter.		Gm. mols. per liter.	
KOH.	KCl.	KOH.	KCl.	KOH.	KCl.
4.71	1.605	11.10	0.253	14.02	0.136
7.90	0.712	12.19	0.191	14.85	0.121
9.41	0.405	12.92	0.168	15.02	0.118
10.95	0.273	13.84	0.138		

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM HYDROXIDE AT 25°.

(Akerlof and Short, 1937.)

Gm. Mols. per 1000 gms. H_2O		Gm. Mols. per 1000 gms. H_2O		Gm. Mols. per 1000 gms. H_2O		Gm. Mols. per 1000 gms. H_2O	
KOH	KCl	KOH	KCl	KOH	KCl	KOH	KCl
1.023	4.079	4.102	2.265	8.37	0.894	15.53	0.281
1.053	4.056	5.187	1.847	9.43	0.750	16.59	0.247
2.033	3.397	5.273	1.839	10.54	0.638	18.42	0.210
2.126	3.365	6.108	1.444	11.28	0.529	19.32	0.198
2.897	2.889	6.203	1.576	12.53	0.433	20.64	0.183
3.150	2.778	7.210	1.246	13.42	0.370	20.55	0.184
3.998	2.473	7.211	1.175	14.44	0.311		

The solid phase is KCl in all cases.

Solubility of Potassium Chloride in Aqueous Solutions of Potassium Hydroxide at the Boiling Points. (von Antropoff, 1924.)

B. pt.	*d* of sat. sol.	Gms. per 100 gms. sat. sol. KOH.	Gms. per 100 gms. sat. sol. KCl.	B. pt.	*d* of sat. sol.	Gms. per 100 gms. sat. sol. KOH.	Gms. per 100 gms. sat. sol. KCl.
108.5	–	0.0	36.5	120.7	1.351	30.0	11.9
109.2	1.227	5.0	31.9	125.7	1.382	35.0	9.6
110	1.245	10.0	27.4	131.5	1.415	40.0	7.7
111.5	1.266	15.0	22.9	139.3	1.448	45.0	6.4
113.5	1.292	20.0	18.7	151.5	1.8	50.0	5.4
116.5	1.320	25.0	14.9	166.3	–	55.0	4.7

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF MONO POTASSIUM PHOSPHATE AND VICE VERSA AT 0°.

(Askenasy and Nessler, 1930.)

The results are expressed in the Jänecke method which is in terms of the number of gm. mols. of H_2O required to dissolve 100 gm. mols. of salt or salt mixture of determined molecular composition.

d. of sat. sol.	Composition of Dissolved Salts in Gm. Mols.		Gm. Mols. H_2O to dissolve 100 gm. mols. salt mixture	Solid Phase
	KCl	KH_2PO_4		
1.1420	100.0	0.0	1440	KCl
1.1690	95.8	4.2	1420	"
1.1750	92.1	7.9	1415	" + KH_2PO_4
1.1427	73.0	27.0	1840	KH_2PO_4
1.1199	62.7	37.3	2210	"
1.1183	44.9	55.1	2860	"
1.1179	31.7	68.3	3320	"
1.1158	18.1	81.9	3540	"
1.1151	0.0	100.0	4125	"

The author also gives results for the quarternary system $(K, NH_4)(Cl, H_2PO_4) + H_2O$ at 0°.

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE AND VICE VERSA..

(Hering, 1936.)

d. of sat. sol.	Gms. per 100 gms. H_2O		Solid Phase	d. of sat. sol.	Gms. per 100 gms. H_2O		Solid Phase
	K_2SO_4	KCl			K_2SO_4	KCl	
	Results at 0°				Results at 50° (con.)		
—	0.0	27.9	KCl	1.104	16.5	0.0	K_2SO_4
—	1.08	27.7	" + K_2SO_4				
—	7.38	0.0	K_2SO_4		Results at 75°		
	Results at 25°			1.203	0.0	49.6	KCl
				1.211	2.14	48.8	" + K_2SO_4
1.179	0.0	35.9	KCl	1.171	3.46	36.3	K_2SO_4
1.185	1.45	35.7	" + K_2SO_4	1.135	5.82	24.3	"
1.153	2.13	27.1	K_2SO_4	1.110	10.8	12.3	"
1.120	3.40	18.2	"	1.116	20.6	0.0	"
1.092	6.07	9.2	"				
1.086	12.1	0.0	"		Results at 100°		
	Results at 50°			1.211	0.0	55.5	KCl
				1.216	2.55	55.0	" + K_2SO_4
1.194	0.0	43.0	KCl	1.119	24.0	0.0	K_2SO_4
1.200	1.79	42.4	" + K_2SO_4				

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE AT 100° AND VICE-VERSA.

(Campbell, Downes and Samis, 1934.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
K_2SO_4	KCl		K_2SO_4	KCl	
0.0	35.60	KCl	5.54	18.63	K_2SO_4
1.56	34.64	"	11.00	8.58	"
1.63	35.96	" + K_2SO_4	18.76	0.0	"
2.46	28.58	K_2SO_4			

SOLUBILITY OF MIXTURES OF POTASSIUM CHLORIDE AND POTASSIUM SULFATE IN WATER.

t°.	Gms. per 100 Gms. H_2O.		Observer.	t°.	Gms. per 100 Gms. H_2O.		Observer.
	KCl +	K_2SO_4.			KCl +	K_2SO_4.	
10	30.9	1.32	(Precht & Wittgen.)	40	38.7	1.68	(P. and W.)
15.8	28	2.3	(Kopp.)	50	41.3	1.82	"
20	33.4	1.43	(P. and W.)	60	43.8	1.94	"
25	34.76	2.93	(Van't Hoff & Meyerhoffer.)	80	49.2	2.21	"
30	36.1	1.57	(P. and W.)	100	54.5	2.53	"

100 gms. aq. solution, sat. with both salts, contain 26.2 gms. KCl + 1.09 gms. K_2SO_4 at 30°. (Schreinemakers and de Baat, 1914.)

EQUILIBRIUM IN THE SYSTEM POTASSIUM CHLORIDE, POTASSIUM SULFATE AND POTASSIUM CARBONATE IN WATER.

(Teeple, 1929.)

Gms. per 100 gms. H_2O KCl	K_2SO_4	K_2CO_3	Solid Phase
Results at 35°			
39.0	—	—	KCl
—	14.1	—	K_2SO_4
—	—	115.1	$K_2CO_3.1\frac{1}{2}H_2O$
38.4	1.7	—	KCl + K_2SO_4
3.1	—	114.1	" + $K_2CO_3.1\frac{1}{2}H_2O$
—	trace	112.5	$K_2CO_3.1\frac{1}{2}H_2O$ + K_2SO_4
2.9	"	112.7	" + " + KCl
Results at 50°			
43.1	—	—	KCl
—	17.1	—	K_2SO_4
—	—	121.2	$K_2CO_3.1\frac{1}{2}H_2O$
42.2	1.8	—	K_2SO_4 + KCl
Results at 50° (con.)			
3.6	—	121.3	$K_2CO_3.1\frac{1}{2}H_2O$+KCl
—	trace	121.2	" + K_2SO_4
3.6	"	121.2	" + " + KCl
Results at 75°			
49.7	—	—	KCl
—	20.6	—	K_2SO_4
—	—	136.4	$K_2CO_3.1\frac{1}{2}H_2O$
48.5	1.9	—	KCl + K_2SO_4
5.2	—	134.9	$K_2CO_3.1\frac{1}{2}H_2O$ + KCl
—	trace	135.8	" + K_2SO_4
5.2	"	133.5	" + " + KCl

Data for the following four or more component Systems containing KCl, in Water, are given by Teeple, 1929.

KCl + NaCl + Na_2SO_4 + K_2SO_4 at 35°, 50° and 75°.
KCl + NaCl + Na_2CO_3 + K_2CO_3 at 35°, 50° and 75°.
KCl + NaCl + Na_2SO_4 + K_2SO_4 + Na_2CO_3 + K_2CO_3 at 20°, 35°, 50°, 75° and 100°
KCl + NaCl + $Na_2B_4O_7$ + $K_2B_4O_7$ at 35°.
KCl + NaCl + $Na_2B_{10}O_{16}$ + $K_2B_{10}O_{16}$ at 35°.

SOLUBILITY DATA FOR THE RECIPROCAL SALT PAIRS $KCl+Na_2SO_4 \rightleftarrows K_2SO_4+NaCl$.

(Meyerhoffer and Saunders, 1899.)

t°.	d_{t} of Sat. Sol.	Mols. per 1000 Mols. H_2O. SO_4.	K_2.	Na_2.	Cl_2.	Solid Phase.
4.4*	...	5.42	14.39	51.83	60.8	$K_3Na(SO_4)_2+KCl+NaCl$
0.2	...	3.35	12.78	50.93	60.36	$Na_2SO_4.10H_2O+KCl+NaCl$
0.4	...	3.59	16.38	40.75	53.54	$Na_2SO_4.10H_2O+KCl+K_3Na(SO_4)_2$
16	...	4.72	17.58	50.56	63.42	$K_3Na(SO_4)_2+KCl+NaCl$
24.8	1.2484	4.37	20.02	48.36	64.01	"
16.3*	...	16.29	9.16	61.06	53.93	$K_3Na(SO_4)_2+NaCl+Na_2SO_4.10H_2O+Na_2SO_4$
24.5	1.2625	14.45	9.90	58.46	53.91	$K_3Na(SO_4)_2+NaCl+Na_2SO_4$
0.3	...	2.75	25.77	17.93	40.95	$K_3Na(SO_4)_2+KCl+K_2SO_4$
25	1.2034	2.94	36.20	14.80	48.06	"
17.9*	1.2470	13.84	0	62.54	48.70	$Na_2SO_4.10H_2O+Na_2SO_4+NaCl$
30.1*	1.289	50.41	10.08	40.33	0	$K_3Na(SO_4)_2+Na_2SO_4.10H_2O+Na_2SO_4$

* tr. pt.

Curves are given in the original paper and a complete discussion of the older work.

SOLUBILITY OF MIXTURES OF SODIUM SULFATE, POTASSIUM CHLORIDE, POTASSIUM SULFATE, ETC., IN WATER.

(Meyerhoffer and Saunders, 1899.)

t°.	Sp. Gr. of Solutions.	Mols. per 1000 Mols. H_2O. SO₄	K₂	Na₂	Cl₂	Solid Phase.
*4.4	...	5.42	14.39	51.83	60.8	$K_3Na(SO_4)_2+Na_2SO_4.10H_2O+KCl+NaCl$
0.2	...	3.35	12.78	50.93	60.36	$Na_2SO_4.10H_2O+KCl+NaCl$
0.4	...	3.59	16.38	40.75	53.54	$Na_2SO_4.10H_2O+KCl+K_3Na(SO_4)_2$
16.3	...	4.72	17.58	50.56	63.42	$K_3Na(SO_4)_2+KCl+NaCl$
24.8	1.2484	4.37	20.00	48.36	64.01	$K_3Na(SO_4)_2+KCl+NaCl$
*16.3	...	16.29	9.16	61.06	53.93	$K_3Na(SO_4)_2+NaCl+Na_2SO_4.10H_2O+Na_2SO_4$
24.5	1.2625	14.45	9.90	58.46	53.91	$K_3Na(SO_4)_2+NaCl+Na_2SO_4$
0.3	...	2.75	25.77	17.93	40.95	$K_3Na(SO_4)_2+KCl+K_2SO_4$
25.0	1.2034	2.94	36.20	14.80	48.06	$K_3Na(SO_4)_2+KCl+K_2SO_4$
*17.9	1.2474	13.84	0.0	62.57	48.70	$Na_2SO_4.10H_2O+Na_2SO_4+NaCl$
*30.1	1.2890	50.41	10.08	40.33	0.0	$K_3Na(SO_4)_2+Na_2SO_4.10H_2O+Na_2SO_4$
−21.4	...	...	...	46.61	46.36	$NaCl.2H_2O+Na_2SO_4.10H_2O$
−23.7	...	...	10.51	39.58	50.09	$NaCl.2H_2O+KCl$
−10.9	...	1.45	30.68	...	29.23	$KCl+K_2SO_4$
−3	...	16.25	10.03	6.21	...	$K_3Na(SO_4)_2+Na_2SO_4.10H_2O$
−3	...	16.24	10.03	6.21	...	$K_3Na(SO_4)_2+K_2SO_4$
−14	...	1.39	25.59	8.78	32.94	$K_3Na(SO_4)_2+Na_2SO_4.10H_2O+KCl$
−14	...	1.39	25.59	8.78	32.94	$K_3Na(SO_4)_2+K_2SO_4+KCl$
−23.3	...	0.41	15.15	44.20	58.97	$Na_2SO_4.10H_2O+KCl+NaCl.2H_2O$

* Indicates transition points.

EQUILIBRIUM IN THE SYSTEM POTASSIUM CHLORIDE, POTASSIUM SULFATE, SODIUM CHLORIDE, SODIUM SULFATE AND WATER AT DIFFERENT TEMPERATURES:

(Blasdale, 1918.)

Saturation was secured by constant stirring at constant temperature.

Results at 25°.

d of sat. sol.	Gms. per 100 gms. H_2O. KCl.	K_2SO_4.	NaCl.	Na_2SO_4.	Solid Phase.
1.212	–	–	–	27.93	Na_2SO_4
1.088	–	12.02	–	–	K_2SO_4
1.187	36.96	–	–	–	KCl
1.199	–	–	35.63	–	NaCl
1.282	–	9.31	–	30.97	$Na_2SO_4+K_3Na(SO_4)_2$(Glaserite)
1.149	–	13.24	–	6.69	K_2SO_4+ »
1.190	36.63	1.53	–	–	» +KCl
1.237	16.28	–	29.88	–	NaCl+ »
1.239	–	–	32.19	9.81	» $+Na_2SO_4$
1.243	–	–	18.82	21.68	$Na_2SO_4.10H_2O+$ »
1.273	–	7.32	14.28	22.28	» + » $+K_3Na(SO_4)_2$
1.200	29.38	2.23	6.78	–	$KCl+K_2SO_4+$ »
1.250	16.37	–	27.96	3.51	» + Na Cl + »
1.266	–	11.04	34.90	2.25	Na_2SO_4+ » + »

Exactly similar results are also given for 0°, 50°, 75° and 100°.

Fusion-point data for mixtures composed of the various combinations, KCl, K_2SO_4, LiCl, Li_2SO_4, NaCl and Na_2SO_4, are given by Dombrowskaja and Klatchko, 1933.

POTASSIUM CHLORIDE

Equilibrium in the Reciprocal Salt Pair

$2KCl + (NH_4)_2SO_4 \rightleftarrows K_2SO_4 + 2NH_4Cl$

in Water Alone and in Water Saturated with Ammonia at Atmospheric Pressure. (Hill and Loucks, 1937.)

Results for the 3 component Systems in Water at 25°

Gms. per 100 gms. sat. solution				Solid Phase
$(NH_4)_2SO_4$	KCl	K_2SO_4	NH_4Cl	
—	26.42	—	—	KCl
—	25.90	1.05	—	" + K_2SO_4
—	0.0	10.80	—	K_2SO_4
10.36	—	9.59	—	(0.953 K_2SO_4 + 0.047 $(NH_4)_2SO_4$)
15.40	—	8.72	—	(0.925 " + 0.075 ")
28.31	—	6.12	—	(0.773 " + 0.227 ")
39.20	—	2.86	—	(0.195 " + 0.805 ")
43.42	—	—	—	$(NH_4)_2SO_4$
26.12	—	—	16.35	" + NH_4Cl
—	11.02	—	21.97	(0.166 NH_4Cl + 0.834 KCl) + (0.975 NH_4Cl + 0.025 KCl)
—	26.42	—	—	KCl

Results for the 3 component Systems in Water at 25°, sat. with NH_3.

Gms. per 100 gms. sat. solution				Solid Phase
$(NH_4)_2SO_4$	KCl	K_2SO_4	NH_4Cl	
—	15.26	—	—	KCl
—	15.30	trace	—	" + K_2SO_4
—	0.0	0.20	—	K_2SO_4
2.85	—	—	—	(0.932 K_2SO_4 + 0.068 $(NH_4)_2SO_4$)
7.56	—	0.23	—	(0.776 " + 0.224 ")
11.35	—	—	—	(0.676 " + 0.324 ")
11.98	—	—	—	(0.525 " + 0.475 ")
13.54	—	0.20	—	(0.342 " + 0.658 ")
14.97	—	—	—	(0.186 " + 0.814 ")
17.55	—	0.07	—	(0.083 " + 0.917 ")
18.4	—	0	—	$(NH_4)_2SO_4$
4.66	—	—	33.72	" + NH_4Cl
—	—	—	35.59	NH_4Cl
—	2.86	—	33.59	(0.158 NH_4Cl + 0.842 KCl) + (0.977 NH_4Cl + 0.023 KCl)

The results in parentheses show the composition of the solid solutions present as solid phases.

The authors also give results for the 4 component systems saturated with solid phases composed of mixtures of the three solid solutions of the salts. They also investigated, for the purpose of industrial preparation of K_2SO_4, the field in which this salt separates in order to learn what percentage of $(NH_4)_2SO_4$ accompanies it as a contamination.

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF MAGNESIUM CHLORIDE AT 0° AND VICE VERSA.

(Igelsrud, and Thompson, 1936.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$MgCl_2$	KCl		$MgCl_2$	KCl	
0.0	21.87	KCl	26.79	2.13	KCl + 1.1.6
5.88	15.21	"	27.03	1.68	1.1.6
9.49	11.70	"	29.70	0.49	"
16.33	6.31	"	34.68	0.026	" + $MgCl_2.6H_2O$
25.24	2.35	"	34.63	0.0	$MgCl_2.6H_2O$

1.1.6 = $KCl.MgCl_2.6H_2O$ (Carnallite)

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS MAGNESIUM CHLORIDE SOLUTIONS.

(Precht and Wittgen — Ber. 14, 1667, '81.)

t°.	Grams KCl per 100 Grams Sat. Solution in:				
	11% $MgCl_2$.	15% $MgCl_2$.	21.2% $MgCl_2$.	30% $MgCl_2$.	20% $MgCl_2$
10	14.3	9.9	5.3	1.9	4.2 KCl + 5.7 NaC
20	15.9	11.3	6.5	2.6	6.0 " + 5.9 "
30	17.5	12.7	7.6	3.4	6.9 " + 6.0 "
40	19.0	14.2	8.8	4.2	7.9 " + 6.1 "
50	20.5	15.6	10.0	5.0	8.9 " + 6.3 "
60	21.9	17.0	11.2	5.8	9.9 " + 6.4 "
80	24.5	19.5	13.6	7.3	10.9 " + 6.6 "
90	25.8	20.8	14.7	8.1	11.9 " + 6.7 "
100	27.1	22.1	15.9	8.9	13.0 " + 6.9 "

Cl

More recent data on the solubility of potassium chloride in aqueous solutions of magnesium chloride are given by Feit and Przibylla (1909).

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF MAGNESIUM CHLORIDE AT 100°.

(Campbell, Downes and Samis, 1934.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$MgCl_2$	KCl		$MgCl_2$	KCl	
0.0	36.0	KCl	24.80	9.60	KCl
4.35	29.80	"	29.89	5.15	" + 1.1.6
9.93	23.59	"	40.0	1.88	1.1.6
16.35	17.50	"	40.0	1.64	"
20.15	13.45	"	41.0	0.73	" + $MgCl_2.6H_2O$

1.1.6 = $KCl.MgCl_2.6H_2O$ (Carnallite).

Results for the four component system KCl + K_2SO_4 + $MgCl_2$ + $MgSO_4$ at 100° are also given by Campbell, Downes and Samis, 1934.)

EQUILIBRIUM IN THE SYSTEM MAGNESIUM CHLORIDE, POTASSIUM CHLORIDE AND WATER AT DIFFERENT TEMPERATURES. (Keitel, 1923.)

t°.	Gms. per 100 gms. sat. sol. $MgCl_2$.	KCl.	Solid Phase.	t°.	Gms. per 100 gms. sat. sol. $MgCl_2$.	KCl.	Solid Phase.
15...	35.10	0.0	Bischofite	55...	15.14	14.79	KCl
15...	27.59	2.76	KCl + Carnallite	55...	7.24	23.40	»
15...	23.83	5.49	KCl	83...	39.80	0.0	Bischofite
15...	16.57	10.73	»	83...	37.80	1.01	» + Carnallite
15...	7.66	17.66	»	83...	36.99	2.52	Carnallite
25...	35.60	0.0	Bischofite	83...	29.45	5.80	» + KCl
25...	35.14	0.5	» + Carnallite	83...	20.53	12.75	KCl
25...	27.70	3.70	KCl »	83...	14.63	18.31	»
25...	26.81	4.56	KCl	83...	14.77	18.27	»
25...	24.58	5.22	»	83...	7.15	26.85	»
25...	23.10	6.06	»	105...	43.47	0.0	Bischofite
25...	16.40	10.36	»	105...	40.75	1.07	» + Carnallite
25...	15.64	11.54	»	105...	36.51	3.62	Carnallite
25...	7.68	19.50	»	105...	30.82	7.00	» + KCl
55...	37.55	0.0	Bischofite	105...	21.44	14.83	KCl
55...	37.38	0.21	»	105...	14.08	21.72	»
55...	36.88	0.62	» + Carnallite	105...	13.97	21.87	»
55...	28.74	4.43	KCl »	105...	6.52	29.90	»
55...	22.72	9.79	KCl	105...	0.0	36.45	»

Cl

Bischofite = $MgCl_2.6H_2O$; Carnallite = $MgCl_2.KCl.6H_2O$.

The following determinations at 25° are reported by Lee and Egerton, 1923.

$d_{\frac{25}{25}}$ of sat. sol.	Gms. per 100 gms. sat. sol. $MgCl_2$.	KCl.	Solid Phase.	$d_{\frac{25}{25}}$ of sat. sol.	Gms. per 100 gms. sat. sol. $MgCl_2$.	KCl.	Solid Phase.
1.341	35.54	0.0	$MgCl_2.6H_2O$	-	26.79	3.20	KCl+Carnallite
-	35.14	0.53	» +Carnallite	-	26.66	3.19	»
-	35.13	0.38	» »	1.234	19.83	7.90	KCl
-	35.47	0.52	» »	1.201	12.11	13.56	»
-	26.81	3.33	KCl »	1.182	0.0	26.74	»

POTASSIUM CHLORIDE

EQUILIBRIUM IN THE SYSTEM POTASSIUM CHLORIDE, MAGNESIUM CHLORIDE AND WATER AT TEMPERATURES ABOVE 100°.

(Achomow and Wassilljew, 1938.)

d. of sat. sol.	Gms. per 1000 gms. H_2O		Solid Phase	d. of sat. sol.	Gms. per 1000 gms. H_2O		Solid Phase
	$MgCl_2$	KCl			$MgCl_2$	KCl	
Results at 100°				Results at 150°			
—	100	415	KCl	—	100	558	KCl
—	300	220	"	—	300	347	"
—	500	108	"	—	500	214	"
—	700	10	"	—	900	105	"
1.307	507	103	" + 1.1.6	1.381	864	90	" + 1.1.6
1.384	723	9	1.1.6+$MgCl_2.4H_2O$	1.435	1054	37	1.1.6+$MgCl_2.4H_2O$
				1.455	1178	46(167°)	KCl + $MgCl_2.4H_2O$
Results at 125°							
				Results at 200°			
—	100	480	KCl				
—	300	280	"	—	100	687	KCl
—	500	160	"	—	300	454	"
—	700	82	"	—	500	294	"
1.335	690	100	" + 1.1.6	—	900	162	"
1.420	890	28	1.1.6 + $MgCl_2.4H_2O$	1.472	1290	54	"+$MgCl.2H_2O$

1.1.6 = $KCl.MgCl_2.6H_2O$ (Carnallite)

The authors also give results for the system KCl + NaCl + $MgCl_2$ + H_2O at 100-200°.

Data for the System KCl + $MgCl_2$ + NaCl + $MgSO_4$ at 20°-200° + are given by Froehlich, 1929.

Data for the reciprocal Salt pairs $(KCl)_2 + MgBr_2 \rightleftarrows (KBr)_2 + MgCl_2$, at 20°, recalculated from the results of Boeke, 1908, are given by Jänecke, 1938.

Data for the System KCl + RbCl + $MgCl_2$ + H_2O at 25°, recalculated from the results of D'Ans and Busch, 1937, are given by Jänecke, 1937, 1938.

SOLUBILITY OF MIXTURES OF POTASSIUM CHLORIDE AND AMMONIUM CHLORIDE IN WATER AT 25°.

(Fock — Z. Kryst. Min. 28, 353, '97.)

Grams per Liter Solution.		Mol. per cent in Solution.		Sp. Gr. of Solutions.	Mol. per cent in Solid Phase.	
NH_4Cl	KCl	NH_4Cl	KCl.		NH_4Cl	KCl.
0.00	311.3	0.00	100.0	1.1807	0.0	100
22.81	293.3	9.41	90.59	1.1716	1.21	98.79
35.39	278.7	15.04	84.96	1.1678	2.11	97.89
89.17	273.2	34.26	65.74	1.1591	6.18	93.82
127.8	234.6	46 59	53.44	1.1493	8.90	91.10
147.2	204.2	51 63	48.37	1.1461	10.53	89.47
197.3	157.7	63.56	36.44	1.1391	17.86	82.14
232.5	116.8	73.49	26.51	1.1326	60.20	39.80
244.5	123.0	73 48	26.52	1.1329	76.88	23.12
261.9	111.0	79.10	20.90	1.1245	97.51	2.49
259.0	102.2	82 14	17.86	1.1212	97.79	2.21
278.6	53.16	87.96	12.04	1.1009	98.85	1.15
320.7	31.24	93.45	6.55	1.0912	99.33	0.67
273.5	**0.00**	**100.00**	**0.00**	**1.0768**	**100.0**	**0.00**

The following additional data for the above system are given by Biltz and Marcus (1911). The results show that $NH_4Cl + KCl$ form a series of mix-crystals broken by a gap which extends between about 20 and 98 mol. per cent NH_4Cl in the crystals.

Composition of Sat. Solution.				Composition of Solid Phase.		
Gms. per 100 Gms. Sat Sol		Mols. per 1000 Mols. H_2O		Gms per 100 Gms Crystals		Mol. % NH_4Cl in Crystals.
NH_4Cl.	KCl.	NH_4Cl	KCl.	NH_4Cl.	KCl.	
5.13	22 29	23.8	74.2	1.21	98.79	1.7
7	20.40	32.5	67.9	2.22	97.78	3.1
11	18.04	52.2	61.4	4	96	5.5
13.73	16.11	65.9	55.5	5.89	94.11	8
15.46	14.53	74.4	50.2	7.24	92.76	9.8
19.54	12.16	96.3	43	11.20	88.80	14.9
22.04	10.49	109	37.4	16.90	83 10	22.1
21.68	10.40	109	37.4	26.04	73.96	32.9
21.95	10 48	109	37.4	97.60	2 40	98.3
24.30	6.48	118.2	22.6	98.28	1.72	98.8

These authors also give data for the ammonium chloride carnellite and potassium chloride carnellite diagram at 25°.

SOLUBILITY OF MIXTURES OF AMMONIUM AND POTASSIUM CHLORIDES IN WATER AT 25°, 65° AND 90°.

(Uyeda, 1912.)

The results as presented by Uyeda show the percentage composition of the dissolved mixture and of the undissolved residue in the several cases, but not the quantity of salts dissolved. Mixed crystals were formed over certain ranges of concentration at each temperature.

Data for the cryohydric temperatures and composition of the saturated solutions of mixtures of the chlorides, nitrates and sulfates of ammonium, potassium and sodium are given by Mazatto (1891).

EQUILIBRIUM IN THE SYSTEM POTASSIUM CHLORIDE, AMMONIUM CHLORIDE AND WATER.

(Jänecke, 1928.)

The Jänecke method of expressing the concentration of the saturated solution is in terms of the number of Gm. Mols. H_2O required to dissolve 100 gm. mols. salt or salt mixture of the determined molecular composition.

In the present case the salts form mixed crystals and the solid phases in contact with the solutions are composed of such mixed crystals containing varying percentages of the two salts.

Composition of dissolved salts in gm. mols.		Gm. Mols. H_2O to dissolve 100 gm. mols. salt mixture	Solid Phase
KCl	NH_4Cl		
		Results at 0°	
100	0.0	1430	100 Mol. % KCl
80	20	1330	95 " " (1)
60	40	1200	90 " (1)
40	60	1030	84 " (1)
28.5	71.5	950	81 " + 95.5 Mol. % NH_4Cl
20	80	990	96.5 " (1)
0	100	1000	100 "
		Results at 20°	
100	0.0	1210	100 Mol. % KCl
80	20	1090	? "
60	40	970	? "
40	60	840	? "
27.5	72.5	740	75 " + 95 Mol. % NH_4Cl
20	80	720	? Mol. % NH_4Cl
0	100	800	100 "
		Results at 40°	
100	0.0	1030	100 Mol. % KCl
80	20	920	? "
60	40	820	? "
40	60	750	? "
26	74	620	66 " + 93.5 Mol. % NH_4Cl
20	80	620	? Mol. % NH_4Cl
0	100	650	100 "
		Results at 60°	
100	0.0	905	100 Mol. % KCl
80	20	760	? "
60	40	650	? "
40	60	550	? "
24	76	510	54 " + 91 Mol. % NH_4Cl
20	80	520	? Mol. % NH_4Cl
0	100	540	100 "
		Results at 80°	
100	0.0	810	100 Mol. % KCl
20	80	430	38 " + 90 Mol. % NH_4Cl
0	100	450	100 Mol. % NH_4Cl
		Results at 100°	
100	0.0	730	100 Mol. % KCl
15.5	84.5	360	28 " + 91 Mol. % NH_4Cl
0	100	390	100 Mol. % NH_4Cl

(1) These values by Askenasy and Nessler, 1930.

Jänecke also gives similar results for equilibrium in the system composed of the reciprocal salt pair $KCl + NH_4NO_3 \rightleftharpoons NH_4Cl + KNO_3$; Askenasy and Nessler, 1930, give results for the quarternary system $(K, NH_4)(Cl, H_2PO_4) + H_2O$ at 0°.

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF AMMONIA.

(Guyer, Bieler and Schmid, 1934.)

The authors present their results in the form of a diagram but do not give their experimental determinations. The following approximate values were estimated from the published diagram.

Results at -15°

Gms. per 100 gms. sat. sol. NH_3	Gms. per 100 gms. sat. sol. KCl	Solid Phase
55	4.0	KCl
60	3.1	"
70	1.7	"
80	0.8	"
90	0.35	"
100	0.2	"

Results at $+25^{\circ}$

Gms. per 100 gms. sat. sol. NH_3	Gms. per 100 gms. sat. sol. KCl	Solid Phase
62	4.0	KCl
70	2.4	"
80	1.3	"
90	0.5	"
100	0.1	"

SOLUBILITY OF POTASSIUM CHLORIDE IN LIQUID AMMONIA DETERMINED BY THE SYNTHETIC METHOD.

(Pataclieke and Tanne, 1936.)

t°	Gms. KCl per 100 gms. sat. sol.	Solid Phase	t°	Gms. KCl per 100 gms. sat. sol.	Solid Phase
-76.6	0.078	NH_3	-33.9	0.213(1)	KCl
-76.6	0.115	"	-19.4	0.167	"
-76.7	0.167	"	- 0.6	0.141	"
-76.8	0.193	"	0.0	0.132(2)	"
-76.9	0.209	"	+15.0	0.115	"
-77.0	0.219	"	25	0.04 (3)	"
-77.2	0.252	NH_3 + KCl	18.9	0.102	"
-57.9	0.219	KCl	31.2	0.089	"
-45.0	0.209	"	44.2	0.078	"
-35.2	0.193	"			

The authors also give results showing that the solubility of KCl in liquid ammonia is increased to almost double by the presence of NaCl or of NH_4Cl.

(1) Johnson and Krumboltz, 1933; (2) Linhard and Stephan, 1933-1934; (3) Hunt, 1932.

THE SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF MIXTURES OF OTHER SALTS.

The polytherms of the four salt points of the potassium chloride field in quinary systems of oceanic salt deposits have been redetermined with great care by Dr. Serowy, 1923. This is a repetition and extension of the fundamental work of Van't Hoff, D'Ans and others. Results at temperatures between 0° and 120° are given for the equilibrium solution Q (Van't Hoff) in contact with K Cl + Na Cl + carnellite + kainite or kiesierite; at temperatures between 60.5° and 120° for the equilibrium solution P in contact with K Cl + Na Cl + glaserite + langbeinite; between 0° and 120° for the equilibrium solution F in contact with K Cl + Na Cl + glaserite; between 0° and 120° for the equilibrium solution E in contact with K Cl + Na Cl + carnellite and between 23° and 120° for the equilibrium solution R in contact with Na Cl + kainite + kiesierite + carnallite and with K Cl + Na Cl + kiesierite + langbeinite. For additional references see also magnesium chloride,

POTASSIUM CHLORIDE

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AND VICE VERSA.

(Cornec and Krombach, 1932.)

t°	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
		KCl	NaCl	
-22.9	—	5.81	20.17	Ice + KCl + $NaCl.2H_2O$
-21.8	—	2.60	21.71	" + $NaCl.2H_2O$
-21.1	—	—	23.07	" + "
-17.8	—	9.01	14.40	" + KCl
-13.7	—	13.64	7.59	" "
-10.7	—	19.54	—	" "
-11.9	—	6.49	21.41	KCl + $NaCl.2H_2O$
-10.0	—	—	24.70	$NaCl.2H_2O$
- 2.3	—	6.96	22.54	" + NaCl + KCl
+ 0.1	—	—	26.27	" + "
0	1.154	21.92	0.0	KCl
"	1.175	16.09	7.67	"
"	1.200	14.39	14.82	"
"	1.221	8.46	20.03	"
"	1.234	7.28	22.40	" + NaCl
"	1.226	5.10	23.52	NaCl
"	1.218	2.58	24.86	"
"	1.209	0.0	26.25	"
10	1.233	8.71	21.66	KCl + NaCl
20	1.174	25.57	0.0	"
"	1.190	19.48	7.36	"
"	1.210	14.29	14.40	"
"	1.221	12.24	17.64	"
"	1.234	10.19	20.03	" + NaCl
"	1.223	6.98	22.65	NaCl
"	1.213	3.54	24.47	"
"	1.201	0.0	26.34	"
30	1.235	11.70	20.25	KCl + NaCl
40	1.189	28.65	0.0	"
"	1.201	22.44	7.19	"
"	1.218	17.05	14.04	"
"	1.236	13.16	19.66	" + NaCl
"	1.221	8.94	21.87	NaCl
"	1.207	4.62	24.15	"
"	1.192	0.0	26.64	"
50	1.237	14.70	19.02	KCl + NaCl
60	1.199	31.29	0.0	"
"	1.210	25.14	6.90	"
"	1.224	19.79	13.52	"
"	1.238	16.07	18.57	" + NaCl
"	1.220	10.97	21.17	NaCl
"	1.202	5.71	23.94	"
"	1.184	0.0	27.03	"
70	1.239	17.59	18.05	KCl + NaCl
80	1.205	33.59	0.0	"
"	1.216	27.59	6.79	"
"	1.229	22.34	13.17	"
"	1.241	19.03	17.59	" + NaCl
"	1.223	14.10	20.03	NaCl
"	1.199	7.38	23.53	"
"	1.175	0.0	27.51	"

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AND VICE VERSA. (Con.)

(Cornec and Krombach, 1932.)

t°	d. of sat. sol.	Gms. per 100 gms. sat. sol. KCl	Gms. per 100 gms. sat. sol. NaCl	Solid Phase
90	1.242	20.32	17.24	KCl + NaCl
100	1.209	35.69	0.0	"
"	1.219	29.95	6.48	"
"	1.232	24.88	12.69	"
"	1.244	21.68	16.90	" + NaCl
"	1.232	19.12	18.12	NaCl
"	1.200	10.25	22.57	"
"	1.166	0.0	28.09	"
110	1.245	23.04	16.58	KCl + NaCl

Results for the b. pts.

t°	d. of sat. sol.	Gms. per 100 gms. sat. sol. KCl	Gms. per 100 gms. sat. sol. NaCl	Solid Phase
108.5	1.209	36.50	0.0	KCl
111.9	1.246	23.28	16.52	" + NaCl
108.7	1.162	0.0	28.30	NaCl

The above determinations for the solutions simultaneously saturated with KCl + NaCl are in good agreement with the values reported by Blasdale, 1918, but not with those of the earlier workers including Precht & Wittgen, 1881; Etard, 1897; Leather and Mukerje, 1913; Reinders, 1915; and D'Ans, 1915. The more recent determinations of the system at 20° by Di Capua and Scalletti, 1927, are in satisfactory agreement with the above results. Cl

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AND VICE VERSA AT TEMPERATURES ABOVE THE BOILING POINTS.

(Cornec and Krombach, 1932.)

The determinations were made in a small unoxydizable steel autoclave in which Jena glass recepticles were fitted in such a manner that the solution after saturation in one by gentle agitation could be filtered into the other by inverting the autoclave.

t°	Gms. per 100 gms. sat. sol. KCl	Gms. per 100 gms. sat. sol. NaCl	Solid Phase	t°	Gms. per 100 gms. sat. sol. KCl	Gms. per 100 gms. sat. sol. NaCl	Solid Phase	t°	Gms. per 100 gms. sat. sol. KCl	Gms. per 100 gms. sat. sol. NaCl	Solid Phase
120	37.65	0.0	KCl	140	19.07	19.61	NaCl	169.5	8.68	25.93	NaCl
"	32.28	6.24	"	"	9.98	24.13	"	"	0.0	30.62	"
"	27.33	12.25	"	"	0.0	29.30	"	189.6	44.34	0.0	KCl
"	24.23	16.35	"+NaCl	149	27.44	16.08	" +KCl	"	39.36	5.68	"
"	17.29	19.69	NaCl	169.5	42.42	0.0	KCl	"	35.44	10.86	"
"	9.48	23.66	"	"	37.24	5.92	"	"	33.38	13.64	"
"	0.0	28.60	"	"	33.04	11.41	"	"	31.74	16.33	"+NaCl
130	25.29	16.33	" + KCl	"	30.72	14.52	"	"	25.58	18.78	NaCl
140	39.60	0.0	KCl	"	29.63	16.03	" +NaCl	"	18.36	22.01	"
"	34.43	6.17	"	"	23.38	18.78	NaCl	"	9.88	26.13	"
"	29.71	11.86	"	"	15.24	22.66	"	"	0.0	31.45	"
"	26.45	16.17	"+NaCl	"							

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AND VICE VERSA AT TEMPERATURES ABOVE 100°.

(Ackoumow and Wassiljew, 1939.)

t°	d. of sat. sol.	Gms. per 1000 gms. H_2O		Solid Phase	t°	d. of sat. sol.	Gms. per 1000 gms. H_2O		Solid Phase
		KCl	NaCl				KCl	NaCl	
100	—	480	100	KCl	170	1.305	543	293	KCl+NaCl
"	—	440	150	"	180	1.318	577	300	" "
"	—	400	200	"	190	1.330	614	309	" "
"	—	360	250	"	200	—	743	100	"
"	1.245	359	257	" +NaCl	"	—	708	150	"
"	—	300	280	NaCl	"	—	682	200	"
110	1.255	390	259	KCl+NaCl	"	—	661	250	"
120	1.264	415	265	" "	"	1.340	650	319	" +NaCl
130	1.274	440	270	" "	"	—	600	322	NaCl
140	1.282	465	275	" "	"	—	500	340	"
150	—	606	100	"	"	—	400	364	"
"	—	570	150	"	"	—	300	389	"
"	—	533	200	"	220	—	698	332	KCl+NaCl
"	—	500	250	"	230	—	722	338	" "
"	1.289	486	280	"+NaCl	250	—	769	351	" "
"	—	400	303	NaCl	270	—	817	374	" "
"	—	300	333	"	280	—	847	382	" "
160	1.295	508	285	KCl+NaCl	300	—	900	400	" "

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AND VICE VERSA AT 18.5°.

(Holluta and Mautner, 1927.)

To standard solutions of one of the salts an excess of the other salt was added and the mixtures heated to 60° and then cooled and shaken at 18.5°, until equilibrium was attained. A given volume of the saturated solution was evaporated to dryness and from the weight of the residue, the concentration of the original aqueous solvent and the densities of the original solvent and final saturated solution, the weight of each salt present in 1000cc. of the saturated solution was calculated. The results thus obtained agreed satisfactorily with calculations based upon chloride determinations.

Gm. Mols. NaCl per liter aq. solvent	d. of sat. sol.	Gms. per 1000 cc. sat. sol.		Gm. Mols. KCl per liter aq. solvent.	d. of sat. sol.	Gms. per 1000 cc. sat. sol.	
		NaCl	KCl			KCl	NaCl
0.0	1.1738	0.00	298.50	0.0	1.2019	0.0	316.30
0.2	1.1752	10.26	290.50	0.2	1.2055	13.24	310.10
0.4	1.1766	20.62	281.58	0.4	1.2090	26.54	304.64
0.6	1.1792	31.06	273.14	0.6	1.2132	39.90	297.90
1.0	1.1840	52.18	256.74	1.0	1.2194	66.72	284.50
3.0	1.2070	161.72	179.44	1.5	1.2283	100.66	268.02
4.66	1.2343	257.22	124.16	1.837	1.2343	124.16	257.22

Solubility of Potassium Chloride in Aqueous Solutions of Sodium Chloride and Vice Versa.

(Leather and Mukerji, 1913; see also Nicol, 1891.)

Results at 20°.			Results at 40°.			Results at 91°.			
Sp. Gr. Sat. Sol.	Gms. per 100 Gms. H_2O.		Sp. Gr. Sat. Sol.	Gms. per 100 Gms. H_2O.		Sp. Gr. Sat. Sol.	Gms. per 100 Gms. H_2O.		Solid Phase in Each Case.
	KCl.	NaCl.		KCl.	NaCl.		KCl.	NaCl.	
1.176	34.61	0	1.194	40.60	0	1.222	53.58	0	KCl
1.197	26.60	10.13	1.207	31.42	10.68	1.236	45.01	10.66	"
1.213	19.65	20.61	1.235	24.43	20.99	1.262	35.84	22.87	"
1.237	14.92	30.36	1.248	18.23	30.60	1.262	33.12	28.12	"
1.240	15.36	29.61	1.242	18.74	30.32	1.264	32.45	28.26	" +NaCl
1.233	14.76	30.38	1.247	19.13	29.92	1.235	27.15	29.18	NaCl
1.224	9.70	32.40	1.222	10.49	32.59	1.223	13	33.93	"
1.193	0	35.63	1.107	0	36.53	1.180	0	38.72	"

Results are also given for 30°.

For results in the systems Potassium Chloride, Lead Chloride and Water see under $PbCl_2$

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF RUBIDIUM CHLORIDE AT 25°.

(D'Ans and Busch, 1937.)

Cl

Gm. Mols. per 1000 gm. Mols. H_2O		Solid Phase Mixed crystals containing	Gm. Mols. per 1000 gm. Mols. H_2O		Solid Phase Mixed crystals containing
Rb_2Cl_2	K_2Cl_2		Rb_2Cl_2	K_2Cl_2	
0	43.5	100 Mol. % K_2Cl_2	41.2	22.5	67.3 Mol. % K_2Cl_2
10.0	37.6	97.6 " "	51.0	17.5	41.8 " "
19.2	33.5	92.6 " "	59.3	10.4	15.5 " "
31.0	28.0	84.5 " "	70.1	0.0	0 " "

Results are also given for the quarternary System KCl + RbCl + $MgCl_2$ at 25°.

Solubility of Potassium Chloride in Aqueous Solutions of Stannous Chloride at 25° and Vice Versa. (Fujimura, 1914.)

Gms. per 100 Gms. H_2O.		Solid Phase.	Gms. per 100 Gms. H_2O.		Solid Phase.
$SnCl_2$.	KCl.		$SnCl_2$.	KCl.	
0	34.73	KCl	58.48	17.85	$SnCl_2.KCl.H_2O$
2.86	32.17	"	81.78	19.06	"
4.37	34.08	"	107.65	17.79	"
5.95	31.76	$SnCl_2.2KCl.2H_2O$	170.70	21.26	"
5.83	30.65	"	247.50	24.38	"
10.24	27.30	"	337.26	25.51	"
17.42	24.68	"	290.30	19.66	$SnCl_2.2H_2O$
27.88	24.40	"	235.50	7.49	"
34.28	5.99	"	222.5	2.73	"
54.19	19.45	$SnCl_2.KCl.H_2O$	234.05	...	"

SOLUBILITY OF POTASSIUM CHLORIDE IN DILUTE AQUEOUS SOLUTIONS OF METHYL ALCOHOL AT 0° AND AT 25°.

(Armstrong and Eyre, 1910–11.)

Wt. % CH_3OH in Solvent.	Gms. KCl per 100 Gms Sat Sol. at: 0°.	25°.
0	22.06	26.69
0.79	21.74	26.42
1.57	21.39	26.01
3.10	20.61	25.25
8.76	17.84	22.82

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS METHYL ALCOHOL AT 25°.

(Herz and Anders, 1907; McIntosh, 1903.)

Solvent $d_{\frac{25}{4}}$.	Solvent Wt. % CH_3OH.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. KCl per 100 cc. Sat. Sol.	Solvent. $d_{\frac{25}{4}}$.	Solvent. Wt. % CH_3OH.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. KCl per 100 cc. Sat. Sol.
0.9971	0	1.1782	31.13	0.8820	64	0.9064	3.44
0.9791	10.6	1.125	24.53	0.8489	78.1	0.8607	1.54
0.9481	30.8	1.033	13.65	0.8167	98.9(?)	0.8242	0.75
0.9180	47.1	0.9679	7.61	0.7882	100	0.7037	0.43

100 gms. methyl alcohol dissolve 0.53 gm. KCl at 25°. (Turner and Bissett, 1913.)
" ethyl " " 0.022 " " " " "
" propyl " " 0.004 " " " " "
" amyl " " 0.0008 " " " " "

Potassium chloride is insoluble in CH_3OH at the crit. temp. (Centnerszwer, 1910.)

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF METHYL ALCOHOL AT 25°.

(Akerlof and Turck, 1935.)

Composition of Solvent in Wt. % CH_3OH	Composition of Solvent in Mol. frac. CH_3OH	Gm. Mols. KCl per 1000 gms. Solvent	Composition of Solvent in Wt. % CH_3OH	Composition of Solvent in Mol. frac. CH_3OH	Gm. Mols. KCl per 1000 gms. Solvent
0.0	0.000	4.826	59.28	0.4502	0.6487
11.10	0.0656	3.638	69.74	0.5645	0.3766
20.11	0.1240	2.820	78.98	0.6787	0.2193
29.87	0.1933	2.077	80.45	0.6983	0.2005
39.93	0.2721	1.476	90.04	0.8248	0.1135
50.65	0.3661	0.9561	100.00	1.0000	0.0707

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF ETHYL AND METHYL ALCOHOL.

(Zeitlin, 1926.)

Solvent	Gm. mols. KCl per liter at 10°.2	13°.3	Gms. per 1000 cc sat. sol. 10°.2	19°.9
Water	3.712	3.903	—	—
Aq. 25.96 Wt. % CH_3OH	1.700	1.896	126.8	141.4
" 45.13 "	0.8403	0.8700	62.65	64.87
" 74.88 "	0.1886	0.2121	14.06	15.81
" 100.00 "	0.0520	0.0560	3.88	4.18
" 25.07 % Wt. C_2H_5OH	1.607	1.755	119.8	130.9
" 50.01 "	0.5860	0.6004	43.66	44.77
" 75.03 "	0.1127	0.1245	8.4	9.28
" 97.3 "	0.00	0.0052	—	0.39

100 gms. aqueous 50 wt. percent C_2H_5OH solution dissolve 6.9 gms. KCl at 20° and 15.3 gms. at 100°. (Wright, 1927.)

100 gms. 40 wt. per cent alcohol dissolve 5.87 gms. KCl + 12.25 gms. NaCl at 25°.
100 gms. 40 wt. per cent alcohol dissolve 5.29 gms. KNO_3 + 10.06 gms. KCl at 25°.
(Soch, 1898.)

100 gms. abs. ethyl alcohol dissolve 0.034 gm. KCl at 18.5°.
100 gms. abs. methyl alcohol dissolve 0.5 gm. KCl at 18.5°.
(de Bruyn, 1892; Rohland, 1898.)

SOLUBILITY OF POTASSIUM CHLORIDE IN DILUTE SOLUTIONS OF ETHYL ALCOHOL AT 0° AND AT 25°.

(Armstrong, Eyre, Hussey and Paddison, 1907; Armstrong and Eyre, 1910–11.)

Wt. % C_2H_5OH in Solvent.	Gms. KCl Dissolved per 100 Gms. Sat. Sol. at: 0°.	25°.	d_{25} of Sol. Sat.
0	22.1	26.44	1.1813
1.14	21.6	25.91	1.1754
2.25	20.9	25.29	1.1689
4.41	19.7	24.21	1.1568
8.44	...	22.46	1.1357
12.13	15.5	...	...
18.69	...	17.42	1.0847

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS ALCOHOL AT:

15°.

(Schiff — Liebig's Ann. 118, 365, '61.)

Sp. Gr. of Alcohol.	Wt. per cent Alcohol.	G. KCl per 100 g. Aq. Alcohol.
0.984	10	19.8
0.972	20	14.7
0.958	30	10.7
0.940	40	7.7
0.918	50	5.0
0.896	60	2.8
0.848	80	0.45

Gerardin's results at 15° agree well with the above determinations.

14.5°.

(Bodländer — Z. physik. Ch. 7, 316, '91.)

Sp. Gr. of Sat. Solutions.	Grams per 100 cc. Solution. C_2H_5OH.	H_2O.	KCl.
1.1720	...	88.10	29.10
1.1542	2.79	85.78	26.85
1.1365	4.98	84.00	24.67
1.1075	10.56	79.63	20.56
1.1085	15.57	75.24	17.24
1.0545	20.66	70.52	14.27
1.0455	24.25	67.05	13.25
0.9695	40.42	50.18	6.35
0.9315	48.73	40.60	3.82
0.8448	68.63	15.55	0.30

30° and 40°.

(Bathrick — J. Physic. Chem. 1, 160, '96.)

Wt. per cent Alcohol.	Gms. KCl per 100 Gms. Aq. Alcohol, At 30°.	At 40°.
0	38.9	41.8
5.28	33.9	35.9
9.43	30.2	33.3
16.9	24.9	27.6
25.1	19.2	21.8
34.1	15.6	17.2
43.1	11.1	13.1
55.9	6.8	8.2
65.9	3.6	4.1
78.1	1.3	1.6
86.2	0.4	0.5

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS ALCOHOL.

(Gerardin — Ann. chim. phys. [4] 5, 140, '65.)

Interpolated from the original results.

t°.	Grams KCl per 100 Gms. Aq. Alcohol of Sp. Gr.:							
	0.9904 = 5.5 Wt. %.	0.9848 = 9.35 Wt. %.	0.9793 = 13.6 Wt. %.	0.9726 = 19.1 Wt. %.	0.9573 = 30 Wt. %.	0.939 = 40 Wt. %.	0.8967 = 60 Wt. %.	0.8244 = 90 Wt. %.
0	23.4	19.5	15.5	11.5	7.0	4.0	1.7	0.0
5	25.0	21.0	16.8	12.8	8.0	4.8	2.2	0.0
10	26.4	22.5	18.0	14.0	9.0	5.6	2.7	0.0
15	26.8	24.0	19.2	15.2	10.0	6.4	3.1	0.04
20	29.1	25.3	20.3	16.1	10.8	7.2	3.5	0.06
25	30.4	26.8	21.5	17.1	11.6	7.9	3.9	0.08
30	31.7	28.0	22.6	18.2	12.5	8.5	4.2	0.10
40	34.3	30.8	24.8	20.0	14.0	9.9	4.8	0.20
50	37.0	33.5	27.0	21.8	15.5	10.8	5.2	0.30
60	...	...	...	...	16.8	11.8	5.5	0.40

Cl

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 25°.

(McIntosh, 1903.)

Wt. % C_2H_5OH.	Mols. KCl per Liter.	Gms. KCl per 100 cc. Sat. Sol.	Wt. % C_2H_5OH.	Mols. KCl per Liter.	Gms. KCl per 100 cc. Sat. Sol.
0	4.18	31.18	60	0.56	4.18
10	3.21	23.93	70	0.305	2.27
20	2.40	17.89	80	0.125	0.93
30	1.78	13.27	90	0.042	0.31
40	1.26	9.40	100	0.011	0.08
50	0.84	6.26			

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT DIFFERENT TEMPERATURES.

Results at 25°

(Flatt & Jordan, 1933.)

Wt. % C_2H_5OH in solvent	Gms. KCl per 100 gms. solvent
0.0	35.86
20.4	19.70
42.5	9.162
67.9	2.278

Results at 16°, 25° and 35°

(Ferner and Mellon, 1934.)

Wt. Percent C_2H_5OH in solvent	Gms. KCl per 100 gms. aq. solvent at:		
	16°	25°	35°
86.4	0.2256	0.2778	0.3134
89.6	0.1414	0.1743	0.1995
92.3	0.0862	0.1084	0.1207
96.9	0.0431	0.0500	0.0603
100.0	0.0265	0.0288	0.0325

Solubility of Potassium Chloride in Pure Ethyl Alcohol Solutions of Ammonium Nitrate at 25°.

(Seward and Schumb, 1930.)

Gm. Mols. NH_4NO_3 per liter solvent	Gm. Mols. KCl per liter sat. sol.	Gm. Mols. NH_4NO_3 per liter solvent	Gm. Mols. KCl per liter sat. sol.
0.000	0.003108 (= 0.2318 gm.)	0.004807	0.005020
0.000188	0.003125	0.008587	0.007229
0.000466	0.003141	0.01947	0.008827
0.000992	0.003327	0.05129	0.011131
0.002352	0.003716		

Solubility of Potassium Chloride in Several Alcohols at 25°.

(Larson and Hunt, 1939.)

Alcohol	Formula	d. of alcohol	d. of sat. solution	Gms. KCl dissolved per 100 gms. alcohol
Methanol	CH_3OH	0.7866	0.7907	0.5391
Ethanol	C_2H_5OH	0.7851	0.7852	0.0294
1-Propanol	$CH_3CH_2CH_2OH$	0.8001	0.7994	0.0061
1-Butanol	$CH_3(CH_2)_2CH_2OH$	0.8057	0.8058	0.0030
2-Propanol (iso)	$CH_3CHOHCH_3$	0.7810	0.7809	0.0023
2-Methyl-1-propanol	$(CH_3)_2CHCH_2OH$	0.7979	0.7980	0.0020
1-Pentanol	$CH_3(CH_2)_3CH_2OH$.	0.8095	0.8096	0.0022
2-Butanol (iso)	$CH_3CH_2CHOHCH_3$	0.8025	0.8022	0.00084

Cl

Solubility of Potassium Chloride in Several Alcohols at Different Temperatures.

(Kirn and Dunlap, 1931.)

t°	Gm. Mols. KCl per 100 gms. mols. of:					
	Methanol CH_3OH	Ethanol C_2H_5OH	Propanol C_3H_7OH	Iso Propanol C_3H_7OH	Butanol C_4H_9OH	Iso Butanol C_4H_9OH
20	0.833	0.1270	0.00700	0.1235	0.00822	0.00326
30	0.729	0.1378	0.00796	0.1300	0.00852	0.00356
35	0.691	0.1443	0.00793	0.1340	—	—
40	0.642	0.1454	0.00773	0.1390	0.00904	0.00400
45	0.528	0.1277	0.00683	0.1295	—	—
50	0.415	0.0845	0.00473	0.1060	0.00935	0.00407

Solubility of Potassium Chloride in Dilute Aqueous Solutions of Propyl Alcohol at 0° and at 25°.

(Armstrong and Eyre, 1910–11.)

Wt. % C_3H_7OH in Solvent.	Gms. KCl per 100 Gms. Sat. Sol. at: 0°.	25°.
1	22.06	26.44
1.48	21.25	25.94
2.91	20.49	25.23
5.66	18.97	23.82

POTASSIUM CHLORIDE

Solubility of Potassium Chloride in Aqueous Solutions of Iso Propyl Alcohol at 25°.

(Ginnings and Chen, 1931.)

The results locate the binodal curve of the systems and include a tie line * which shows the composition of two layers in contact with each other and the plait point, PP, at which the two liquid layers become homogenous.

Gms. per 100 gms. sat. solution		Gms. per 100 gms. sat. solution	
Iso C_3H_5OH	KCl	Iso C_3H_5OH	KCl
13.72	17.48*	36.14	9.17
17.64	15.17	37.50	8.93 PP
22.87	12.95	42.56	7.65
29.34	11.04	53.95	5.12

Solubility of Potassium Chloride in Aqueous Solutions of Iso Propyl Alcohol at Different Temperatures.

(Femer and Mellon, 1934.)

Cl

Wt. Percent iso C_3H_5OH in Solvent	Gms. KCl per 100 gms. aq. solvent at:		
	16°	25°	35°
87.7	0.1095	0.1280	0.1494
92.6	0.0286	0.0298	0.0364
96.5	0.0074	0.0084	0.0104
100.0	0.0026	0.0027	0.0029

Solubility of Potassium Chloride in Aqueous Solutions of Tertiary Butanol at 30°.

(Ginning and Robbins, 1930.)

The results which were determined by the synthetic method locate the binodal curve of the system and include tie lines * which show the composition of layers in contact with each other and the plait point, PP, at which the two liquid layers become homogeneous.

Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.	
$(CH_3)_3COH$	KCl	$(CH_3)_3COH$	KCl	$(CH_3)_3COH$	KCl
—	23.3*	18.2	8.1	39.0	4.2PP
7.9	15.9	20.5	7.4	43.8	3.3
9.4	14.6	—	7.1*	50.9	2.6
10.5	13.3	—	6.7*	53.0	— *
11.5	12.2	23.9	6.2	57.0	— *
12.5	11.4	28.3	5.6	58.4	2.0
16.5	9.0	33.3	4.8	67.3	1.4
		36.6	4.5	90.0	— *

The composition of the plait point, PP, at 25° is 4.5 gms. KCl and 41.0 gms. $(CH_3)_3$ COH per 100 gms. sat. solution. Ginnings, Herring and Webb, 1933.

DISTRIBUTION OF POTASSIUM CHLORIDE BETWEEN WATER AND BUTYL ALCOHOL AT 25°.

(Alleman, 1928.)

Normality of KCl in:		$\frac{(b)}{(a)}$	Normality of KCl in:		$\frac{(b)}{(a)}$
H_2O layer (a)	C_4H_9OH(b) layer		H_2O layer(a)	C_4H_9OH layer(b)	
2.0	0.0182	0.0091	0.25	0.0051	0.0199
1.0	0.0134	0.0135	0.10	0.0020	0.0204
0.50	0.0079	0.0167	0.025	(0.0011)	(0.0455)

DISTRIBUTION OF POTASSIUM CHLORIDE AT 17° BETWEEN: (Wosnessensky, 1925.)

Water and Amyl Alcohol.

Millimols. KCl per liter of		$\frac{C_1}{C_2^{1.38}}$.
H_2O layer (C_1).	Alcohol layer (C_2).	
360.255	0.831	461
512.011	1.050	480
677.507	1.287	486
810.000	1.491	478
921.140	1.648	477

Water and Phenol.

Millimols. KCl per liter		$\frac{C_1}{C_2}$.
H_2O layer (C_1).	Phenol layer (C_2).	
64.0	4.5	14.2
111.5	7.9	14.1
290.3	20.4	14.2
324.5	22.8	14.2

Cl

SOLUBILITY OF POTASSIUM CHLORIDE IN ANHYDROUS ACETIC ACID DETERMINED BY THE SYNTHETIC METHOD.

(Davidson and Chappell, 1928.)

t°	Gm. Mols. KCl per 100 gm. mols. KCl + CH_3COOH	Solid Phase	t°	Gm. Mols. KCl per 100 gm. mols. KCl + CH_3COOH	Solid Phase
16.45	0.168	CH_3COOH	59	0.239	KCl
24	0.157	KCl	63	0.257	"
30	0.170	"	70	0.272	"
39	0.188	"	76	0.295	"
47	0.207	"	87	0.336	"
55	0.229	"	93	0.367	"

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF URETHAN AT 25°.

(Pelitsch, 1928, 1929.)

Gm. Mols. per 1000 gms. H_2O		Solid Phase	Gm. Mols. per 1000 gms. H_2O		Solid Phase
$NH_2COOC_2H_5$	KCl		$NH_2COOC_2H_5$	KCl	
0.0	4.83	KCl	2.597	4.16	KCl + $NH_2COOC_2H_5$
0.0561	4.81	"	3.972	3.84	Lower liquid layer
0.0786	4.80	"	27.556	2.20	Upper " "
0.2245	4.76	"	28.477	2.0	$NH_2COOC_2H_5$
0.5612	4.66	"	40.88	1.0	"
1.1225	4.49	"	53.09	0.0	"

100cc sat. sol. of potassium chloride in ethyl urethan ($NH_2COOC_2H_5$) contain 0.105 gm. KCl at 60°. (Stuckgold, 1917.)

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS ACETONE SOLUTIONS.

(Snell, 1898; at 20°, Herz and Knoch, 1904.)

Wt. (see Note) Per cent Acetone in Solvent.	At 20°. KCl per 100 cc. Solution.		At 30°. Gms. per 100 Gms. Solution.		At 40°. Gms. per 100 Gms. Solution.		At 56°. Gms. per 100 Gms. Solution.	
	Millimols.	Gms.	Acetone.	KCl.	Acetone.	KCl	Acetone.	KCl.
0	410.5	30.62	0	27.27	0	28.69	0	30
9.1	351.7	26.23	6.96	23.42	6.79	25.33	...	...
20	286.6	21.38	16.22	18.90	15.75	21.28	...	...
30	223.7	16.69	25.45	15.06	two layers		25.67	14.42
40	166.5	12.42	35.52	11.31	"		36.03	9.93
50	115.4	8.61	45.98	8.04	"		46.46	7.07
60	71.2	5.31	56.91	5.12	"		57.37	4.38
70	38.5	2.87	68.18	2.60	"		68.56	2.22
80	12.9	0.96	79.43	0.76	79.34	0.58	79.25	0.94
90	2	0.15	89.88	0.13	89.84	0.16	±81° sat. sol.	
100	0	0	100	0	100	0		

NOTE. — For the 20° results the per cent acetone in the solvent is in terms of volume instead of weight per cent, and the concentration of the second solution is 10 per cent instead of 9.1 which is the weight per cent concentration of the solvent for the corresponding results at the other temperatures.

AT THE TEMPERATURE 40° AND FOR CONCENTRATIONS OF ACETONE BETWEEN 20 AND 80 PER CENT THE SATURATED SOLUTION SEPARATES INTO TWO LAYERS HAVING THE FOLLOWING COMPOSITIONS:

Upper Layer. Gms. per 100 Gms. Solution.			Lower Layer. Gms. per 100 Gms. Solution.		
H_2O.	$(CH_3)_2CO$.	KCl.	H_2O.	$(CH_3)_2CO$.	KCl.
55.2	31.82	12.99	28.14	69.42	2.44
53.27	35.44	11.29	30.96	65.97	3.07
51.23	48.50	10.27	32.64	63.79	3.56
50.34	30.88	9.77	34.07	62.01	3.92
48.02	43.18	8.79	37.44	57.67	4.89
46.49	45.34	8.17	38.68	56.17	5.25
58.99	25.24	15.77	23.66	74.91	1.43

Note.—No solid phase could be present when equilibrium is attained since, with vapor, there are 3 components and 4 phases; hence if the temperature is fixed the system becomes invariant.

100 cc. sat. solution of potassium chloride in furfurol ($C_4H_3O.COH$) contain 0.085 gm. KCl at 25°. (Walden, 1906.)

1000 gms. highly purified acetone dissolve 0.00087 gm. KCl at 18° and 0.00097 gm. at 37° as calculated from specific conductivity measurements. (Lannung, 1932.)

SOLUBILITY OF POTASSIUM CHLORIDE IN DILUTE AQUEOUS SOLUTIONS OF SEVERAL COMPOUNDS AT 25°.

(Armstrong and Eyre, 1913.)

Compound.	Gms. Cmpd. per 1000 Gms. H_2O.	Gms. KCl per 100 Gms. Sat. Sol.	Compound.	Gms. Cmpd. per 1000 Gms. H_2O.	Gms. KCl per 100 Gms. Sat. Sol.
Water alone	...	26.89	Glycol	15.51	26.43
Acetaldehyde	11.01	27.05	"	62.05	25.26
Paraldehyde	11.01	26.42	Mannitol	45.53	24.86
Glycerol	13.01	25.58	"	136.59	24.46

100 gms. 95% formic acid dissolve 19.4 gms. KCl at 19.7°. (Aschan, 1913.)
" glycerol ($d_{15} = 1.256$) " 3.72 " " " 15–16°. (Ossendowski, 1907.)
100 cc. anhydrous hydrazine " 9 " " " room temp. (Welsh and Broderson, 1915.)
100 gms. hydroxylamine " 12.3 " " " 17–18°. (de Bruyn, 1892.)

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF GLYCOL AT 30°.

(Trimble, 1931.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.	
	CH_2OHCH_2OH	KCl
1.1820	0.0	27.10
1.1648	15.08	21.97
1.1510	33.47	16.53
1.1424	52.00	11.84
1.1371	73.27	7.75
1.1368	94.90	5.00

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF GLYCEROL AT 25°.

(Herz and Knoch, 1905.)

Sp. Gr. of Glycerol at 25°/4° = 1.2555. Impurity about 1.5%.

Wt. Per cent Glycerol in Solvent.	KCl per 100 cc. Solution.		Sp. Gr. of Solutions.	Wt. Per cent Glycerol in Solvent.	KCl per 100 cc. Solution.		Sp. Gr. of Solutions.
	Millimols.	Gms.			Millimols.	Gms.	
0	424.5	31.66	1.180	54.23	238.5	17.79	1.219
13.28	383.4	28.61	1.185	83.84	149	11.11	1.259
25.98	339.3	25.31	1.194	100	110.6	8.25	1.286
45.36	271.4	20.24	1.211				

100 gms. H_2O dissolve 246.5 gms. sugar + 44.8 gms. KCl at 31.25°, or 100 gms. of the sat. solution contain 62.28 gms. sugar + 11.33 gms. KCl. (Köhler, 1897.)

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF GLUCOSE AT 25°.

(Armstrong and Eyre, 1910–11.)

Wt. % $C_6H_{12}O_6+H_2O$ in Aq. Solvent.	Gms. KCl per 160 Gms. Sat. Solution.
0	26.63
4.72	25.86
9	25.18
16.53	23.89
37.27	20.15

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF DIOXAN AT 25°.

(Herz and Lorentz, 1929.)

Vol. Percent Dioxan in Solvent	Gm. Mol. KCl per liter sat. sol.	Vol. Percent Dioxan in Solvent	Gm. Mol. KCl per liter sat. sol.
10	3.45	55	0.85 (L)
20	2.80	77	0.14 (U)
33	2.00	80	0.12
50	1.22		

Between 51 and 77 Vol. percent Dioxan to liquid layers are formed
(L) = lower liquid layer (U) = upper liquid layer

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF PYRIDINE AT 10°.

(Schroeder, 1908.)

Aq. Mixture.		Gms. KCl per 100 Gms. Sat. Sol.	Aq. Mixture.		Gms. KCl per 100 Gms. Sat. Sol.
cc. H_2O.	cc. Pyridine.		cc. H_2O.	cc. Pyridine.	
100	0	23.79	40	60	3.33
90	10	19.76	30	70	1.25
80	20	16.37	20	80	0.24
70	30	13.19	10	90	0.04
60	40	10.05	0	100	0
50	50	6.34			

Cl The binodal curve and plait point of the system KCl + Pyridine + H_2O at 25° has been determined by Ginnings, Webb and Hinohara, 1933, but the authors do not give their experimental results but only the values of a series of arbitrary constants calculated from them by means of empirical equations.

100 gms. liquid Sulfur Dioxide dissolve 0.041 gm. KCl at 0°. (Jander and Ruppolt, 1937.)

100 gms. sat. sol. of Potassium Chloride in Selenium Oxychloride ($SeOCl_2$) contain 2.89 gms. KCl at 25°. (Wise, 1923.)

FUSION-POINT DATA HAVE BEEN DETERMINED FOR THE FOLLOWING MIXTURES OF KCl AND OTHER SALTS.

KCl + KI (1)(2)(3)
" + KF (3)
" + KOH (4)
" + $KCrO_4$ (5)(25)
" + KPO_3 (6)
" + K_3PO_4 (6)
" + $K_4P_2O_7$ (6)

KCl + K_2SO_4 (3)(5)(7)
" + LiCl (18)(21)(22)
" + " + NaCl (18)
" + $MgCl_2$ (16)(17)
" + HgCl (8)
" + NH_4Cl (15)
" + NH_4NO_3 (14)

KCl + NaCl (3)(8)(11)(12)
" + NaI (24)
" + Na_2SO_4 (8)
" + RbCl (19)
" + $SbCl_3$ (20)(23)
" + $SrCl_2$ (9)(5)(13)
" + " + NaCl (13)
" + TlCl (10)

(1) Wrzesnewski, 1912; (2) Amadori and Pampanini, 1911; (3) Ruff and Plato, 1903; (4) Scarpa, 1915; (5) Sackur, 1911-12; (6) Amadori, 1912; (7) Janecke, 1912; (8) Sackur, 1913; (9) Vortisch, 1914; (10) Sandonnini, 1911; 1914; (11) Schaeffer, 1919; (12) Lautsberry and Page, 1920; (13) Scholich, 1920; (14) Perman and Saunders, 1923; (15) Jänecke, 1928; (16) Menge, 1911; (17) Dernby, 1918; (18) Richards and Meldrum, 1917; (19 Keitel, 1925; (20) Kendall, Crittenden and Miller, 1923; (21) Elchardus and Laffitte, 1932; (22) Keitel, 1925; (23) Zouravlev, 1939 (24) Waxberg, 1930; (25) Zemczuzny, 1908.

POTASSIUM Palladium **CHLORIDE** K_2PdCl_6

From measurements of the solubility of Potassium Chloro-palladate (K_2PdCl_6) at 25° in normal aqueous Hydrochloric Acid containing KCl and saturated with Chlorine at atmospheric pressure the Solubility Product $(K^+)^2(PdCl_6^{--})$ was found to be 5.97×10^{-8} moles per liter. (Wellman, 1930.)

POTASSIUM Platinum **CHLORIDE** See **PLATINUM CHLORIDES**

POTASSIUM Rhenium **CHLORIDE** K_2ReCl_6

POTASSIUM Rhenium Oxy **CHLORIDE** $K_4Re_2OCl_{10}$

SOLUBILITY OF EACH SEPARATELY IN AQUEOUS HYDROCHLORIC ACID.
(Noddak and Noddak, 1933.)

Wt. Percent HCl in Aq. Solvent	Gms. K_2ReCl_6 per 1000cc sat. solution at:		Gms. $K_4Re_2OCl_{10}$ per 1000cc sat. solution at:	
	0°	18°	0°	18°
12.0	21.38	30.28	75.0	—
20.0	25.0	46.0	—	—
37.0	3.3	3.72	5.5	—

Mono POTASSIUM Tin CHLORIDE $KSnCl_3.H_2O$.

SOLUBILITY OF MONO POTASSIUM STANNO CHLORIDE IN WATER.
(Rimbach und Fleck, 1916.)

t°.	3°.2	14°.2	37°.6.	59°.4.	71°.0.
Gms. $KSnCl_3$ per 100 gms. sat. sol....	26.1	34.9	54.0	72.8	82.1

Solid phase $KSnCl_3.H_2O$ at all temperatures.

Di POTASSIUM Tin CHLORIDE $K_2SnCl_4.2H_2O$.

SOLUBILITY OF DI POTASSIUM STANNO CHLORIDE IN WATER.
(Rimbach and Fleck, 1916.)

t°.	Gms. per 100 gms. sat. sol. Cl.		Sn.		K.		K_2SnCl_4	Solid Phase.
2.3*..	9.14		3.28		7.94		-	$K_2SnCl_4.?H_2O$
14.1*..	12.18		5.68		9.72		–	»
35.6...	18.28	+	14.56	+	10.61	=	43.5	$K_2SnCl_4.2H_2O$
57.4...	23.13	+	19.50	+	12.72	=	55.4	»
77.3...	26.56	+	22.35	+	14.63	=	63.5	»

Tetra POTASSSIUM Tin CHLORIDE $K_4SnCl_6.H_2O$.

SOLUBILITY OF TETRA POTASSIUM STANNO CHLORIDE IN WATER.
(Rimbach and Fleck, 1916.)

t°.	Gms. per 100 gms. sat. sol. Cl.		Sn.		K.		K_4SnCl_6	Solid Phase.
0.5*..	10.99		0.93		11.55		–	$K_4SnCl_6.H_2O+SnCl_2.H_2O$
19.5*..	13.10		1.93		13.19		–	» »
41.0*..	16.00		5.82		13.84			» »
61.7*..	20,18		9.95		15.73.		–	» »
70.0...	22.71	+	12.86	+	16.63	=	52.20	$K_4SnCl_6.H_2O$
81.2...	25.74	+	19.57	+	15.71	=	61.02	»

* At these temperatures the atomic ratios in solution did not correspond to the double salt hence the solid phase is a mixture of the double salt and stanno chloride.

Experiments on the Solubility of Potassium Stannic Chloride and Ammonium Stannic Chloride in Aqueous Solutions of Hydrochloric Acid containing sodium and ammonium chlorides are given by Smith, 1928.

SOLUBILITY OF POTASSIUM CHLORATE IN WATER.

The results of Taylor, 1897; Carlson, 1910; Calzolari, 1912; Brönsted, 1913; Tschugneff and Chlopin, 1914; Toda, 1921, 1922; Iljinski, 1922; Wright, 1927; DiCapua and Scalletti, 1927; Flöttmann, 1928; Ricci, 1937, 1938; and Ricci and Yanik, 1937, were plotted and the following average values read from the curve. The results above 100° are from Tilden and Shenstone, 1881; and Benrath, Gjedebo, Schiffers and Wunderlich, 1937. The solid phase is $KClO_3$ in all cases.

t°	d. of sat. sol.	Gms. $KClO_3$ per 100 gms. sat. sol.	t°	d. of sat. sol.	Gms. $KClO_3$ per 100 gms. sat. sol.	t°	Gms. $KClO_3$ per 100 gms. sat. sol.
0	1.021	3.2	70	—	23.2	200	72.0
10	—	4.9	80	1.165	27.3	220	78.0
15	(1.0363)	5.7 (5.739)	90	—	31.5	240	83.0
20	(1.0420)	6.8 (6.793)	100	1.219	36.0	260	87.0
25	(1.0484)	7.9 (7.999)	1040.pt	1.230	37.5	280	91.0
30	—	9.2	120	—	43.5	300	94.5
40	1.073	12.2	140	—	52.0	330	96.7
50	—	15.6	160	—	59.0		
60	1.115	19.2	180	—	65.5		

The results in parentheses are by Flöttmann, 1928.

C10 SOLUBILITY OF POTASSIUM CHLORATE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT 20°.

(Winteler — Z. Electrochem. 7, 360, '00.)

Sp. Gr. of Solutions.	Grams per Liter.		Sp. Gr. of Solutions.	Grams per Liter.	
	KCl.	$KClO_3$.		KCl	$KClO_3$.
1.050	0	71.1	1.098	120	24.5
1.050	10	58.0	1.108	140	22.5
1.050	20	49.0	1.119	160	21.0
1.054	40	39.5	1.130	180	20.0
1.064	60	34.0	1.140	200	20.0
1.075	80	30.0	1.168	250	20.0
1.086	100	27.0			

SOLUBILITY OF POTASSIUM CHLORATE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE.

(Arrhenius — Z. physik. Chem. 11, 397, '93.)

Results at 19.85°.

Mols. per Liter.		Grams per Liter.	
KNO_3.	$KClO_3$.	KNO_3.	$KClO_3$
0.0	0.570	0.0	09 88
0.125	0.529	12.65	64.86
0.25	0.492	25.29	60.33
1.0	0.374	101.19	45.85
2.0	0.328	202.38	40.22

Results at 23.87°.

Mols. per Liter.		Grams per Liter.	
KNO_3.	$KClO_3$	KNO_3.	$KClO_3$.
0.0	0.645	0.0	79.09
0.5	0.515	50.59	63.14

APPROXIMATE SOLUBILITY OF POTASSIUM CHLORATE IN AQUEOUS SALT SOLUTIONS AT SEVERAL TEMPERATURES. (Alekceevsky, 1921.)

The determinations were made by adding $KClO_3$ to the aqueous solvent untill no more dissolved after a period of 3 hours. The curves drawn from the results are very irregular, thus showing that saturation could not have been reached in all cases.

	Gms. $KClO_3$ per 100 cc sat. Solution in Aqueous.					
t°.	5 % K_2CO_3.	10 % K_2CO_3.	20 % K_2CO_3.	30 % K_2CO_3	40 % K_2CO_3.	50 % K_2CO_3.
20.....	6.0	5.0	4.0	2.5	2.0	1.0
30.....	6.5	6.0	5.0	3.5	2.5	2.5
40.....	8.5	8.0	6.5	4.5	4.5	3.5
50.....	9.5	9.0	7.5	6.0	6.0	4.0

	Gms. $KClO_3$ per 100 cc sat. Solution in Aqueous.		
t°.	5 to 7 % Na_2CO_3.	5 % NaCl.	20 % NaCl.
20..........................	5.0	5.0	5.0
30..........................	5.5	5.5	5.5
40..........................	7.5	7.5	6.5
50..........................	10.5	13.0	11.5

SOLUBILITY OF POTASSIUM CHLORATE IN AQUEOUS SOLUTIONS OF POTASSIUM HYDROXIDE AT 20°. (Brönsted, 1920 *a*.)

Gm. mols. per liter.		Gm. mols. per liter.		Gm. mols. per liter.	
KOH.	$KClO_3$.	KOH.	$KClO_3$.	KOH.	$KClO_3$.
4.71	0.0924	8.60	0.0410	14.02	0.0215
5.06	0.0882	9.41	0.0351	14.85	0.0195
6.35	0.0609	10.95	0.0287	15.02	0.0191
7.95	0.0445	12.19	0.0254		

C10

SOLUBILITY OF POTASSIUM CHLORATE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE AND VICE VERSA AT 25°. (Toda, 1921 *a*, 1922.)

Saturation was secured by constant rotation in a thermostat.

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
KNO_3.	$KClO_3$.		KNO_3.	$KClO_3$.	
0.0	7.745	$KClO_3$	18.97	4.39	$KClO_3.NO_3$
0.68	7.65	$KClO_3.NO_3$	27.14	3.90	»
1.55	7.07	»	27.14	3.90	$KClO_3+KNO_3$
3.59	6.52	»	27.21	3.61	KNO_3
7.12	5.76	»	27.57	1.63	»
12.81	5.10	»	27.24	0.0	»

SOLUBILITY OF POTASSIUM CHLORATE IN AQUEOUS SOLUTIONS OF SODIUM CHLORATE AND VICE VERSA AT 24° 2. AND AT 40°. (Iljinsky, 1924.)

See note under Potassium carbonate.

t°.	*d* of sat. sol.	Gms. per 100 gms. H_2O.		Solid. Phase.	t°.	*d* of sat. sol.	Gms. per 100 gms. H_2O.		Solid. Phase.
		$NaClO_3$.	$KClO_3$.				$NaClO_3$.	$KClO_3$.	
24.2..	1.045	0.5	8.1	$KClO_3$	24.2..	1.441	99.7	3.1	$KClO_3+NaClO_3$
» ..	1.086	7.5	8.0	»	» ..	1.429	98.6	0.0	$NaClO_3$
» ..	1.189	27.5	7.0	»	40....	1.073	0.0	14.2	$KClO_3$
» ..	1.241	41.0	6.0	»	» ..	–	13.5	9.9	»
» ..	1.260	47.4	5.0	»	» ..	1.268	48.4	7.0	»
» ..	1.326	60.0	5.2	»	» ..	1.308	58.7	7.0	»
» ..	1.329	61.8	5.6	»	» ..	1.453	98.8	7.0	»
» ..	1.392	82.7	5.3	«	» ..	1.483	116.0	7.2	» $+NaClO_3$
					» ..	1.462	116.4	0.0	$NaClO_3$

SOLUBILITY OF POTASSIUM CHLORATE IN AQUEOUS SOLUTIONS OF POTASSIUM HYDROXIDE, HYDROGEN PEROXIDE, AND MIXTURES OF THE TWO AT 25°.

(Calvert, 1901.)

The mixtures were agitated by means of a stream of air. Equilibrium was approached both from above and below 25°.

Composition of Solvent.	Mols. $KClO_3$ Dissolved per Liter of Sat. Sol.	Gms. $KClO_3$ Dissolved per Liter of Sat. Sol.
Water alone	0.675	82.71
Aqueous 0.125 *n* KOH	0.625	76.60
" 0.25 *n* "	0.573	70.23
Aq. H_2O_2 containing 1.26 mols. H_2O_2 per l.	0.730	89.45
" " 1.31 " "	0.737	90.33
Aq. 0.25 *n* KOH " 0.015 " "	0.578	70.82
" " 0.276 " "	0.584	71.57
" " 0.954 " "	0.616	75.50
" " 1.073 " "	0.673	82.47

SOLUBILITY OF POTASSIUM CHLORATE IN AQUEOUS SOLUTIONS OF POTASSIUM BROMIDE AT 13°. (Blarez, 1911.)

Gms. per 100 Gms. Solution.		Gms. per 100 Gms. Solution.		Gms. per 100 Gms. Solution.	
KBr.	$KClO_3$.	KBr.	$KClO_3$.	KBr.	$KClO_3$.
0.20	5.18	1.0	5.04	6.0	3.46
0.60	5.20	2.0	4.60	8.0	2.80
0.8	5.06	3.0	4.2	10.0	2.40
		4.0	4.0		

C10

SOLUBILITY OF POTASSIUM CHLORATE IN AQUEOUS SOLUTIONS OF OTHER POTASSIUM SALTS AT 14°-15°. (Blarez, 1911.)

Salt.	Gms. per 100 Gms. Solution.		Salt.	Gms. per 100 Gms. Solution.	
	K Salt.	$KClO_3$.		K Salt.	$KClO_3$.
KOH	1.43	4.47	KNO_3	2.59	4.51
KCl	1.91	4.45	"	5.18	3.88
"	3.82	3.58	K_2SO_4	2.23	4.71
KBr	3.05	4.49	"	4.46	3.98
"	6.10	3.60	$K_2C_2O_4$	2.42	4.72
KI	4.25	4.59	"	4.85	3.93
"	8.51	3.65			

SOLUBILITY OF POTASSIUM CHLORATE IN AQUEOUS SOLUTIONS OF SEVERAL SALTS, EACH DETERMINED SEPARATELY AT 25°.

(Holluta and Peter, 1979.)

Concentration of Aq. Solvent in Gm. Equiv. Salt per liter	Gms. $KClO_3$ per liter sat. solution in Aq. Solutions of:				
	KCl	KNO_3	K_2SO_4	$NaClO_3$	NaCl
0.0	83.030	83.030	83.030	83.030	83.030
0.025	—	—	82.570	—	—
0.05	—	—	80.622	—	—
0.1	76.653	77.951	79.103	76.974	83.233
0.2	71.484	75.225	75.387	71.959	84.383
0.3	67.793	72.587	71.995	67.655	85.615
0.4	64.191	70.346	69.834	63.805	85.998
0.5	60.375	68.695	67.004	60.027	86.968
0.75	54.010	63.619	59.389	53.208	88.069
1.0	48.142	61.096	54.3[illegible]	49.170	88.924
2.0	34.673	53.213	—	40.425	90.398
3.0	27.600	49.068	—	32.340	—
4.0	—	—	—	22.228	—
[illegible]	—	—	—	11.285	—

SOLUBILITY OF POTASSIUM CHLORATE IN AQUEOUS SOLUTIONS OF POTASSIUM IODIDE AT 25° AND VICE VERSA.

(Ricci, 1937.)

d. of sat. sol.	Gms. per 100 gms. sat. sol. $KClO_3$	Gms. per 100 gms. sat. sol. KI	Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol. $KClO_3$	Gms. per 100 gms. sat. sol. KI	Solid Phase
1.047	7.905	0.0	$KClO_3$	1.555	1.10	49.94	$KClO_3$
1.103	5.04	9.33	"	1.702	0.82	58.34	"
1.178	3.35	18.74	"	1.724	0.83	59.28	" + KI
1.275	2.30	28.72	"	1.724	0.67	59.36	KI
1.400	1.60	39.26	"	1.718	0.0	59.76	"

SOLUBILITY OF POTASSIUM CHLORATE IN AQUEOUS SOLUTIONS OF POTASSIUM IODATE AND VICE VERSA.

(Ricci, 1938.)

Results at 25°

d. of sat. sol.	Gms. per 100 gms. sat. sol. KIO_3	Gms. per 100 gms. sat. sol. $KClO_3$	Solid Phase
1.048	0.0	7.90	$KClO_3$
1.068	2.92	7.31	"
1.090	5.43	6.80	" + KIO_3
1.082	5.85	5.31	KIO_3
1.070	7.05	2.31	"
1.043	8.45	0.0	"

Results at 50°

Gms. per 100 gms. sat. sol. KIO_3	Gms. per 100 gms. sat. sol. $KClO_3$	Solid Phase
0.0	15.78	$KClO_3$
2.41	15.11	"
5.27	14.31	"
7.27	13.77	" + KIO_3
8.76	8.58	KIO_3
10.87	3.71	"
13.21	0.0	"

SOLUBILITY OF POTASSIUM CHLORATE IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE AND VICE VERSA.

(Ricci and Yanick, 1937.)

d. of sat. sol.	Gms. per 100 gms. sat. sol. $KClO_3$	Gms. per 100 gms. sat. sol. K_2SO_4	Solid Phase
Results at 15°			
1.032	5.676	0.0	$KClO_3$
1.085	3.29	7.86	" + K_2SO_4
1.076	0.0	9.258	K_2SO_4
Results at 25°			
1.048	7.897	0.0	$KClO_3$
1.063	6.72	2.73	"
1.080	5.77	5.57	"
1.099	5.06	8.19	"

d. of sat. sol.	Gms. per 100 gms. sat. sol. $KClO_3$	Gms. per 100 gms. sat. sol. K_2SO_4	Solid Phase
Results at 25° (con.)			
1.100	4.96	8.64	$KClO_3$+K_2SO_4
1.099	3.30	9.43	K_2SO_4
1.089	1.80	9.93	"
1.083	0.0	10.76	"
Results at 45°			
—	13.90	0.0	$KClO_3$
—	9.80	9.13	" + K_2SO_4
—	0.0	13.53	K_2SO_4

1000cc aqueous 5.2 percent NH_3 Solution dissolve 52.5 gms. $KClO_3$ at 20°. (Konowalow, 1899b)

SOLUBILITY OF POTASSIUM CHLORATE IN AQUEOUS SOLUTIONS OF SODIUM CHLORATE AND VICE VERSA AT 20°.

(DiCapua and Scalletti, 1927.)

The quite irregular results of the authors were plotted and the following average values taken from the curve.

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$KClO_3$	$NaClO_3$		$KClO_3$	$NaClO_3$	
6.75	0.0	$KClO_3$	2.5	40.0	$KClO_3$
4.6	5.0	"	2.5	42.0	" + $NaClO_3$
3.8	10.0	"	2.0	42.5	$NaClO_3$
3.4	15.0	"	1.0	45.0	"
3.1	20.0	"	0.33	47.5	"
2.7	30.0	"	0.0	49.5	"

SOLUBILITY OF POTASSIUM CHLORATE:

(Taylor, 1897; see also Gerardin, 1865.)

C10

Wt. per cent Alcohol or of Acetone in Solvent.	In Aqueous Alcohol.				In Aqueous Acetone.			
	At 30°. Gms. $KClO_3$ per 100 Gms.		At 40°. Gms. $KClO_3$ per 100 Gms.		At 30°. Gms. $KClO_3$ per 100 Gms.		At 40°. Gms. $KClO_3$ per 100 Gms.	
	Solution.	Water.	Solution.	Water.	Solution.	Water.	Solution.	Water.
0	9.23	10.17	12.23	13.93	9.23	10.17	12.23	13.93
5	7.72	8.80	10.48	12.33	8.32	9.56	11.10	13.11
10	6.44	7.65	8.84	10.77	7.63*	9.09	10.28*	12.60
20	4.51	5.90	6.40	8.56	6.09	8.10	8.27	11.26
30	3.21	4.74	4.67	7.00	4.93	7.40	6.69	10.24
40	2.35	4.00	3.41	5.88	3.90	6.76	5.36	9.45
50	1.64	3.33	2.41	4.94	2.90	5.98	4.03	8.40
60	1.01	2.53	1.41	3.69	2.03	5.17	2.86	7.35
70	0.54	1.82	0.78	2.63	1.24	4.18	1.68	5.68
80	0.24	1.22	0.34	1.73	0.57	2.88	0.79	3.97
90	0.06	0.62	0.12	1.17	0.18	1.82	0.24	2.45

* Solvent, 9.09 Wt. per cent Acetone.

100 gms. aqueous 50.0 wt. percent C_2H_5OH solution dissolve 1.1 gms. $KClO_3$ at 20° and 14.1 gms. at 100°. The determinations were made in sealed tubes. (Wright, 1927.)

SOLUBILITY OF POTASSIUM CHLORATE IN AQUEOUS SOLUTIONS OF ACETONE AT 17.6°.

(Hartley, 1931.)

The saturated solutions were prepared in sealed glass tubes and analyzed by evaporation to dryness and weighing.

Mol. $(CH_3)_2CO$ per 1.0 mol. $(CH_3)_2CO + H_2O$	Mol. $KClO_3$ per 1.0 mol. $KClO_3 + (CH_3)_2CO + H_2O$
0.000	0.00953
0.0233	0.00847
0.0409	0.00779
0.0513	0.00740

SOLUBILITY OF POTASSIUM CHLORATE IN AQUEOUS SOLUTIONS OF VARIOUS COMPOUNDS AT 25°. (Rothmund, 1910.)

Aqueous 0.5 Normal Solution of:	$KClO_3$ per Liter. Mols.	$KClO_3$ per Liter. Gms.	Aqueous 0.5 Normal Solution of:	$KClO_3$ per Liter. Mols.	$KClO_3$ per Liter. Gms.
Water alone	0.1475	20.44	Ammonia	0.1474	20.43
Methyl Alcohol	9.1402	19.43	Dimethylamine	0.1342	18.60
Ethyl Alcohol	0.1356	18.75	Pyridine	0.1410	19.54
Propyl Alcohol	0.1343	18.61	Urethan	0.1400	19.40
Tertiary Amyl Alcohol	0.1279	17.72	Formamide	0.1539	21.32
Acetone	0.1451	20.11	Acetamide	0.1447	20.05
Ether	0.1336	18.51	Acetic Acid	0.1462	20.26
Glycol	0.1416	19.62	Phenol	0.1362	18.87
Glycerol	0.1404	19.45	Methylal	0.1400	19.40
Urea	0.1510	20.92	Methyl Acetate	0.1429	19.80

SOLUBILITY OF POTASSIUM CHLORATE IN GLYCEROL.

t°	d. of Glycerol	Percent Glycerol	Gms. $KClO_3$ per 100 gms. glycerol	Authority
15-16	1.256	96.0	3.54	(Ossendowski, 1907.)
20	1.2326	86.5	1.32	(Holm, 1921, 1921(a), 1922.)
20	1.2645	98.5	1.03	" " " "
25	1.249	95.0	1.05	(Schnellbach and Rosin, 1931.) C1

100 gms. sat. solution of $KClO_3$ in glycol contain 0.9 gm. $KClO_3$. (de Coninick, 1905.)

100 gms. liquid ammonia (NH_3) dissolve 2.52 gms. $KClO_3$ at 0°. (Hunt and Boncyk, 1933.)

POTASSIUM Per CHLORATE $KClO_4$

SOLUBILITY OF POTASSIUM PERCHLORATE IN WATER.

The following values were taken from an average curve constructed from the results of Pierrot, 1921; Willard and Smith, 1923; Moser and Ritschel, 1925; Flöttmann, 1928; Cornec and Neumeister, 1929; Flatt and Jordan, 1930, 1933; and Caven and Bryce, 1934. Above 100° Benrath Gjedebo, Schiffers and Wunderlich, 1937. The results in parentheses are the average of previously reported determinations by Carlson, 1910; Rosenheim and Weinhaber, 1910-11 and Calzolari, 1912. The solid phase is $KClO_4$ in all cases.

t°	d. of sat. sol.	Gms. $KClO_4$ per 100 gms. sat. sol.		t°	d. of sat. sol.	Gms. $KClO_4$ per 100 gms. sat. sol.		t°	Gms. $KClO_4$ per 100 gms. sat. sol.
0	1.005	0.75		50	1.017	4.90	(6.5)	120	25
10	—	1.05		60	(1.033)	6.8	(9.0)	140	32.5
15	1.0076	1.33		70	—	9.2	(11.8)	180	46
20	1.0085	1.65		75	1.036	10.36		200	52.5
25	1.0096	2.03		80	(1.053)	11.8	(14.8)	225	60
30	—	2.50		90	—	15.0	(18.0)	250	67
40	(1.022)	3.60	(4.4)	100	1.0681	18.2	(21.8)	265	70

SOLUBILITY OF POTASSIUM PERCHLORATE IN AQUEOUS SOLUTIONS OF HYDROGEN PEROXIDE AT 25°

(Akerlof and Turck, 1935.)

Gms. H_2O_2 per 100 gms. aq. solvent	Gm. Mols. $KClO_4$ per 1000 gms. aq. solvent
0.00	0.149
15.72	0.175
31.43	0.199

SOLUBILITY OF POTASSIUM PERCHLORATE IN AQUEOUS SOLUTIONS OF ALUMINIUM PERCHLORATE AT 30°.

(Craven and Bryce, 1934.)

Gms. per 100 gms. H_2O		Solid Phase	Gms. per 100 gms. H_2O		Solid Phase
$Al(ClO_4)_3$	$KClO_4$		$Al(ClO_4)_3$	$KClO_4$	
0.0	2.528	$KClO_4$	4.956	1.028	$KClO_4$
2.652	1.462	"	8.158	0.7041	"
3.043	1.357	"	34.56	0.2115	"

SOLUBILITY OF POTASSIUM PERCHLORATE IN AQ. KCL AND AQ. K_2SO_4 SOLUTIONS AT 25°. (Noyes and Boggs, 1911.)

ClO

In Aq. KCl Solutions.			In Aq. K_2SO_4 Solutions.		
Gms. per 100.2 cc. Sat. Sol.		Wt. of 100.2 cc. of Solution.	Gms. per 100.2 cc. Sat. Sol.		Wt. of 100.2 cc. of Solution.
$KClO_4$.	KCl.		$KClO_4$.	K_2SO_4.	
2.0566	0	...	2.0566	0	...
1.7800	0.3715	101.42	1.8262	0.4339	101.47
1.5597	0.7421	101.45	1.6396	0.8665	101.55

SOLUBILITY OF POTASSIUM PERCHLORATE IN AQUEOUS SALT SOLUTIONS AT 25°.

(Bozorth, 1923.)

Saturation was obtained by constant agitation, and approaching equilibrium from above and from below. The salt content of the solvents was determined by evaporation and drying the residue at 200°. The salt content of the saturated solutions was determined in the same manner and the difference ascribed to dissolved perchlorate.

Salt.	Gm. Equiv. Salt. per 1000 gms. H_2O.	Gm. Equiv. $KClO_4$ per 1000 gms. H_2O.	Salt.	Gm. Equiv. Salt. per 1000 gms. H_2O.	Gm Equiv $KClO_4$ per 1000 gms. H_2O.
None = H_2O..	0.0	0.1491 (=20.67gms.)	$NaNO_3$ ...	0.1008	0.1611
KCl	0.0983	0.1136	" ...	0.3139	0.1790
"	0.2994	0.0757	" ...	0.6220	0.1994
"	0.6089	0.0535	K_2SO_4....	0.0998	0.1194
KNO_3........	0.0971	0.1174	"	0.3025	0.0857
"	0.2954	0.0846	"	0.6008	0.0644
"	0.6686	0.0642	Na_2SO_4...	0.1047	0.1633
$NaClO_4$......	0.1026	0.1122	" ...	0.3210	0.1800
"	0.3090	0.0752	" ...	0.6610	0.1957
"	0.6273	0.0533	$BaCl_2$.....	0.0991	0.1569
NaCl.........	0.1007	0.1567	"	0.2974	0.1638
"	0.2994	0.1558	"	0.5995	0.1693
"	0.5903	0.1732	$Ba(NO_3)_2$.	0.0990	0.1605
			" .	0.3019	0.1747
			" .	0.6075	0.1902

SOLUBILITY OF MIXED CRYSTALS OF POTASSIUM PERMANGANATE AND POTASSIUM PERCHLORATE AT 7°.

(Muthmann and Kuntze, 1894; recalculated by Fock, 1897.)

Milligram Mols. per Liter.		Gms. per Liter.		Mol. per cent $KMnO_4$ in Crystals of Solid Phase.
$KMnO_4$.	$KClO_4$.	$KMnO_4$.	$KClO_4$.	
0	63.91	0	8.86	0
29.37	54.48	4.65	7.55	2.84
67.73	42.75	10.71	5.93	9.78
79.04	39.59	12.50	5.49	10.81
99.81	38.63	15.79	5.36	15.96
122.24	34.39	19.34	4.77	23.56
119.21	38.91	18.84	5.39	24.28
128.08	33.77	20.26	4.68	26.40
144.46	33.14	22.86	4.59	34.32
167.81	29.53	26.55	4.09	44.42
183.09	25.19	28.97	3.49	67.33
197.82	20.16	31.30	2.80	77.95
233.75	28.26	36.98	3.92	94.37
264.27	0	41.81	0	100

C10

EQUILIBRIUM IN THE SYSTEM COMPOSED OF POTASSIUM AND SODIUM PERCHLORATES AND NITRATES AT 25° AND AT 100°.

(Hering, 1928.)

t°	d. of sat. sol.	Gms. per 100 gms. H_2O				Solid Phase
		$KClO_4$	$NaClO_4$	$NaNO_3$	KNO_3	
25	1.013	2.07	—	—	—	$KClO_4$
"	1.684	—	211.0	—	—	$NaClO_4.H_2O$
"	1.392	—	—	91.7	—	$NaNO_3$
"	1.189	—	—	—	38.3	KNO_3
"	1.684	0.87	210.0	—	—	$KClO_4 + NaClO_4.H_2O$
"	1.732	—	209.0	41.7	—	$NaClO_4 + NaNO_3$
"	1.512	—	—	97.7	49.2	$KNO_3 + NaNO_3$
"	1.195	0.96	—	—	38.8	$KClO_4 + KNO_3$
"	1.733	1.91	208.0	41.2	—	" + $NaNO_3$ + $NaClO_4.H_2O$
"	1.419	7.24	—	94.4	—	" + $NaNO_3$
"	1.515	1.92	—	97.7	49.1	" + " + KNO_3
100	1.070	22.1	—	—	—	"
"	1.758	—	329.0	—	—	$NaClO_4$
"	1.507	—	—	175.1	—	$NaNO_3$
"	1.569	—	—	—	244.0	KNO_3
"	1.770	9.0	333.0	—	—	$KClO_4 + NaClO_4$
"	1.825	—	333.0	114.0	—	$NaClO_4 + NaNO_3$
"	1.786	—	—	234.0	328.0	$KNO_3 + NaNO_3$
"	1.609	22.0	—	—	255.0	$KClO_4 + KNO_3$
"	1.837	11.6	331.0	116.0	—	" + $NaNO_3$ + $NaClO_4$
"	1.578	38.6	—	186.0	—	" + "
"	1.803	22.6	—	242.0	332.0	" + " + KNO_3

SOLUBILITY OF POTASSIUM PERCHLORATE IN AQUEOUS SOLUTIONS OF SODIUM NITRATE AND VICE VERSA.

(Cornec and Neumeister, 1929.)

d. of sat. sol.	Gms. per 100 gms. sat. sol. $KClO_4$	Gms. per 100 gms. sat. sol. $NaNO_3$	Solid Phase
	Results at 0°		
1.005	0.75	0.0	$KClO_4$
1.136	1.43	16.4	"
1.237	1.70	28.1	"
1.317	1.82	36.8	"
1.368	1.88	41.8	" + $NaNO_3$
1.352	0.0	42.3	$NaNO_3$
	Results at 25°		
1.013	2.03	0.0	$KClO_4$
1.155	2.25	24.0	"
1.265	3.52	48.3	"
1.352	3.60	40.4	"
1.419	3.59	46.8	" + $NaNO_3$
1.404	1.82	47.3	$NaNO_3$
1.392	0.0	47.8	"
	Results at 50°		
1.017	4.91	0.0	$KClO_4$
1.158	6.10	18.2	"
1.264	6.29	30.6	"
1.349	6.23	39.6	"
1.417	5.99	46.2	"
1.468	5.73	51.0	" + $NaNO_3$
1.454	3.56	52.0	$NaNO_3$

d. of sat. sol.	Gms. per 100 gms. sat. sol. $KClO_4$	Gms. per 100 gms. sat. sol. $NaNO_3$	Solid Phase
	Results at 50° (con.)		
1.441	1.85	52.6	$NaNO_3$
1.427	0.0	53.2	"
	Results at 75°		
1.036	10.36	0.0	$KClO_4$
1.187	10.81	19.8	"
1.312	10.28	34.0	"
1.407	9.61	43.5	"
1.461	9.11	48.9	"
1.523	8.61	54.4	" + $NaNO_3$
1.509	6.11	55.7	$NaNO_3$
1.501	5.42	56.0	"
1.492	3.92	56.7	"
1.488	3.20	57.1	"
1.486	2.80	57.3	"
1.469	0.0	58.7	"
	Results at 100°		
1.068	18.17	0.0	$KClO_4$
1.241	16.39	22.7	"
1.370	14.81	37.1	"
1.472	13.41	47.4	"
1.535	12.44	53.6	"
1.578	11.89	57.3	" + $NaNO_3$
1.554	8.21	59.4	$NaNO_3$
1.540	5.17	61.0	"
1.507	0.0	63.7	"

SOLUBILITY OF POTASSIUM PERCHLORATE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE.

(Cornec and Neumeister, 1929.)

d. of sat. sol.	Gms. per 100 gms. sat. sol. $KClO_4$	Gms. per 100 gms. sat. sol. $NaNO_3$	Solid Phase
	Results at 0°		
1.005	0.75	0.0	$KClO_4$
1.214	0.74	26.2	" + NaCl
1.209	0.0	26.4	NaCl
	Results at 25°		
1.013	2.03	0.0	$KClO_4$
1.207	1.61	25.9	" + NaCl
1.198	0.0	26.6	NaCl
	Results at 50°		
1.017	4.71	0.0	$KClO_4$
1.205	3.19	25.9	" + NaCl
1.85	0.0	26.9	NaCl

d. of sat.	Gms. per 100 gms. sat. sol. $KClO_4$	Gms. per 100 gms. sat. sol. $NaNO_3$	Solid Phase
	Results at 75°		
1.036	10.36	0.0	$KClO_4$
1.207	6.18	27.5	" + NaCl
1.176	0.0	27.5	NaCl
	Results at 100°		
1.068	18.17	0.0	$KClO_4$
1.116	15.32	8.1	"
1.153	12.72	15.0	"
1.190	10.85	21.0	"
1.216	9.49	25.1	" + NaCl
1.201	6.85	36.0	NaCl
1.183	3.54	27.0	"
1.164	0.0	28.6	"

The following results are given by Cornec & Neumeister, 1929 for the quarternary system.

$KClO_4 + NaCl + NaNO_3 + H_2O$

t°	d. of sat. sol.	Gms. per 100 gms. sat. sol.			Solid Phase
		$KClO_4$	NaCl	$NaNO_3$	
0	1.342	1.15	16.4	23.4	$KClO_4 + NaCl + NaNO_3$
25	1.404	3.19	4.1	41.7	" + $NaNO_3$
"	1.395	2.84	8.4	36.9	" + "
"	1.388	2.55	12.3	32.5	" + " + NaCl
"	1.332	2.31	16.0	23.4	" + NaCl
"	1.274	2.00	20.5	13.0	" + "
"	1.378	1.28	12.8	32.3	" + $NaNO_3$
50	1.445	4.76	8.6	41.3	$KClO_4 + NaCl + NaNO_3$
"	1.398	4.60	11.1	34.6	" + "
"	1.341	4.34	14.6	25.7	" + "
"	1.277	3.84	19.6	14.3	" + "
75	1.509	7.69	5.9	48.3	$KClO_4 + NaCl + NaNO_3$
"	1.454	7.67	8.1	41.5	" + "
"	1.384	7.51	11.7	31.5	" + "
"	1.305	6.92	17.1	18.6	" + "
100	1.578	11.54	2.20	55.1	$KClO_3 + NaNO_3$
"	1.538	5.86	4.79	55.5	NaCl + "
"	1.573	10.80	4.23	53.6	" + " + $KClO_4$
"	1.518	11.52	5.73	47.0	" + $KClO_4$
"	1.440	11.72	8.84	37.0	" + "
"	1.340	11.34	14.71	22.1	" + "

SOLUBILITY OF POTASSIUM PERCHLORATE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 14°.

(Pierrat, 1921.)

Saturation was obtained by constant agitation for several hours. The saturated solution was evaporated to dryness in a current of air and the residue dissolved in enough water to yield the original volume of the solution. The salt content of this solution was then determined by electrolytic conductivity measurement.

Wt. per cent C_2H_5OH in solvent.	Gms. $KClO_4$ per liter sat. sol.	Wt. per cent C_2H_5OH in solvent.	Gms. $KClO_4$ per liter sat. sol.
0.0	12.4	42.4	3.9
7.1	9.2	58.5	2.6
13.2	7.8	94.7	0.15
27.3	5.7		

SOLUBILITY OF POTASSIUM PERCHLORATE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL.

(Flatt, 1933 Flatt and Jordan, 1930, 1933.)

t°	Vol. Percent C_2H_5OH in Solvent	Gms. $KClO_4$ per 100 gms. sat. sol.	t°	Vol. Percent C_2H_5OH in Solvent	Gms. $KClO_4$ per 100 gms. sat. sol.
25	0 (= H_2O)	2.065	40	50	1.422
"	50	0.790	"	75	0.548
"	75	0.313			

100 gms. 51.2 Vol. % Aq. C_2H_5OH ($d = 0.9319$) dissolve 0.754 gm. $KClO_4$ at 25.2°. (Thin and Cumming, 1915.)

" 93.5 " " ($d = 0.8219$) " 0.051 gm. $KClO_4$ at 25.2°. (Thin and Cumming, 1915.)

" 98.8 " " ($d = 0.7998$) " 0.019 gm. $KClO_4$ at 25.2°. (Thin and Cumming, 1915.)

" 90 Wt. % Aq. C_2H_5OH " 0.036 gm. $KClO_4$ at 25.2°. (Wenze, 1891.)

" 97.2 " " " 0.0156 gm. $KClO_4$ at 25.2°. (Wenze, 1891.)

SOLUBILITY OF POTASSIUM PERCHLORATE IN AQUEOUS AND IN ALCOHOLIC SOLUTIONS OF PERCHLORIC ACID AT 25.2°.

(Thin and Cumming, 1915.)

In Aq. $HClO_4$ Solutions.		In Alcoholic $HClO_4$ Solutions.	
Normality of Aq. $HClO_4$.	Gms. $KClO_4$ per 100 Gms. Sat. Sol.	Aqueous Solvent.	Gms. $KClO_4$ per 100 Gms. Sat. Sol.
0 (= water)	2.085	93.5% Alcohol	0.051
0.01	1.999	" +0.2% $HClO_4$*	0.0175
0.10	1.485	98.8% Alcohol + "	0.010
1	0.527	" +2% $HClO_4$*	0.028

* The $HClO_4$ was added as aq. 20% $HClO_4$ solution hence the concentration of the alcohol was decreased.

C10

SOLUBILITY OF POTASSIUM PERCHLORATE AND ABSOLUTE ETHYL ALCOHOL SOLUTION OF AMMONIUM SALTS AT 25°.

(Seward and Schumb, 1930.)

Results for C_2H_5OH ($d = 0.7852$) Solutions of:

Ammonium Nitrate		Ammonium Perchlorate		Ammonium Iodide	
Gm. Mols. per liter		Gm. Mols. per liter		Gm. Mols. per liter	
NH_4NO_3	$KClO_3$	NH_4ClO_4	$KClO_4$	NH_4I	$KClO_4$
0.000000	0.0005654	0.000000	0.0005654	0.000495	0.0006148
0.000254	0.0005986	0.000222	0.0004979	0.000856	0.0006493
0.000488	0.0006233	0.000514	0.0004087	0.001141	0.0006784
0.000971	0.0006773	0.001004	0.0003251	0.001518	0.0007068
0.001858	0.0007283	0.001742	0.0002536	0.001765	0.0007156
0.004345	0.0008396			0.002343	0.0007462

SOLUBILITY OF POTASSIUM PERCHLORATE IN SEVERAL SOLVENTS AT 25°.

(Willard and Smith, 1923.)

Solvent.	$d_{\frac{25}{4}}$ of sat. sol.	Gms. $KClO_4$ per 100 gms. sat. sol.	Solvent.	$d_{\frac{25}{4}}$ of sat. sol.	Gms. $KClO_4$ 100 gms. sat. sol.
Water..........	1.0096	2.02	*n* Butyl alcohol..	0.8060	0.0045
Ethyl alcohol....	0.7852	0.012	*iso* " " ..	0.7981	0.005
Methyl alcohol..	0.7878	0.105	Acetone.........	0.7868	0.155
n Propyl alcohol.	0.8011	0.010	Ethyl acetate....	0.8945	0.0015

SOLUBILITY OF POTASSIUM PERCHLORATE IN NORMAL BUTYL ALCOHOL, ETC. AT 25° ± 3. (Smith, 1923 *a*.)

Composition of solvent.			Milligrams $KClO_4$ per 100 cc. sat. sol.	Composition of solvent.			Milligrams $KClO_4$ per 100 cc. sat. sol.
Per cent Pure *n* Butyl alcohol.	Per cent $HClO_4 2H_2O$.	Per cent H_2O.		Per cent Pure *n* Butyl alcohol.	Per cent $HClO_4 2H_2O$.	Per cent H_2O.	
100	0.0	0.0	1.35	99.0	0.0	1.0	2.0
99.75	0.25	0.0	1.00	97.0	0.0	3.0	3.8
99.5	0.5	0.0	1.00	96.0	1.0	3.0	1.6
99.0	1.0	0 0	1.9	96.5	0.5	3.0	1.2
98.0	1.0	1.0	1.4	94.0	1.0	5.0	2.3

100 cc. pure ethyl acetate dissolve 1.3 mg. $KClO_4$ at 25°. (Smith, 1925.)

SOLUBILITY OF POTASSIUM PERCHLORATE IN MIXTURES OF ETHYL ACETATE AND ALCOHOLS AT 25°. (Smith, 1925.)

Composition of solvent.	Gms $KClO_4$ per 100 gms. sat. sol.
90 Vol. % $CH_3COOC_2H_5$ + 10 Vol. % CH_3OH	0.35
85 » » + 15 » »	0.52
80 » » + 20 » »	0.55
90 » » + 10 » C_2H_5OH	0.16
85 » » + 15 » »	0.26
80 » » + 20 » »	0.33
90 » » + 10 » of 93 % C_2H_5OH	0.28
85 » » + 15 » » »	0.44
80 » » + 20 » » »	0.50
90 » » + 10 » *n* Butyl alcohol	0.24
85 » » + 15 » »	0.20
80 » » + 20 » »	0.25

SOLUBILITY OF POTASSIUM PERCHLORATE IN ANHYDROUS ACETIC ACID SOLUTIONS OF VARIOUS SALTS AT 25°.

(Seward and Hamblet, 1932; Scholl and Hutchinson and Chandlee, 1933.)

Results for CH_3COOH (d_{25}= 1.044) solutions of:

Lithium Chloride

Gm. Mols. per liter	
LiCl	$KClO_4$
0.00000	0.000196
0.00070	0.000293
0.00141	0.000360
0.00285	0.000524
0.00641	0.000701
0.00943	0.000767
0.02870	0.001265

Magnesium Chloride

Gm. Mols. per liter	
$MgCl_2$	$KClO_4$
0.0000042	0.000228
0.0000115	0.000250
0.0000314	0.000276
0.0000420	0.000297
0.0000829	0.000336
0.0001440	0.000347
0.0002820	0.000394
0.0005390	0.000475

Ammonium Perchlorate

Gm. Mols. per liter	
NH_4ClO_4	$KClO_4$
0.000198	0.000194
0.000316	0.000176
0.000378	0.000190
0.000509	0.000171
0.000765	0.000155
0.000983	0.000155
0.001306	0.000139
0.002093	0.000141

Sodium Bromide

Gm. Mols. per liter	
NaBr	$KClO_4$
0.000078	0.000233
0.000120	0.000247
0.000192	0.000288
0.000210	0.000314
0.000278	0.000329
0.000590	0.000387
0.000700	0.000409

Sodium Bromide

Gm. Mols. per liter	
NaBr	$KClO_4$
0.00000	0.000195
0.000078	0.000235
0.000120	0.000270
0.000192	0.000290
0.000210	0.000288
0.000278	0.000310
0.000590	0.000379

Sodium Nitrate

Gm. Mols. per liter	
$NaNO_3$	$KClO_4$
0.00000	0.000195
0.000168	0.000253
0.000346	0.000305
0.000633	0.000357
0.001009	0.000413
0.001550	0.000483
0.001825	0.000522

POTASSIUM CHROMATES K_2CrO_4, $K_2Cr_2O_7$, $K_2Cr_3O_{10}$, etc.

EQUILIBRIUM IN THE SYSTEM, POTASSIUM OXIDE, CHROMIC ACID AND WATER AT SEVERAL TEMPERATURES.

(Koppel and Blumenthal, 1907.)

Results at 0°. Gms. per 100 Gms. Sat. Solution.		Results at 30°. Gms. per 100 Gms. Sat. Solution.		Results at 60°. Gms. per 100 Gms. Sat. Solution.		Solid Phase at each Temp.
K_2O.	CrO_3.	K_2O.	CrO_3.	K_2O.	Cr_2O_3.	
31.18	...	46.8	...	about 50	...	$KOH.2H_2O$
26.06	0.54	26.89	0.94	32.98	0.53	K_2CrO_4
19.31	4.27	22.25	3.06	21.05	9.15	"
17.06	11.77	18.65	13.72	20.25	14.43	"
17.62	18.71	19.12	20.39	20.70	21.97	"
17.73	19.04	19.35	21	20.61	23.61	" $+K_2Cr_2O_7$
10.90	11.93	15.04	16.85	14.53	20.82	$K_2Cr_2O_7$
1.87	3.13	11.20	13.11	10.01	21.21	"
0.78	22.38	2.42	28.21	6.86	39.64	"
1.47	42.95	2.50	44.50	7.06	49.84	" $+K_2Cr_3O_{10}$
1.25	44.52	...	...	4.06	54.73	$K_2Cr_3O_{10}$
1.17	46.84	...	...	2	60.69	"
1.37	47.40	2.35	49.95	...	...	" $+K_2Cr_4O_{13}$
1.24	48.23	1.35	53.39	...	...	$K_2Cr_4O_{13}$
1.16	56.93	...	...	...	...	"
0.64	61.79	0.69	62.81	1.27	65.77	" $+CrO_3$
0	61.54	...	62.52	0	65.12	CrO_3

CrO

THE CRYOHYDRATES (EUTECTICS) IN THE SYSTEM $K_2O - CrO_3 - H_2O$.

The points were determined by adding to a sat. solution of $K_2Cr_2O_7$ successive 1 to 2 gm. portions of chromic acid and ascertaining the freezing-point and composition of the solution. At the point of appearance of a new solid phase an additional amount of chromic acid does not change the f.-pt. since the added CrO_3 goes into the solid phase. This relation also holds at the points where the solution is simultaneously saturated with $K_2Cr_2O_7$ and $K_2Cr_2O_{10}$ or $K_2Cr_2O_{10}$ and $K_2Cr_4O_{13}$.

t° of Equilibrium of Sat. Sol. with Ice.	Gms. per 100 Gms. Sat Solution.		Solid Phase in Equilibrium with Sat. Sol. and Ice.	t° of Equilibrium of Sat. Sol. with Ice.	Gms per 100 Gms. Sat. Solution		Solid Phase in Equilibrium with Sat. Sol. and Ice.
	K_2O.	CrO_3.			K_2O.	CrO_3.	
−25	20	5.70	K_2CrO_4	−13.22	not det.	27.26	$K_2Cr_2O_7$
−13	17.52	13.89	"	−14.50	"	28.85	"
−11.37	17.12	18.18	"	−22.10	"	35.92	"
−11.50	17.18	18.11	" $+K_2Cr_2O_7$	−22.11	0.47	36.14	"
−5	8.27	8.01	$K_2Cr_2O_7$	−26.77	0.88	39.86	"
−0.63	1.38	2.93	"	−30.20	1.18	42.31	" $+K_2Cr_3O_{10}$
−1.78	not det.	6.81	"	−34.01	0.95	43.45	$K_2Cr_3O_{10}$
−5.5	"	16.05	"	−39	0.79	45.65	" $+K_2Cr_4O_{13}$
−6.43	0.48	17.25	"	−49	not det.	49.11	$K_2Cr_4O_{13}$
10.25	0.45	23.63	"	−61.5	0.61	53.57	"

The viscosity of the solutions at the lower temperatures increased so much that the cryohydrate points could not be determined. By graphic extrapolation the cryohydrate temperature of chromic acid and of chromic acid + potassium tetrachromate is near −80° and the CrO_3 content is 59 gms. per 100 gms. sat. solution.

By interpolation from the data given in the preceding tables the following solubilities in water are obtained:

THE ICE CURVE AND SOLUBILITY OF POTASSIUM CHROMATE IN WATER.

t°.	Gms. K_2CrO_4 per 100 Gms. H_2O.	Solid Phase.	t°	Gms. K_2CrO_4 per 100 Gms. H_2O.	Solid Phase.
− 0.99	4.53	Ice	−11.35 Eutec.	54.54	Ice + K_2CrO_4
− 1.2	6.12	"	0	57.11	K_2CrO_4
− 4.3	26.99	"	30	65.13	"
− 7.12	42.04	"	60	74.60	"
−10.35	52.41	"	105.8 b. pt.	88.8	"

Potassium Dichromate

t°.	Gms. $K_2Cr_2O_7$ per 100 Gms. H_2O.
−0.63*	4.50
0	4.65
30	18.13
60	45.44
104.8†	108.2

Potassium Dichromate + Potassium Chromate.

t°.	Gms. per 100 Gms. H_2O.	
	K_2O.	CrO_3.
−11.5*	17.18	18.11
0	17.73	19.03
+30	19.35	21
60	20.61	23.61
106.8†	24.3	30.5

Potassium Dichromate + Potassium Trichromate.

t°.	Gms. per 100 Gms. Sat Solution.	
	K_2O.	CrO_3.
−30*	1.18	42.51
0	1.47	42.99
+20	2.20	43.10
30	2.50	44.50
60	7.06	49.84
114†	16.80	59.20

* Eutec. † b. pt.

Potassium Trichromate + Potassium Tetrachromate.

t°.	Gms. per 100 Gms. Sat. Sol.	
	K_2O.	CrO_3.
−39 Eutec.	0.79	45.69
0	1.37	47.40
20	2	48.46
30	2.25	49.95
60	5.01	54.09

Potassium Tetrachromate + Chromic Acid (CrO_3).

t°.	Gms. per 100 Gms. Sat. Sol.	
	K_2O.	CrO_3.
0	0.64	61.79
20	0.62	62.80
30	0.69	62.81
60	1.27	65.77

Data for boiling points in the system $K_2O + CrO_3.H_2O$ determined by means of the Beckmann apparatus, are also given.

The older data for K_2CrO_4 and $K_2Cr_2O_7$ are as follows:

SOLUBILITY OF EACH IN WATER.

(Alluard, 1864; Nordenskjold and Lindstrom, 1869; Etard, 1894; Kremers, 1854; Tilden and Shenstone, 1884.)

t°.	Potassium Chromate. Grams per 100 Grams Water.			Potassium Dichromate. Grams per 100 Grams Water.	
0	58.2*	59.3†	60.2‡	5*	5§.
10	60.0	61.2	62.5	7	7
20	61.7	63.2	64.5	12	12
25	62.5	64.2	64.5	16	16
30	63.4	65.2	66.5	20	20
40	65.2	67.0	68.6	26	27
50	66.8	69.0	70.6	34	37
60	68.6	71.0	72.7	43	47
70	70.4	73.0	74.8	52	58
80	72.1	75.0	76.9	61	70
90	73.9	77.0	79.0	70	82
100	75.6	79.0	82.2	80	97
125	79.0	...	...	110	145
150	83.0	...	...	143	205

* Etard. † Alluard. ‡ N. and L. § A., K., T. and S.

SOLUBILITY OF POTASSIUM CHROMATES IN WATER AT 30°.

(Schreinemaker — Z. physik. Ch. 55, 83, '00.)

Composition in Wt per cent of:				Solid Phase.
The Solution		The Residue.		
Per cent CrO_3	Per cent K_2O	Per cent CrO_3.	Per cent K_2O.	
0	±47	...	...	$KOH.2H_2O$
0.0	47.16	12.59	47.54	$_2CrO_4$
0.1775	34.602	10.93	37.47	"
1.351	26.602	16.482	32.532	"
5.598	20 584	37.131	39.922	"
15.407	19.225	27.966	29.377	"
20.67	19 17	...	...	$K_2CrO_4 + K_2Cr_2O_7$
19.096	17.30	37.64	22.61	$K_2Cr_2O_7$
11.35	7.88	...	...	"
17.93	3.412	25.85	7.82	"
43.51	3.01	49.45	9.91	"
44.46	3.245	53.94	12.40	$K_2Cr_2O_7 + K_2Cr_3O_{10}$
46.368	2.823	60.314	12 935	$K_2Cr_3O_{10}$
49.357	2.353	63.044	11.684	$K_2Cr_3O_{10} + K_2Cr_4O_{13}$
53.215	1.360	62 958	8.002	$K_2Cr_4O_{13}$
62.55	0.796	67.944	6.731	"
62.997	0.621	70.0	4 0	$K_2Cr_4O_{13} + CrO_3$
62.28	0.0	...	...	CrO_3

CrO

100 gms. sat. solution in glycol, $C_2H_4(OH)_2.H_2O$, contain 1.7 gms. K_2CrO_4 at 15.4°.
100 gms. sat. solution in glycol, $C_2H_4(OH)_2.H_2O$, contain 6 gms. $K_2Cr_2O_7$ at 14.6°.
(de Coninck, 1905)

100 gms. H_2O dissolve 10.1 gms. $K_2Cr_2O_7$ at 15.5°. (Greenish and Smith, 1901)

100 gms. sat. solution in water contain 5.52 gms. $K_2Cr_2O_7$ at 4.81°, 15.17 gms. at 30.1° and 17.77 gms. at 35.33°. (Le Blanc and Schmandt, 1911)

100 cc. sat. aqueous solution contain 11.43 gms. $K_2Cr_2O_7$ at 20°.
(Sherrill and Eaton, 1907)

SOLUBILITY OF POTASSIUM CHROMATES IN WATER.

(Flöttmann, 1928.)

Results for Potassium Chromate

t^0	d. of sat, sol.	Gms. K_2CrO_4 per 100 gms. sat. sol.
15	1.3749	38.49
20	1.3785	38.94
25	1.3805	39.38

Results for Potassium Di Chromate

t^0	d. of sat. sol.	Gms. $K_2Cr_2O_7$ per 100 gms. sat. sol.
15	1.0635	8.893
20	1.0768	10.822
25	1.0916	12.98

The following more recent determinations of the Solubility of Potassium DiChromate in Water are given by Rakowski and Babajewa, 1931.

t^0	0	20	40	60	80	100
Gms. $K_2Cr_2O_7$ per 100 gms. sat. sol.	4.47	10.97	20.83	31.3	42.20	50.0

SOLUBILITY OF POTASSIUM CHROMATE IN WATER AT TEMPERATURES ABOVE 100°.

(Benrath, Gjedebo, Schiffers and Wunderlich, 1937.)

The authors' results were plotted and the following values taken from the average curve.

t°	Gms. K_2CrO_4 per 100 gms. sat. sol.	t°	Gms. K_2CrO_4 per 100 gms. sat. sol.	t°	Gms. K_2CrO_4 per 100 gms. sat. sol.
100	44.0	180	48.5	260	52.6
120	45.5	200	49.6	280	53.6
140	46.5	220	50.6	300	54.6
160	47.8	240	51.6	320	55.7

SOLUBILITY OF POTASSIUM CHROMATE IN AQUEOUS SOLUTIONS OF SEVERAL SALTS EACH DETERMINED SEPARATELY AT 25°.

(Herz and Hiebenthal, 1929.)

Results for Aqueous Solutions of:

Potassium Bromide		Potassium Chloride		Magnesium Chloride		Sodium Chloride		Ammonium Chloride	
Gm. Mol. per liter		Gm. Mol. per liter		Gm. Mol. per liter		Gm. Mol. per liter		Gm. Mol. per liter	
KBr	1/6 K_2CrO_4	KCl	1/6 K_2CrO_4	1/2 $MgCl_2$	1/6 K_2CrO_4	NaCl	1/6 K_2CrO_4	NH_4Cl	1/6 K_2CrO_4
0.00	8.35	0.0	8.35	0.0	8.35	0.42	8.22	0.45	7.68
0.41	7.56	0.40	7.76	0.42	7.58	0.86	7.71	0.83	6.92
0.82	6.91	0.46	7.69	0.86	6.11	1.73	6.51	1.81	5.58
1.24	6.26	1.31	6.48	1.73	4.30	2.59	5.46	2.34	5.00
1.78	5.50	1.72	5.89	2.27	2.74	3.30	4.79	2.93	4.43
2.19	5.00	2.18	5.24	2.76	1.30	3.40	4.57	3.76	3.49
2.70	4.38	*2.70	4.75	3.26	1.04	*4.25	4.49	4.51	2.87

SOLUBILITY OF POTASSIUM CHROMATE IN AQUEOUS SOLUTIONS OF POTASSIUM MOLYBDATE AT 25° AND VICE VERSA.

(Amadori, 1912a)

Gms. per 100 Gms. H_2O.		Gms. per 100 Gms. H_2O.		Gms. per 100 Gms. H_2O.	
K_2CrO_4.	K_2MoO_4.	K_2CrO_4.	K_2MoO_4.	K_2CrO_4.	K_2MoO_4.
64.62	0	14.13	98.72	4.92	165.4
49.59	15.37	10.07	118.8	2.14	180.8
38.90	38.79	10.24	119.9	1.70	183
33.21	50.96	7.12	137.8	0	184.6
		6.37	157.2		

SOLUBILITY OF POTASSIUM CHROMATE IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE AT 25° AND VICE VERSA.

(Amadori, 1912a)

Gms. per 100 Gms. H_2O.		Gms. per 100 Gms. H_2O.		Gms. per 100 Gms. H_2O.	
K_2CrO_4.	K_2SO_4.	K_2CrO_4.	K_2SO_4.	K_2CrO_4.	K_2SO_4.
63.09	0.76	40.93	3.33	7.81	8.98
61.39	1.17	27.36	4.82	4.36	10.25
58.40	1.84	20.83	5.72	1.94	10.86
51.81	2.36	14.65	7.12	0	12.10

100 cc. anhydrous hydrazine dissolve 1 gm. K_2CrO_4 at room temp. }
100 cc. anhydrous hydrazine dissolve 1 gm. $K_2Cr_2O_7$ at room temp. } (Welsh and Broderson, 1915.)

SOLUBILITY OF MIXED CRYSTALS OF POTASSIUM SULFATE AND POTASSIUM CHROMATE AT 25°

(Fock, 1897.)

Milligram Mols. per Liter. K_2SO_4.	Milligram Mols. per Liter. K_2CrO_4.	Grams per Liter. K_2SO_4.	Grams per Liter. K_2CrO_4.	Mol. per cent K_2SO_4 in Solution.	Sp. Gr. of Solution.	Mol. per cent K_2SO_4 in Solid Phase.
618.1	0.0	107.7	0.00	100.0	1.083	100.0
608.4	103	106.0	20.02	85.51	1.092	99.65
341.0	691.8	59.46	134.5	33.01	1.141	97.30
174.8	1496.0	30.47	290.5	10.50	1.231	91.97
110.7	2523	19.30	490.5	4.21	1.356	28.43
100.6	2687	17.54	522.3	3.60	1.377	2.41
0.0	2847	0.0	553.5	0.00	1.398	0.00
734.0	0.0	127.9	0.0	100.0	1.0863	100.0
617.0	103.4	107.6	20.1	85.65	1.0934	99.78
463	452.7	80.72	88.0	55.55	1.1235	98.49
279	948.2	48.64	184.4	22.72	1.1700	96.07
153	1469	26.68	285.6	9.41	1.2255	85.77
296	2681	51.61	521.2	21.09	1.3688	25.73
0.0	2715	0.00	527.8	0.00	1.3781	0.00

THE SYSTEM AMMONIUM CHROMATE + POTASSIUM CHROMATE + WATER AT 25°.

(Araki, 1925.)

CrO

Gms. per 100 gms. sat. sol. K_2CrO_4.	Gms. per 100 gms. sat. sol. $(NH_4)_2CrO_4$.	Solid Phase.	Gms. per 100 gms. sat. sol. K_2CrO_4.	Gms. per 100 gms. sat. sol. $(NH_4)_2CrO_4$.	Solid Phase.
39.35	0.00	K_2CrO_4	15.82	19.98	Mixtures of the two series of solid solutions
36.77	1.41	Series of solid solutions of $(NH_4)_2CrO_4$ in K_2CrO_4	15.20	20.18	
34.38	3.25		14.55	20.36	
29.36	6.75		14.47	20.40	Series of solide solutions of K_2CrO_4 in $(NH_4)_2CrO_4$
25.89	10.01		14.14	20.70	
22.35	12.85		11.69	21.30	
18.64	16.51		10.63	21.94	
16.07	19.10		7.08	22.88	
15.84	19.95		4.53	23.43	

A STUDY OF THE RECIPROCAL SALT PAIR $[(NH_4)_2, K_2]—[CrO_4, SO_4]$ AT 25°.

(Ishikawa, 1926.)

Previous experiments have shown that $K_2SO_4 + K_2CrO_4$ and also $(NH_4)_2SO_4 + K_2SO_4$ each form a complete series of solid solutions with no gap, while $(NH_4)_2CrO_4 + (NH_4)_2SO_4$ and $(NH_4)_2CrO_4 + K_2CrO_4$ each form a series of solid solutions with gaps respectively at 2.90 to 21.51 and 16.75 to 55.50 molar percentages of ammonium chromate. The present experiments were made by adding to a solution in equilibrium with two kinds of solid solutions of two salts having a common ion, another salt in different proportion, in such a manner that when equilibrium is attained, two or three solid phases remained as residue. The mixtures were rotated in a thermostat for at least two days. The results of the analyses are given in a table and plotted in the Janecke square diagram.

AMMONIUM Lanthanum **CHROMATE** $3(NH_4)_2CrO_4 . La(CrO_4)_3 . 5H_2O$.

Data showing that the range of existance of the double ammonium lanthanum chromate is in the presence of aqueous solutions containing from 5.06 to 23.22 per cent of ammonium chromate, are given by Carobbi, 1926.

POTASSIUM DICHROMATE $K_2Cr_2O_7$.

SOLUBILITY OF POTASSIUM DICHROMATE IN AQUEOUS SOLUTIONS OF SODIUM DICHROMATE AND VICE VERSA. (Robertson, 1924.)

The mixtures of the two salts were dissolved in water at a higher temperature than that of the isotherm and the flasks then placed in a thermostat at the desired temperature. Constant agitation is not mentioned.

Results at 25°.		Results at 50°.		Results at 100°.		
Gms. per 160 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Solid Phase at each temperature.
$Na_2Cr_2O_7$.	$K_2Cr_2O_7$.	$Na_2Cr_2O_7$.	$K_2Cr_2O_7$.	$Na_2Cr_2O_7$.	$K_2Cr_2O_7$.	
0.0	13.1	0.0	27.4	0.0	47.2	$K_2Cr_2O_7$
4.38	12.2	6.5	24.2	6.3	42.1	»
16.1	8.68	16.3	19.3	14.1	36.5	»
20.0	8.97	21.0	17.8	23.0	29.0	»
26.9	7.70	29.3	13.6	29.6	24.2	»
33.6	6.52	43.6	11.3	44.4	16.4	»
43.2	5.46	48.5	9.47	56.1	13.4	»
55.5	5.16	52.5	9.36	60.6	12.4	»
61.4	5.25	63.3	7.92	70.8	9.96	» $Na_2Cr_2O_7$
65.5	0.0	70.3	0.0	80.1	0.0	$Na_2Cr_2O_7$

SOLUBILITY OF POTASSIUM DICHROMATE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AND VICE VERSA. (Robertson, 1924.)

Results at 25°.		Results at 50°.		Results at 100°.		
Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Solid Phase at each temperature.
KCl.	$K_2Cr_2O_7$.	KCl.	$K_2Cr_2O_7$.	KCl	$K_2Cr_2O_7$.	
2.1	10.0	2.4	25.8	0.0	47.2	$K_2Cr_2O_7$
4.3	8.3	4.6	21.3	3.5	42.1	»
6.32	6.53	6.6	18.9	7.2	37.1	»
8.2	5.5	8.6	16.7	11.4	32.2	»
10.0	4.55	10.6	14.9	15.6	27.6	»
11.6	3.9	11.9	13.2	22.1	20.6	»
13.0	3.36	13.3	12.4	24.9	18.2	»
15.7	2.6	14.8	11.0	—	—	»
18.6	2.2	18.1	8.8	—	—	»
21.2	1.7	21.4	6.8	—	—	»
23.0	1.57	24.0	5.7	—	—	»
26.0	1.2	28.9	4.1	27.6	16.2	» +KCl
–	–	29.0	3.7	29.6	11.6	KCl
26.1	1.05	29.8	1.9	31.9	6.4	»
26.3	0.0	30.6	0.0	35.9	0.0	»

POTASSIUM DICHROMATE $K_2Cr_2O_7$.

SOLUBILITY OF POTASSIUM DICHROMATE IN AQUEOUS SOLUTIONS OF SEVERAL SALTS, EACH DETERMINED SEPARATELY AT 25°.

(Herz and Hiebenthal, 1929.)

Results for Aqueous Solutions of:

Calcium Chloride

Gm. Mols. per liter	
1/2-$CaCl_2$	1/6-$K_2Cr_2O_7$
0.24	2.88
0.45	2.91
0.92	2.84
1.41	3.69
1.64	2.62
1.87	2.56
11.42	1.88

Magnesium Chloride

Gm. Mols. per liter	
1/2-$MgCl_2$	1/6-$K_2Cr_2O_7$
0.0	2.89
0.45	2.78
0.93	2.64
1.84	2.24
2.31	2.07
2.74	1.91
3.15	1.76

Strontium Chloride

Gm. Mols. per liter	
1/2-$SrCl_2$	1/6-$K_2Cr_2O_7$
0.0	2.89
0.51	2.89
1.00	2.91
2.02	2.73
2.23	2.69
2.84	2.62
3.47	2.38

Lithium Chloride

Gm. Mols. per liter	
LiCl	1/6-$K_2Cr_2O_7$
0.0	2.89
0.49	2.73
0.92	2.55
1.78	2.26
2.78	1.85
3.61	1.57
4.49	1.32

CrO

Sodium Chloride

Gm. Mols. per liter	
NaCl	1/6-$K_2Cr_2O_7$
0.47	2.91
0.94	2.98
1.91	2.79
2.84	2.62
3.80	2.33
4.21	2.24
5.03	2.06

Ammonium Chloride

Gm. Mols. per liter	
NH_4Cl	1/6-$K_2Cr_2O_7$
0.0	2.89
0.73	2.52
1.79	2.54
2.59	2.32
3.10	2.16
4.00	1.83
5.32	0.91

POTASSIUM CHROMATES

SOLUBILITY OF POTASSIUM CHROMATE AND OF POTASSIUM DICHROMATE IN AQUEOUS SOLUTIONS OF DIOXANE AT 25°.

(Herz and Lorentz, 1929.)

Results for:

Potassium Chromate

cc Dioxane, ($C_4H_8O_2$), per 100 cc aq. solvent	Gm. Mols. K_2CrO_4 per liter sat. sol.
5.0	1.21
9.0	1.08 L
55.0	0.05 U
80	0.02

Potassium DiChromate

cc Dioxane ($C_4H_8O_2$) per 100 cc aq. solvent	Gm. Mols. $K_2Cr_2O_7$ per liter sat. sol.
10	0.41
33	0.25
50	0.15
60	0.01

L = Lower liquid layer U = Upper liquid layer

SOLUBILITY OF POTASSIUM CHROMATE IN AQUEOUS SOLUTIONS OF URETHAN AT 25°.

(Palitsch, 1928, 1929.)

Gm. Mols. per 1000 gms. H_2O K_2CrO_4	Gm. Mols. per 1000 gms. H_2O $Nh_2COOC_2H_5$	Solid Phase
3.323	0.0	K_2CrO_4
0.1	49.61	Upper liquid layer
3.0	0.396	Lower liquid layer

Fusion-point Data are given for the following mixtures.

K_2CrO_4 + $K_2Cr_2O_7$ (Groschuff, 1908.)
" + K_2MoO_4 (Amadori, 1913.)
" + K_2WO_4 " "
" + K_2SO_4 (" ; Groschuff, 1908.)

$K_2Cr_2O_7$ + $K_2Mo_2O_7$ (Amadori, 1913.)
" + $K_2W_2O_7$ " "
" + $Na_2Cr_2O_7$ (Lehrman, Selditch and Skell, 1936.)

POTASSIUM FLUORIDE $KF.2H_2O$

SOLUBILITY OF POTASSIUM FLUORIDE IN WATER.

(Jatlov and Poljakova, 1938.)

F

t°	Gms. KF per 100 gms. sat. sol.	Solid Phase
-3.2	5.0	Ice
-6.5	10.0	"
-12.2	15.0	"
-19.5	20.0	"
-21.8 Eutec.	21.5	" + $KF.4H_2O$
-20.0	22.7	$KF.4H_2O$
0	30.90	"
10	34.87	"
15	38.13	"
17.5	41.52	"
17.7	47.7	" + $KF.2H_2O$
20	43.70	$KF.2H_2O$
25	50.41	"
30	51.95	"
35	54.65	"
40.2 tr. pt.	58.08	" + KF
0	44.30*	"
17.5	47.52*	"
45	58.62	KF
60	58.72	"
80	60.01	"

* Metastable

100 gms. sat. solution of Potassium Fluoride in Water contain 48.0 gms. KF at 18° and the Sp. Gr. of the solution = 1.502. (Mylius and Funk, 1897.)

Determinations by Forcrand, 1911, at 18° gave 45.3 gms. KF per 100 gms. aqueous solution in contact with $KF.2H_2O$ as solid phase and 35.96 gms. KF per 100 gms. aq. solutions sat. with $KF.4H_2O$ as solid phase.

SOLUBILITY OF POTASSIUM FLUORIDE IN HYDROFLUORIC ACID AT 21°.

(Ditte, 1896.)

Gms. per 100 Gms. H_2O. HF.	KF.	Gms. per 100 Gms. H_2O. HF.	KF.	Gms. per 100 Gms. H_2O. HF.	KF.
0.0	96.3	9.25	29.9	20.68	38.4
1.21	72.0	11.36	29.6	28.60	46.9
1.61	61.0	12.50	30.5	41.98	61.8
3.73	40.4	13.95	31.4	53.71	74.8
4.03	32.5	15.98	33.4	74.20	105.0
6.05	30.4	17.69	35.62	119.20	169.5

100cc sat. solution of Potassium Fluoride in liquid hydrofluoric acid contain 38.0 gms. KF at 0°. (Fredenhagen 1930, 1933; Fredenhagen and Cadenback, 1931.)

POTASSIUM FLUORIDE

FREEZING-POINTS OF MIXTURES OF POTASSIUM FLUORIDE AND HYDROFLUORIC ACID.

(Cady, 1934.)

A thermocouple thermometer was used and the freezing, eutectic and transition points were determined by cooling curves. Data for vapor pressure are also given.

t°	Mol. Fraction HF in Solution	Solid Phase	t°	Mol. Fraction HF in Solution	Solid Phase
-83.7	1.000	HF*	64.0	0.7173	KF.5HF
-85.2	0.9875	"	(64.3)	(0.714)	"
-86.9	0.9732	"	64.3	0.7115	"
-89.5	0.9580	"	63.4	0.7040	"
-92.8	0.9466	"	61.8	0.6969	" +KF.2HF
-97.0	0.9311	" + KF.4HF	62.4	0.6932	KF.2HF
-45.0	0.9143	KF.4HF	70.0	0.6777	"
8.0	0.8884	"	71.7	0.6670	"
48.0	0.8572	"	71.1	0.6606	"
63.2	0.8355	"	68.3	(0.649)	" + α.KF.HF
67.7	0.8241	"	84.	0.6435	α KF.HF
71.8	0.8086	"	128	0.6197	"
(72.0)	6.8000)	"	148	0.6014	"
72.0	0.7993	"	175	0.5695	"
71.0	0.7901	"	189	0.5488	"
67.8	0.7783	"	195	0.5382	" + β KF.HF
(63.6)	(0.771)	" + KF.3HF	217	0.5218	β KF.HF
64.4	0.7676	KF.3HF	231	0.5103	"
65.4	0.7583	"	234	0.5075	"
(65.8)	(0.7500)	"	236.8	0.5032	"
65.8	0.7490	"	(239.0)	(0.5000)	"
65.5	0.7438	"	238.8	0.4996	"
64.5	0.7342	"	236	0.4847	"
62.6	0.7278	"	229.5	0.4860	" + KF
62.4	(0.727)	" + 2KF.5HF	292	0.4775	KF
62.7	0.725	KF.5HF	346	0.4646	"

F

POTASSIUM Acid FLUORIDE KHF_2

SOLUBILITY OF POTASSIUM ACID FLUORIDE IN WATER.

(Jutlov and Poljozova, 1934.)

t°	Gms. KHF_2 per 100 gms. sat. sol.	Solid Phase	t°	Gms. KHF_2 per 100 gms. sat. sol.	Solid Phase
-2.9	5.0	Ice	20	28.15	KHF_2
-4.9	10.0	"	45	38.03	"
-7.6	16.5	" + KHF_2	60	44.08	"
0	19.7	KHF_2	80	53.28	"
+10	23.14	"			

POTASSIUM FLUORIDE KF

SOLUBILITY OF POTASSIUM FLUORIDE IN PURE METHYL ALCOHOL AND IN PURE ETHYL ALCOHOL.

(Germuth, 1931.)

Results for Methyl Alcohol		Results for Ethyl Alcohol	
t°	Gms. KF per 100 gms. sat. sol.	t°	Gms. KF per 100 gms. sat. sol.
20	0.192	20	0.106
30	0.168	30	0.096
40	0.150	40	0.068
50	0.125	50	0.023
55	0.092	55	0.016

100 gms. liquid Sulfur Dioxide dissolve 0.018 gm. KF at 0°. (Jander and Wickert, 1936; Jander & Ruppolt, 1937.)

1000 gms. pure acetone dissolve 0.00022 gms. KF at 18° and 0.00025 gm. at 37°, as determined by specific conductivity. (Lannung, 1932.)

EQUILIBRIUM IN THE SYSTEM POTASSIUM FLUORIDE, ETHYL ALCOHOL AND WATER AT 23°–26°.

(Frankforter and Frary, 1913.)

The authors determined the binodal curve, the quadruple points and two tie lines.

Gms. per 100 Gms. Upper Layer.			Gms. per 100 Gms Lower Layer.		
KF.	C_2H_5OH.	H_2O.	KF.	C_2H_5OH.	H_2O.
1.23	92.67	6.07*	45.33	0.67	54*
...	...	...	37.82	1.70	60.49
1.16	83.30	15.54	...	...	...
...	...	...	28.68	4.7	66.85
2.86	65.81	31.33	...	...	...
4.47	57.4	38.13	20.90	11.9	67.2†
5.47	53.04	41.49	...	...	...
...	...	...	18.55	15.6	65.85
6.93	47.52	45.55	...	...	...
8.84	41.28	49.88	15.7	21.8	62.5†
9.55	38.66	51.79	...	...	...
...	...	...	13.57	27.27	59.15
10.52	35.91	53.57	...	...	...
...	...	...	11.43	33.23	54.34
11	30	59	11	30	59‡

* Quad. points. † Tie line. ‡ Plait point approx.

A method for the determination of alcohol in unknown mixtures, based upon the above data, is described by the authors.

THE BINODAL CURVE FOR THE SYSTEM POTASSIUM FLUORIDE, PROPYL ALCOHOL AND WATER AT 23°-26°.

(Frankforter and Frary, 1913.)

Gms. per 100 Gms. Homogeneous Liquid.			Gms. per 100 Gms. Homogeneous Liquid.		
KF.	C_3H_7OH.	H_2O	KF.	C_3H_7OH.	H_2O.
0.17	96.78	3.05*	8.15	7.49	84.36
0.31	78.91	21.19	10	5.97	84.03
0.62	66.29	33.09	12.21	4.39	83.41
0.81	59.97	39.22	14.18	3.45	82.37
1.29	47.46	51.21	18.75	1.89	79.35
1.77	35.40	62.83	25.83	0.74	73.43
2.50	19.05	78.45	35.38	0.23	64.38
5.32	10.64	84.04	47.62	0.039	52.34*

* Quad. point.

One tie line was determined. In this case the upper layer contained 78.91% C_3H_7OH and 0.31% KF, and the lower layer contained 9.67% KF.

In this system, the effect of change in temperature is more marked than in the preceding one in which ethyl alcohol is present.

100 gms. sat. solution of potassium fluoride in 99.6% propyl alcohol contain 0.34 gm. KF at room temp. (Frankforter and Frary, 1913.)

BINODAL CURVE FOR THE SYSTEM POTASSIUM FLUORIDE, ISOPROPYL ALCOHOL AND WATER AT 20°.

(Frankforter and Temple, 1915.)

F

Results in terms of gms. per 100 gms. of solvent, alcohol + water.

Gms. per 100 Gms. Solvent			Gms. per 100 Gms. Solvent		
KF	$CH_3CHOHCH_3$.	H_2O	KF.	$CH_3CHOHCH_3$.	H_2O
51.826	1.555	98.445	12.385	21.438	78.562
38.748	2.965	97.035	5.071	59.339	40.661
26.039	6.525	93.475	3.973	65.455	34.545
17.812	12.215	87.785	1.705	82.750	17.250

BINODAL CURVE FOR THE SYSTEM POTASSIUM FLUORIDE, ALLYL ALCOHOL AND WATER AT 20°.

(Frankforter and Temple, 1915.)

The results are given in terms of grams per 100 gms. Alcohol + Water instead of gms. per 100 gms. of the homogeneous mixture.

Gms. per 100 Gms. Solvent			Gms. per 100 Gms. Solvent		
KF.	CH_2CHCH_2OH.	H_2O	KF	CH_2CHCH_2OH	H_2O
45.707	2.270	97.730	7.508	35.390	64.610
38.076	3.983	96.017	6.024	42.011	57.989
30.675	5.879	94.121	4.813	47.550	52.450
24.341	7.129	92.871	3.631	54.211	45.789
20.580	9.691	90.309	2.236	59.948	36.443
17.371	11.491	88.509	1.931	65.630	34.370
13.184	17.764	82.236	1.635	68.845	31.155
10.880	22.537	77.463	1.368	71.395	28.605
8.873	29.529	70.471	1.066	75.377	24.223

BINODAL CURVE FOR THE SYSTEM POTASSIUM FLUORIDE, ACETONE, WATER AT 20°.

(Frankforter and Cohen, 1914)

Gms. per 100 Gms. Homogeneous Mixture.			Gms. per 100 Gms Homogeneous Mixture.		
KF.	$(CH_3)_2CO$.	H_2O.	KF.	$(CH_3)_2CO$.	H_2O.
46.3	trace	53.7*	9.17	23.53	67.30
44.24	0.24	55.52	5	38.72	56.28
33.34	1	65.66	3.06	47.89	46.84
29.86	1.60	68.54	1.38	58.06	40.55
25.74	3.02	71.24	0.979	62.60	36.42
20.28	5.90	73.80	0.75	65.41	33.84
16.31	9.72	73.97	0.50	69.58	29.92
12.40	15.59	72.01	0	98	2*

* Quad. point.

Data for 4 tie lines are also given and the approximate position of the plait point is shown on the diagram.

Several points on the binodal curves at temperatures between 0° and 35° are also given.

A discussion, with examples, is given of the applicability of the above data to the determination of acetone in unknown mixtures.

BINODAL CURVE FOR THE SYSTEM POTASSIUM FLUORIDE, METHYL ETHYL KETONE AND WATER AT 20°.

(Frankforter and Cohen, 1916)

Gms. per 100 Gms. Homogeneous Mixture.			Gms. per 100 Gms Homogeneous Mixture.		
KF.	$CH_3.CO.C_2H_5$.	H_2O.	KF.	$CH_3.CO.C_2H_5$.	H_2O.
34.38	0.17	65.45	10.50	4.87	84.63
23.63	0.50	75.87	5.70	9.93	84.37
18.62	1.49	79.89	3.96	12.42	83.61
15.91	2.19	81.90	0.84	21.23	77.93
13.80	2.98	83.22	0.34	23.55	76.11

SOLUBILITY OF POTASSIUM FLUORIDE IN AQUEOUS SOLUTIONS OF ISO PROPYL ALCOHOL AT 25°.

(Ginnings and Chen, 1931.)

The results locate the binodal curve of the system, including a tie line, *, which shows the composition of two liquid layers in contact with each other and, the plait, PP, at which the two liquid layers become homogeneous.

Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.	
I. C_3H_5OH	KF	I C_3H_5OH	KF
0.16	46.75	23.40	6.40
2.20	25.00	36.80	4.3 PP
4.45	18.68	39.20	4.0
7.70	14.30	65.80	1.0 *
15.10	9.30		

SOLUBILITY OF POTASSIUM FLUORIDE IN AQUEOUS SOLUTIONS OF TERTIARY BUTYL ALCOHOL AT 30°.

(Ginnings and Robbins, 1930.)

The points on the binodal curve of this system were determined by observing the appearance or disappearance of clouding in a mixture of weighed amounts of KF and one of the liquids, upon addition of a weighed amount of the other. Conjugate points representing the lines * located by determining KF in two liquid layers in contact with each other. The plait point, PP, was found by plotting.

Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.	
$(CH_3)_3COH$	KF	$(CH_3)_3COH$	KF	$(CH_3)_3COH$	KF
0.2	51.9	8.2	10.0	—	3.4*
0.7	29.8*	8.7	9.6	24.1	3.3
1.2	24.6	9.7	8.8	28.6	2.8
1.6	22.2	12.5	7.0	34.1	2.3
1.9	20.7	14.9	5.7	36.0	2.2PP
2.4	19.7	15.4	5.6	48.3	1.4
2.8	18.7	16.6	5.1	55.0	—*
3.8	16.9	17.7	4.5	60.0	—*
5.6	14.0	—	4.3*	60.6	0.8
6.3	12.7	—	4.1*	64.0	—*
7.7	10.9	20.4	3.7	99.0	—*

The binodal curve and plait point of the systems KF + $(CH_3)_2COH$ + H_2O at 25° and of KF + Pyridine + H_2O at 25° have been determined respectively by Ginnings, Herring and Webb, 1933 and Ginnings, Webb and Hinobara, 1933, but the authors do not give their experimental results but only the values of a series of arbitrary constants calculated from them by means of empirical equations.

EQUILIBRIUM IN THE SYSTEM POTASSIUM FLUORIDE, NICKEL FLUORIDE AND WATER.

(Furtenacker, Finger and Hey, 1933.)

Results at 20°			Results at 50°		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
NiF_2	KF		NiF_2	KF	
1.98	1.21	MC	2.01	1.18	MC
1.20	3.52	"	1.12	4.30	"
0.80	6.32	"	0.26	9.25	"
0.52	9.64	"	0.03	15.4	"
0.40	12.9	"	0.01	19.2	"
0.01	16.8	"	—	22.1	"
—	20.2	"	—	25.0	"
—	25.5	"	—	27.7	"
—	28.1	"	—	31.3	"
—	33.0	"	—	36.8	"
—	37.5	"	—	41.3	"

MC = A series of mixed crystals (solid solutions) varying in composition from 0.8 to 1.4 mols. KF per 1 mol. of NiF_2.

POTASSIUM Hafnium FLUORIDE K_2HfF_6

100 gms. sat. solution of Potassium Hafnium Fluoride in Water contain 3.0 gms. K_2HfF_6 at 20°. (v. Hevesy, 1923.)

POTASSIUM Niobium FLUORIDE K_2NbF_7

SOLUBILITY IN WATER AND IN AQUEOUS HF AND AQUEOUS KF SOLUTIONS.
(Ruff and Schiller, 1911.)

The determinations were made in platinum vessels. The mixtures were shaken for 3 hour periods at constant temperature and the saturated solutions filtered through platinum funnels.

Solvent.	t°.	Gms. per 100 Gms. Sat. Solution.			Solid Phase.
		NbF_5.	KF.	HF.	
Water	16	5.19	2.98	0.35	$K_2NbOF_5.H_2O$
"	16	7.07	5.33	4.35	$K_2NbOF_5.H_2O+K_2NbF_7$
Aq. 10.95% HF	16	4.33	2.32	10.43	K_2NbF_7
" 7.41% KF	16	1.16	5.54	0.13	$K_2NbOF_5.H_2O$
" 7.39% KF	16	2.67	6.04	5.39	$K_2NbOF_5.H_2O+K_2NbF_7$
Water	85	30.39	14.68	0.35	$K_2NbOF_5.H_2O$(?)
Aq. 4.81% KF	80	11.66	10.08	1.53	"

POTASSIUM Phospho FLUORIDE KPF_6

One liter sat. solution of Potassium Phospho Fluoride in Water contain 0.432 gm. mols. KPF_6 at 22.5°. (Lange and Müller, 1930.)

POTASSIUM GERMANIUM FLUORIDE K_2GeF_6.

SOLUBILITY IN WATER.
(Winkler, 1887; Kruss and Nilson, 1887.)

100 gms. H_2O dissolve 173.98 gms. K_2GeF_6 at 18°, and 34.07 gms. at 100° (W.).
100 gms. H_2O dissolve 184.61 gms. K_2GeF_6 at 18°, and 38.76 gms. at 100° (K. and N.).

POTASSIUM Silico FLUORIDE K_2SiF_6

SOLUBILITY OF POTASSIUM SILICO FLUORIDE IN WATER AND IN AQUEOUS AND ALCOHOLIC SOLUTIONS.

(Wassilieff and Martianoff, 1935.)

The determinations were made at room temperature, about 17°. The mixtures were frequently shaken during several hours and then allowed to stand over night. The dissolved K_2SiF_6 was determined by titration with 0.1 n NaOH using phenolphthaline as indicator, bringing the solution nearly to the boiling point at the end of the titration.

Solvent	Gms. K_2SiF_6 per 100cc sat. sol.	Solvent	Gms. K_2SiF_6 per 100cc sat. sol.
Water	0.1147	2.0 gm. KCl per 100cc aq 50% C_2H_5OH	0.0022
Aq. 50 Wt.% C_2H_5OH	0.0039	The above + 0.5cc 0.1 n HCl	0.0020
Aq. Sat. KNO_3 Solution	0.0048		
Aq. Sat. KCl Solution	0.0048		

F

SOLUBILITY OF POTASSIUM SILICO FLUORIDE IN WATER.

(Carter, 1930.)

The mixtures were agitated mechanically for one hour and allowed to stand 24 hours at constant temperature. The solutions were analyzed volumetrically.

t°	Gms. K_2SiF_6 per 100cc sat. sol.	t°	Gms. K_2SiF_6 per 100cc sat. sol.
0	0.077	45	0.268
16	0.132	55	0.322
25	0.177	70	0.420
35	0.246	78	0.462
		88	0.500

SOLUBILITY OF POTASSIUM SILICO FLUORIDE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 14°.

(Pierrat, 1921.)

Wt. Percent C_2H_5OH in Solvent	Gms. K_2SiF_6 per liter sat. sol.	Wt. Percent C_2H_5OH in Solvent	Gms. K_2SiF_6 per liter sat. sol.
0.0	0.9	27.3	0.09
8.7	0.46	42.4	0.05
15.9	0.21	94.7	0.0096

POTASSIUM Tantalum Fluoride K_2TaF_7

SOLUBILITY OF POTASSIUM TANTALUM FLUORIDE IN AQUEOUS SOLUTIONS OF HYDROFLUORIC ACID.

(Babaeva and Klatchko-Gourvitch, 1935.)

Results at 0°			Results at 20°			Results at 80°		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
H_2F_2	K_2TaF_7		H_2F_2	K_2TaF_7		H_2F_2	K_2TaF_7	
0.105	0.114	K_2TaF_7 + X	0.214	0.226	K_2TaF_7 + X	2.170	3.367	K_2TaF_7
0.610	0.246	K_2TaF_7	0.288	0.319	K_2TaF_7	5.023	3.843	"
1.757	0.287	"	1.520	0.620	"	7.550	4.305	"
3.750	0.364	"	4.234	0.783	"	10.230	4.863	"
6.545	0.454	"	9.859	1.015	"	16.690	6.331	"
11.207	0.579	"	16.520	1.440	"	24.233	8.820	"
17.273	0.815	"	19.047	1.609	"	32.610	11.444	"
24.099	1.326	"	25.420	2.368	"			
38.366	4.500	"	32.025	3.825	"			
			38.157	6.345	"			

POTASSIUM Thorium **FLUORIDE** $K_2ThF_6.H_2O$.

100 gms. sat. solution of Potassium Thorium Fluoride in Water contain 0.000064 gm. K_2ThF_6 at 25°. (Spicin, 1917.)

POTASSIUM Titanium **FLUORIDE** $K_2TiF_6.H_2O$.

SOLUBILITY OF POTASSIUM TITANIUM FLUORIDE IN WATER.

(Marignac, 1866.)

t°	0°	3°	6°	10°	14°	20°
Gms. K_2TiF_6 per 100 gms. H_2O	0.55	0.67	0.77	0.91	1.04	1.28

SOLUBILITY OF POTASSIUM TITANIUM FLUORIDE IN WATER AND IN 98 PERCENT ETHYL ALCOHOL.

(Ginsberg, 1932.)

Results for Water			Results for 98% C_2H_5OH		
t°	Gms. K_2TiF_6 per 100cc sat. sol.	Solid Phase	t°	Gms. K_2TiF_6 per 100cc sat. sol.	Solid Phase
20-22	1.3	$K_2TiF_6.H_2O$	20-22	0.005	$K_2TiF_6.H_2O$.
"	1.2	K_2TiF_6	"	0.0045	"

POTASSIUM Zircono**FLUORIDE** K_2ZrF_6 (See also Zirconium salts.)

SOLUBILITY OF POTASSIUM ZIRCONO FLUORIDE IN WATER. (Missenden, 1922.)

No information is given as to how the determinations were made and no explanation of the column heading « No of parts of water ». Presumably this is the grams of water required to dissolve one gram of the salt.

t°.	No of parts water.	t°.	No of parts water.	t°.	No of parts water.
10....	81.75	40....	42.25	80....	14.50
20....	64.50	50....	34.00	90....	9.00
30....	52.00	60....	26.25	100....	4.25
		70....	19.75		

100 gms. sat. solution of Potassium Zirconium Fluoride in Water contain 2.6 gm. K_2ZrF_6 at 20°. (v. Hevesy, 1923.)

Fusion-point data are given for the following mixtures:

KF + KOH	(Scarpa, 1915.)	KF + K_3PO_4	(Amadori, 1912.)
" + KPO_3·	(Amadori, 1912.)	" + K_2SO_4	(Karandeef, 1909.)
" + $K_4P_2O_7$	" "	" + NaF	(Kurnakow & Zemcznzny, 1907.)

POTASSIUM IODIDE KI.

Solubility in Water.

(Mulder; de Coppet, 1883; Etard, 1894; Meusser, 1905; see also Tilden and Shenstone, 1884; Schreinemakers, 1892.)

t°.	Gms. KI per 100 Gms.		t°.	Gms. KI per 100 Gms.	
	Water.	Solution.		Water.	Solution.
−10	115·1	53·5	80	192	65·8
− 5	119·8	54·5	90	200	66·7
− 1	122·2	55·0	100	208	67 5
0	127·5	56·0	110	215	68 3
10	136	57·6	120	223	69 0
20	144	59·0		Ice Curve	
25	148	59·7			
30	152	60·3	− 5	25·7	22 5
40	160	61·5	− 7	42·6	29·9
50	168	62·7	− 9·5	51·5	34·0
60	176	63·7	−11·5	64·7	39·3
70	184	64·8	−14	75·8	42·7

Sp. Gr. of sat. solution at 15.2° = 1.704. (Greenish and Smith, 1901.)

Individual determinations, in good agreement with the above results, are given by van Dam and Donk (1911), and by Greenish and Smith (1901).

Solubility of Potassium Iodide in Water.

The very closely agreeing results of Scott and Frazier, 1927; Scott and Frazier, 1927; Scott and Durham 1930; Hill, Willson and Bishop, 1933; and Hering, 1936; were plotted and the following values taken from the curve.

t°	d. of sat. sol.	Gms. KI per 100 gms. sat. sol.	t°	d. of sat. sol.	Gms. KI per 100 gms. sat. sol.
0	1.6673	56.1	50	1.7600	62.85
10	—	57.7	60	1.773	63.8
20	1.7160	59.1	70	—	64.8
25	1.7211	59.8	80	1.795	65.65
30	—	60.5	90	—	66.5
40	1.747	61.75	100	1.819	67.35

Solubility of Potassium Iodide in Water at Temperatures above 100° Determined by the Synthetic Method.

(Kracek, 1931; Benrath, Gjedebo, Schiffers and Wunderlich, 1937.)

t°	Gms. KI per 100 gms. H_2O	t°	Gms. KI per 100 gms. H_2O	t°	Gms. KI per 100 gms. H_2O	t°	Gms. KI per 100 gms. H_2O
100	206.4	150	246.7	200	292.9	275	376
110	214.3	160	255.0	210	303.4	300	525
120	222.3	170	263.7	220	314.3	350	558
130	230.3	180	272.9	230	326.0	400	614
140	238.5	190	282.6	240	338.4	450	809

SOLUBILITY OF POTASSIUM IODIDE IN WATER, DETERMINED BY THE FREEZING-POINT METHOD.

(Kremann and Kershbaum, 1907.)

t°.	Gms. KI per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. KI per 100 Gms. Sat. Sol.	Solid Phase.
−12.5	38	Ice	−22.5	52.1	KI
−15	41.2	"	−20	52.6	"
−17.5	44.6	"	−15	53.5	"
−20	48	"	−10	54.5	"
−22.5	51.2	"	− 5	55.4	"
−23.2 Eutec.	51.9	" +KI	0	56.4	"

SOLUBILITY OF POTASSIUM IODIDE + IODINE IN WATER AT 25°.

(Foote and Chalker, 1908.)

Gms. per 100 Gms. Sat. Sol.			Present in Solid Phase.	Gms. per 100 Gms. Sat. Sol.			Present in Solid Phase.
KI.	I.	I − KI.		KI.	I.	I − KI.	
29.45	64.34	34.89	KI and KI_3	25.88	68.79	42.91	KI_3 and Iodine
28.91	63.88	34.97		25.57	69.01	43.44	
26.84	66.54	39.70	KI_3 and KI_7	27.86	66.56		KI_3
27.18	67.14	39.96		27.27	66.91		
27.14	66.60	39.46		26.95	67.17		KI_7
				25.71	67.91		

The experiments of Hamberger (1906) are discussed.

For other data upon polyiodides see Iodine

SOLUBILITY OF MIXTURES OF POTASSIUM IODIDE AND SILVER IODIDE IN WATER AT 0°, 30° AND 50°.

(Van Dam and Donk, 1911.)

Results at 0°.		Results at 30°.		Results at 50°.		
Gms. per 100 Gms. Sat. Sol.		Gms. per 100 Gms. Sat. Sol.		Gms. per 100 Gms. Sat. Sol.		Solid Phase in Each Case.
AgI.	KI.	AgI.	KI.	AgI.	KI.	
0	56.1	0	60.35	0	62.6	KI
9	53	16	55.5	10.7	59.1	"
18	51.2	35.8	46.9	22.8	55.5	"
31.3	46.6	42.8	43.9	45	43.2	"
37.9	44	44.1	43.2	53.4	37.6	" +AgI.KI
37.6	42.7	47.7	40.9	53.5	37.1	AgI.KI
38	41.3	49.7	38.6	53.5	36.6	" +AgI
28.1	36.4	42.8	38.8	53.5	36.5	AgI
26.6	34.6	29.4	37.6	39	38.1	"
6.5	26.1	10	31.4	28	36.7	"
1.5	20.5	...	...	16	33.8	"
0.2	9.8	0.1	10.2	2.5	24.8	"
27.5	48.7	...	...	...	...	AgI.2KI+KI
21	50.3	...	...	...	...	AgI.2KI

SOLUBILITY OF POTASSIUM IODIDE IN AQUEOUS SOLUTIONS OF POTASSIUM IODATE AT 25 AND VICE VERSA.

(Ricci, 1937.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	KIO_3	KI			KIO_3	KI	
1.718	0.0	59.76	KI	1.451	2.54	41.10	KIO_3
1.731	1.10	59.14	"	1.227	3.27	22.38	"
—	2.25	58.62	"	—	4.33	12.04	"
1.751	2.35	58.51	" + KIO_3	1.053	7.15	2.40	"
1.722	2.35	57.02	KIO_3	1.071	8.449	0.0	"

SOLUBILITY OF POTASSIUM IODIDE IN AQUEOUS SOLUTIONS OF POTASSIUM HYDROXIDE AT 20°.

(Brönsted, 1920(a).)

Gm. Mols. per liter sat. sol.		Gm. Mols. per liter sat. sol.	
KOH	KI	KOH	KI
9.41	1.72	12.92	0.824
10.95	1.23	14.02	0.672
11.10	1.176	15.01	0.558
12.19	0.933		

I

SOLUBILITY OF POTASSIUM IODIDE IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE AT 25° AND VICE VERSA.

(Ricci, 1938.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	K_2SO_4	KI			K_2SO_4	KI	
1.718	0.0	59.76	KI	1.273	1.70	28.81	K_2SO_4
1.722	0.08	59.60	" + K_2SO_4	1.185	3.57	18.57	"
1.701	0.10	58.70	K_2SO_4	1.127	6.57	9.13	"
1.399	0.69	39.57	"	1.083	10.76	0.0	"

SOLUBILITY OF POTASSIUM IODIDE IN AQUEOUS SOLUTIONS OF SODIUM IODIDE AND VICE VERSA.

(Hill, Willson and Bishop, 1933.)

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms. sat. sol.		Solid Phase
	KI	NaI			KI	NaI	
8	57.33	0.0	KI	25	7.59	59.35	KI + $NaI.2H_2O$
"	37.54	19.97	"	"	7.06	59.71	$NaI.2H_2O$
"	19.20	40.55	"	"	6.80	59.97	"
"	8.36	55.58	"	"	5.44	60.74	"
"	7.44	57.13	" + $NaI.2H_2O$	"	4.78	61.35	"
"	5.82	58.23	$NaI.2H_2O$	"	2.17	63.15	"
"	0.0	62.49	"	"	0.0	64.72	"
25	59.78	0.0	KI	40	61.73	0.0	KI
"	50.32	9.29	"	"	48.04	13.47	"
"	42.08	17.60	"	"	35.55	26.20	"
"	29.79	30.55	"	"	21.33	42.04	"
"	21.43	40.11	"	"	9.68	57.85	"
"	15.90	46.91	"	"	7.23	62.34	" + $NaI.2H_2O$
"	10.60	54.49	"	"	4.81	63.92	$NaI.2H_2O$
				"	0.0	67.35	"

SOLUBILITY OF POTASSIUM IODIDE IN AQUEOUS SOLUTIONS OF LEAD IODIDE AND VICE VERSA.

Results at 13°. (Demassieux, 1923.) Gms. per 100 gms sat. sol.		Results at 25°. (Burrage, 1926.) Gms. per 100 gms. sat. sol.		Results at 30°. (Demassieux, 1923.) Gms. per 100 gms. sat. sol.		Solid Phase. of each temperature.
KI.	PbI_2.	KI.	PbI_2.	KI.	PbI_2.	
0.0	0.05	0.083	0.0234	2.84	0.002	PbI_2
2.21	0.001	0.166	0.0092	9.33	0.02	»
4.18	0.001	0.332	0.0040	14.48	0.02	»
9.09	0.002	0.664	0.0020	17.36	0.12	»
	–	0.830	0.0019	18.77	0.14	»
	–	1.661	0.0016	19.50	0.15	»
–	–	3.320	0.0020	21.00	0.27	»
–	–	8.307	0.0073	29.43	1.74	»
–	–	13.61	0.0316	29.51	1.82	»
–	–	14.90	0.0578	30.47	2.45	»
–	–	19.45	0.253	30.57	2.52	»
16.02	0.05	21.32	0.428	31.77	3.11	» + $PbI_2.KI.2H_2O$
17.26	0.02	26.82	0.553	32.12	3.10	$PbI_2.KI.2H_2O$
21.32	0.19	36.73	1.221	36.18	3.99	»
34.45	0.68	43.80	2.249	38.44	4.23	»
37.25	0.77	49.43	3.712	42.28	5.64	»
45.17	1.47	51.61	4.654	51.93	9.59	»
52.14	2.91	54.60	5.876	53.96	11.74	»
56.55	4.54	56.59	7.421	56.41	14.14	» + KI
57.66	0.0	57.82	5.235	58.49	9.72	KI
		59.13	5.49	60.28	5.55	»
		59.72	0.00	61.98	1.52	»
				62.02	1.48	»
				62.39	0.0	»

I

In the case of the determinations by Burrage, constant agitation in a thermostat was employed. At low concentration of PbI_2 the lead was determined colorimetrically. For the determinations by Demassieux the solutions were simply shaken by hand several times a day and the temperature held constant to within 0°.5.

See also PbI_2; Lead Iodide, for additional data on this system.

SOLUBILITY OF POTASSIUM IODIDE IN AQUEOUS SOLUTIONS OF METHYL ALCOHOL AT 25°.

(Akerlof and Turck, 1935.)

Wt.% CH_3OH in Solvent	Gm. Mols. KI per 1000 gms. Solvent	Wt.% CH_3OH in Solvent	Gm. Mols. KI per 1000 gms. Solvent	Wt.% CH_3OH in Solvent	Gm. Mols. KI per 1000 gms. Solvent
0.0	8.962	60.21	3.333	89.79	1.412
20.0	6.776	72.39	2.473	94.76	1.187
40.82	4.845	80.03	1.970	100.00	0.965

SOLUBILITY OF POTASSIUM IODIDE IN AQUEOUS SOLUTIONS OF LEAD IODIDE AND VICE VERSA.

(Van Klooster and Balon, 1934.)

Results at 0°

Gms. per 100 gms. sat. sol. KI	Gms. per 100 gms. sat. sol. PbI_2	Solid Phase
56.07	0.0	KI
55.65	1.23	"
55.28	2.00	"
55.10	3.10	" + $KPbI_3 \cdot 2H_2O$
53.10	2.41	$KPbI_3 \cdot 2H_2O$
46.20	1.30	"
40.56	0.724	"
35.20	0.445	"
29.72	0.263	"
25.56	0.146	"
19.60	0.074	"
15.26	0.044	"
11.42	0.037	" + PbI_2
10.35	0.030	PbI_2
7.26	0.012	"
4.55	0.002	"
2.21	0.001	"
0.166	0.003	"
0.0	0.043	"

Results at 25°

Gms. per 100 gms. sat. sol. KI	Gms. per 100 gms. sat. sol. PbI_2	Solid Phase
59.77	0.0	KI
58.53	2.267	"
58.40	3.663	"
57.75	5.22	"
56.60	7.30	" + $KPbI_3 \cdot 2H_2O$
55.75	5.901	$KPbI_3 \cdot 2H_2O$
51.42	4.491	"
43.48	2.348	"
38.38	1.537	"
30.77	0.801	"
21.29	0.422	" + PbI_2
21.09	0.410	PbI_2
21.03	0.408	"
19.58	0.256	"
12.52	0.033	"
9.97	0.020	"
0.645	0.001	"
0.159	0.010	"
0.00	0.075	"

EQUILIBRIUM IN THE SYSTEM POTASSIUM IODIDE, ANTIMONY IODIDE AND WATER.

(Francois, 1935; Francois and Delwaulle, 1938.)

The authors give a diagram but no numerical results. The following approximate values for the triple points were estimated from the diagram.

Results at 16° Gms. per 100 gms. H_2O KI	Results at 16° SbI_3	Results at 32° Gms. per 100 gms. H_2O KI	Results at 32° SbI_3	Results at 48° Gms. per 100 gms. H_2O KI	Results at 48° SbI_3	Solid Phase at each temperature
195	105	220	130	245	155	$KI + 2KI \cdot SbI_3 \cdot H_2O$
160	125	200	155	218	200	SbI_3 + "

EQUILIBRIUM IN THE SYSTEM POTASSIUM IODIDE, CAFFEINE AND WATER.

(Chambon and Duron, 1937.)

Results at 2° Gms. per 100 gms. H_2O Caffeine (anhy.)	Results at 2° KI	Results at 35° Gms. per 100 gms. H_2O Caffeine (anhy.)	Results at 35° KI	Results at 90° Gms. per 100 gms. H_2O Caffeine (anhy.)	Results at 90° KI	Solid phase at each temperature
0.735	0.0	3.52	0.0	83.5	0.0	Caffeine
—	—	—	—	70.2	5.0	"
—	—	—	—	41.0	167.0	"
18.2	133.1	25.0	156.0	43.0	199.0	" + KI
0.0	130.1	0.0	156.0	0.0	196.6	KI

SOLUBILITY OF POTASSIUM IODIDE IN AQUEOUS SOLUTIONS OF ETHYL AND OF METHYL ALCOHOL. (Zeitlin, 1926.) See last table p. 1361.

Solvent.	Gm. mols. KI dissolved per liter at 10°.2.	19°.9.	Solvent.	Gm. mols. KI dissolved per liter at 10°.2.	19°.9.
Water	5.863	6.110	Aq. 25.96 wt. % CH_3OH.	4.169	4.308
Aq. 25.07 wt. % C_2H_5OH.	3.970	4.083	» 45.13 » »	3.089	3.25
» 50.01 » »	2.419	2.612	» 74.88 » »	1.632	1.693
» 75.03 » »	1.120	1.142	100.00 » »	0.7519	0.7350
» 97.30 » »	–	0.0428			

100 gms. glycerol of $d = 1.2326$ (= 86.5 %) dissolve 58.3 gms. KI at 20°.
» » » $d = 1.2645$ (= 98.5 %) » 50.6 » » »

(Holm, 1921, 1921 *a*, 1922.)

SOLUBILITY OF POTASSIUM IODIDE IN AQUEOUS SOLUTIONS OF METHYL ALCOHOL AT 25°.

(Herz and Anders, 1907.)

Solvent.		Sat. Solution.		Solvent.		Sat. Solution.	
d_{25}.	Wt. Per cent CH_3OH.	d_{25}.	Gms. KI per 100 cc.	d_{25}.	Wt. Per cent CH_3OH.	d_{25}.	Gms. KI per 100 cc.
0.9971	0	1.7213	102.9	0.8820	64	1.185	40.33
0.9791	10.6	1.634	92.12	0.8489	78.1	1.066	28.05
0.9481	30.8	1.460	71.55	0.8167	93.9	0.9700	18.76
0.9180	47.1	1.325	55.6	0.7881	100	0.9018	13.28

SOLUBILITY OF POTASSIUM IODIDE IN SEVERAL ALCOHOLS.

Alcohol.	t°.	Gms. KI per 100 Gms. Alcohol.	Authority.
Methyl Alcohol	11.4	13.5	(Timofeiew, 1894.)
" "	12.2	14.6	"
" "	13.5	16	"
" "	25	18.04	(Turner and Bissett, 1913.)
Ethyl "	13.6	1.63	(Timofeiew, 1894.)
" "	25	2.16	(Turner and Bissett, 1913.)
Propyl "	12.2	0.731	(Timofeiew, 1894.)
" "	25	0.43	(Turner and Bissett, 1913.)
Amyl "	25	0.098	" "

100 cc. sat. solution of KI in ethyl alcohol contain 1.585 gms. KI at 25°.

(Laurie, 1912.)

SOLUBILITY OF POTASSIUM IODIDE IN SEVERAL ALCOHOLS AT 25°.

(Larson and Hunt, 1939.)

Alcohol	Formula	d. of sat. sol.	Gms. KI per 100 gms. solvent
Methanol	CH_3OH	0.8982	17.04
Ethanol	C_2H_5OH	0.7977	1.88
1-Propanol	$CH_3CH_2CH_2OH$	0.8035	0.444
1-Butanol (n)	$CH_3(CH_2)_2CH_2OH$	0.8071	0.201
2-Propanol (iso)	$CH_3CHOHCH_3$	0.7821	0.177
2-Methyl-1-propanol	$(CH_3)_2CHCH_2OH$	0.7986	0.0955
1-Pentanol	$CH_3(CH_2)_3CH_2OH$	0.8112	0.0894
2-Butanol (sec)	$CH_3CH_2CHOHCH_3$	0.8026	0.0582

SOLUBILITY OF POTASSIUM IODIDE IN DILUTE AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 25°.

(Armstrong, Eyre, Hussey, and Paddison, 1907.)

Wt. Per cent C_2H_5OH in Solvent.	$d_{\frac{25}{25}}$ of Sat. Sol.	Gms. KI per 100 Gms. Sat. Sol.	Wt. Per cent C_2H_5OH in Solvent.	$d_{\frac{25}{25}}$ of Sat. Sol.	Gms. KI per 100 Gms. Sat. Sol.
0	1.7268	59.80	4.41	1.6833	58.08
1.14	1.7154	59.41	12.14	1.6063	54.93
2.25	1.7042	58.95	18.73	1.5420	52.08

100 gms. aqueous 94% ethyl alcohol dissolve 3.99 gms. KI at 17°. (de Bruyn, 1892.)
100 gms. aqueous 98% methyl alcohol dissolve 17.1 gms. KI at 17°. "

100 cc. of ethyl alcohol of d_{15} = 0.8292 dissolve 8.83 gms. KI at 15°, d_{15} of sat. solution = 0.8989. (Greenish and Smith, 1901.)

SOLUBILITY OF POTASSIUM IODIDE IN ABSOLUTE ALCOHOLS.

(de Bruyn — Z. physik. Ch. 10, 783, '92; Rohland — Z anorg. Ch. 18, 327, '98.)

100 gms. methyl alcohol dissolve 16.5 gms. KI at 20.5°.
100 gms. ethyl alcohol dissolve 1.75 gms. KI at 20.5°.
100 gms. propyl alcohol dissolve 0.46 gm. KI at 15°–20° (R.).

SOLUBILITY OF POTASSIUM IODIDE IN:

Ethyl Alcohol of 0.9406 Sp. Gr.		Aqueous Ethyl Alcohol at 18°.					
t°.	Gms. KI per 100 Gms. Alcohol	Sp. Gr. of Alcohol.	Weight per cent Alcohol.	Gms. KI per 100 Gms. Alcohol.	Sp. Gr. of Alcohol.	Weight per cent Alcohol.	Gms. KI per 100 Gms Alcohol.
8	67.4	0.9904	5.2	130.5	0.9390	45	66.4
13	69.2	0.9851	9.8	119.4	0.9088	59	48.2
25	75.1	0.9726	23.0	100.1	0.8464	86	11.4
46	84.7	0.9665	29.0	89.9	0.8322	91	6.2
55	87.5	0.9528	38.0	76.9			
62	90.2						

I

(Gerardin — Ann. chim. phys. [4] 5, 155, '65.)

SOLUBILITY OF POTASSIUM IODIDE IN ABSOLUTE ETHYL ALCOHOL SOLUTIONS OF SODIUM IODIDE AND OF MAGNESIUM IODIDE AT 25°.

(Hawkins and Partington, 1928, 1930.)

The density of the absolute C_2H_5OH was d $\frac{25}{4}$ = 0.7851. The sat. solutions were prepared in an atmosphere of hydrogen.

Results for C_2H_5OH Solutions of NaI

d. of sat. sol.	Gms. per 100 gms. C_2H_5OH	
	NaI	KI
0.7970	0.0	1.824
0.8215	4.248	1.268
0.8378	7.091	0.9988
0.8502	9.065	0.8878
0.8921	15.84	0.6752
0.9614	27.68	0.442
1.0500	42.8	0.19

Results for C_2H_5OH Solutions of MgI_2

d. of sat. sol.	Gms. per 100 gms. C_2H_5OH	
	MgI_2	KI
0.8161	2.777	1.502
0.8202	3.20	1.513
0.8317	5.33	1.578
0.8420	6.017	1.560
0.8634	8.809	1.393
0.9037	14.41	1.195
0.9182	17.82	1.116
0.9314	18.04	0.00

SOLUBILITY OF POTASSIUM IODIDE IN LIQUID METHYL ALCOHOL AT TEMPERATURES UP TO THE CRITICAL POINT.

(Tyrer, 1910.)

(Determined by the Sealed Tube Method.)

t°.	Gms. KI per 100 Gms. CH_3OH.	t°.	Gms. KI per 100 Gms. CH_3OH.	t°.	Gms. KI per 100 Gms. CH_3OH.
15	14.50	120	27.2	220	27.5
30	16.20	140	29.2	240	24.8
50	18.9	160	30.6	245	22.6
80	22.5	180	30.7	247	21
100	25	200	29.1	250	13.8
				crit. temp. 252.5	7.6

SOLUBILITY OF POTASSIUM IODIDE IN VAPOR OF METHYL ALCOHOL ABOVE THE CRITICAL POINT.

(Tyrer, 1910a.)

Solvent, Gms. CH_3OH per 1 cc. Vapor.	Gms. KI Dissolved per 100 Gms. Solvent at:				
	252°.	270°.	280°.	290°.	300°.
0.1	0.3	...	...	...	...
0.2	1	1	1	1	1
0.3	3.7	3.5	3.4	3.4	3.3
0.36	7.6	7.4	7.3	7.2	7.
0.4	11.8	11.5	11.3	11	...
0.45	18.1	...	...	...	...

Data for the above system are also given by Centnerszwer (1910). This author gives the crit. temp. as 266° and the corresponding concentration as 8.64 gms. KI per 100 gms. of the sat. solution.

SOLUBILITY OF POTASSIUM IODIDE IN MIXTURES OF ALCOHOLS AT 25°.

(Herz and Kuhn, 1908.)

In Methyl + Ethyl Alcohol.			In Methyl + Propyl Alcohol.			In Ethyl + Propyl Alcohol.		
Per cent CH_3OH in Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. KI per 100 cc. Sat. Sol.	Per cent C_2H_7OH in Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. KI per 100 cc. Sat. Sol.	Per cent C_3H_7OH in Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. KI per 100 cc. Sat. Sol.
0	0.8015	1.55	0	0.9018	13.16	0	0.8015	1.55
4.37	0.8041	1.91	11.11	0.8823	10.96	8.1	0.7983	1.46
10.4	0.8071	2.25	23.8	0.8629	8.54	17.85	0.7991	1.37
41.02	0.8295	4.94	65.2	0.8187	2.62	56.6	0.7988	0.75
80.69	0.8704	10.13	91.8	0.8045	0.60	88.6	0.8022	0.52
84.77	0.8795	10.72	96.6	0.8041	0.58	91.2	0.8027	0.49
91.25	0.8908	11.84	100	0.8041	0.43	95.2	0.8029	0.44
100	0.9018	13.16				100	0.8041	0.43

SOLUBILITY OF POTASSIUM IODIDE IN ACETAMIDE.

(Menschutkin, 1908.)

(Determinations by Synthetic Method.)

t°.	Gms. KI per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. KI per 100 Gms. Sat. Sol.	Solid Phase
82 m. pt.	0	CH_3CONH_2	70	28.75	KI
78	6.5	"	85	29.1	"
74	12.8	"	100	29.45	"
70	17.8	"	130	30.15	"
66	21.5	"	145	30.5	"
58	26.2	"	160	30.8	"
53 Eutec.	28.4	" +KI	175	31.1	"

SOLUBILITY OF POTASSIUM IODIDE IN ACETONE AND IN PYRIDINE.

(von Laszczynski, 1894; at 25°, Krug and McElroy, 1892.)

Solvent.	Gms. KI per 100 Gms. Solvent at:					
	−2.5°	10°	22°	25°	56°	119°
Acetone	3.08	...	2.38	2.93	1.21	...
Pyridine	...	0.26	...	...	...	0.11

100 gms. glycerol dissolve 40 gms. KI at 15.5°. (Ossendowski, 1907.)

100 gms. 95% formic acid dissolve 38.2 gms. KI at 18.5°. (Aschan, 1913.)

100 cc. anhydrous hydrazine dissolve 175 gms. KI at room temp. (Welsh and Broderson, 1915.)

100 gms. hydroxylamine dissolve 110 gms. KI at 17.5°. (de Bruyn, 1892.)

100 gms. sat. solution in hydrated lanolin (containing 30% emulsified water) contain 42.5 gms. KI at 45°. (Klose, 1907.) KI is insoluble in anhydrous lanolin.

SOLUBILITY OF POTASSIUM IODIDE IN SEVERAL SOLVENTS.

(Walden, 1906.)

Solvent.	Formula.	t°.	Sp. Gr. of Solution.	Gms KI per 100	
				cc. Solution.	Gms. Solution.
Water	H_2O	0	1.6699	94.05	56.32
Water	H_2O	25	1.7254	102.70	59.54
Methyl Alcohol	CH_3OH	0	0.8964	11.61	12.95
Methyl Alcohol	CH_3OH	25	0.9003	13.5–14.3	14.97
Ethyl Alcohol	C_2H_5OH	0	0.8085	1.197	1.479
Ethyl Alcohol	C_2H_5OH	25	0.7908	1.520	1.922
Glycol	$(CH_2OH)_2$	0	1.3954	45.85	31.03
Glycol	$(CH_2OH)_2$	25	1.3888	47.23	33.01
Acetonitrile	CH_3CN	0	0.8198	1.852	2.259
Acetonitrile	CH_3CN	24	0.7938	1.57	2.003
Propionitrile	C_2H_5CN	0	0.8005	0.34–0.41	0.0429
Propionitrile	C_2H_5CN	25	0.7821	0.32–0.36	0.0404
Benzonitrile	C_6H_5CN	25	1.0076	0.051	0.0506
Nitromethane	CH_3NO_2	0	1.1627	0.314–0.366	0.315
Nitromethane	CH_3NO_2	25	1.1367	0.289–0.349	0.307
Nitrobenzene	$C_6H_5NO_2$	25	...	0.0019	...
Acetone	$(CH_3)_2CO$	0	0.8227	1.732	2.105
Acetone	$(CH_3)_2CO$	25	0.7968	1.038	1.302
Furfurol	$C_4H_3O.COH$	0	...	15.10	...
Furfurol	$C_4H_3O.COH$	25	1.2014	5.62	4.94
Benzaldehyde	C_6H_5COH	25	1.0446	0.343	0.328
Salicylic Aldehyde	$C_6H_4.OH.COH$	0	1.1501	1.257	1.093
Salicylic Aldehyde	$C_6H_4.OH.COH$	25	1.1373	0.549	0.483
Anisic Aldehyde	$C_6H_4.OCH_3.COH$	0	1.1223	1.520	1.355
Anisic Aldehyde	$C_6H_4.OCH_3.COH$	25	1.1180	0.720	0.644
Ethyl Acetate	$CH_3COOC_2H_5$	25	...	0.0013	...
Methyl Cyanacetate	$CH_2CNCOOCH_3$	0	1.1521	3.256	2.827
Methyl Cyanacetate	$CH_2CNCOOCH_3$	25	1.1358	2.459	2.165
Ethyl Cyanacetate	$CH_2CNCOOC_2H_5$	25	1.0628	0.989	0.930

Solubility of Potassium Iodide at 20° in Several Solvents Containing Dissolved Iodine.

(Olivari, 1908.)

Solvent.	Gm. Mols. KI per Liter in Solvent Containing: 0.5 Gm. Mols. I_2 per Liter.	1.5 Gm. Mols. I_2 per Liter.	2.5 Gm. Mols. I_2 per Liter.
Acetic Acid	0.511	1.460	2.080
Ethyl Acetate	0.490	1.400	1.980
Ethyl Alcohol	0.520	1.220	1.730
Nitrobenzene	0.414	0.960	1.380
Ethylbromide	0.140	0.350	...

Solubility of Potassium Iodide in Aqueous Solutions of Ethylene Glycol at 30°.

(Ginnings and Robbins, 1930.)

d. of sat. sol.	Gms. per 100 gms. sat. sol. CH_2OHCH_2OH	KI	d. of sat. sol.	Gms. per 100 gms. sat. sol. $CH_2OH.CH_2OH$	KI
1.7302	0.0	60.31	1.5395	32.27	45.38
1.6655	8.96	55.90	1.4687	51.57	38.27
1.6031	19.26	50.98	1.4272	66.41	33.59

Solubility of Potassium Iodide in Pure Acetone Determined by Specific Conductivity Measurements.

(Lannung, 1932.)

t°	d. of sat. sol.	Gms. KI per 1000 gms. CH_3COCH_3
18	0.799	11.19
37	0.77	8.02

I

Equilibrium in the System Potassium Iodide, Tertiary Butyl Alcohol and Water at 30°.

(Ginnings and Robbins, 1930.)

The points of the binodal curve of this system were determined by observing the appearance or disappearance of clouding in mixtures of weighed amounts of KI in one of the liquids upon addition of weighed amounts of the other. Tie lines, *, connecting conjugate points were located by determination of KI in liquid layers in contact with each other and from these the plait point, PP, was found by plotting.

Gms. per 100 gms. sat. sol. $(CH_3)_3COH$	KI	Gms. per 100 gms. sat. sol. $(CH_3)_3COH$	KI		Gms. per 100 gms. sat. sol. $(CH_3)_3COH$	KI
3.3	54.7*	17.9	39.6		45.0	—*
4.0	52.9	19.9	38.6		46.5	23.4
5.2	49.8	22.1	37.0		49.2	22.1
7.2	47.3	24.2	35.6		50.0	—*
—	47.1*	26.0	34.6	PP	52.0	20.9
8.4	46.1	27.6	33.4		57.7	18.5
9.6	45.0*	30.6	31.9		60.3	16.9
11.3	44.0	35.1	29.5		62.8	15.5
13.9	42.3	39.2	27.0		63.0	—
15.1	41.1	42.0	25.5			
16.6	40.3	44.3	24.6			

The composition of the plait point PP at 25° is 38.4 gms. KI + 22.2 gms. $(CH_3)_3COH$ per 100 gms. sat. solution. (Ginnings, Herring and Webb, 1933.)

DISTRIBUTION OF POTASSIUM IODIDE AT 17° BETWEEN WATER AND AMYL ALCOHOL.

(Wosnessensky, 1925.)

Millimols. KI per liter of H_2O layer (C_1).	Millimols. KI per liter of Alcohol layer (C_2).	$\frac{C_1}{C_2^{0.53}}$.
105.5	0.27	207
228.5	1.20	208
336.75	2.25	218
485.5	5.00	217

100 cc. sat. solution of potassium iodide in ethyl urethan contain 5.81 gms. KI at 60°. (Stuckgold, 1917.)

EQUILIBRIUM IN THE SYSTEM POTASSIUM IODIDE — ETHYL ETHER — WATER AT 20°.

(Dunningham, 1914.)

Gms. per 100 Gms. Upper Layer.			Gms. per 100 Gms. Lower Layer.			Solid Phase.
KI.	H_2O.	$(C_2H_5)_2O$.	KI.	H_2O.	$(C_2H_5)_2O$.	
...	...	...	59.2	40.8	...	KI
0	3.9	96.1	0	93	7	None
0.4	0.4	99.2	55.6	40.7	3.7	KI
0.1	2.2	97.7	25	72.1	2.9	None

DISTRIBUTION OF POTASSIUM IODIDE BETWEEN WATER AND:

Nitrobenzene at 18°. (Dawson, 1908.)

Mols. KI per Liter. $C_6H_5NO_2$ Layer.	Mols. KI per Liter. H_2O Layer.	Dist. Ratio.
0.00114	6.05	5300
0.00108	6.05	5600

Phenol at Room Temp. (Riesenfeld, 1902.)

Gms. KI per 100 cc. C_6H_5OH Layer.	Gms. KI per 100 cc. Aq. Layer.	Dist. Ratio.
0.052	0.725	13.2
0.197	2.42	12.3
2.09	30.7	14.7

SOLUBILITY OF POTASSIUM IODIDE IN PURE ALLYL ALCOHOL SOLUTIONS OF SODIUM IODIDE AT 25°.

(Partington and Winterton, 1934.)

The density of the Allyl Alcohol, CH_2CHCH_2OH, was $d\frac{25}{4} = 0.84572$.

d. of sat. sol.	Gms. per 100 gms. $C_6H_5CH_2OH$ NaI	Gms. per 100 gms. $C_6H_5CH_2OH$ KI	d. of sat. sol.	Gms. per 100 gms. $C_6H_5CH_2OH$ NaI	Gms. per 100 gms. $C_6H_5CH_2OH$ KI
0.85080	0.0	1.133	0.90753	8.164	0.745
0.86134	1.157	1.060	0.93501	12.501	0.565
0.87286	2.138	1.000	0.96453	17.520	0.390
0.88750	5.300	0.837	0.98624	23.252	0.200
0.88890	5.321	0.820	1.02685	28.48	0.0
0.90044	7.110	0.781			

SOLUBILITY OF POTASSIUM IODIDE IN PURE BENZYL ALCOHOL SOLUTIONS OF SODIUM IODIDE AT 25°.

(Partington and Winterton, 1934.)

The density of the Benzyl alcohol, $C_6H_5CH_2OH$, was 1.0453.

d. of sat. sol.	Gms. per 100 gms. $C_6H_5CH_2OH$ NaI	Gms. per 100 gms. $C_6H_5CH_2OH$ KI	d. of sat. sol.	Gms. per 100 gms. $C_6H_5CH_2OH$ NaI	Gms. per 100 gms. $C_6H_5CH_2OH$ KI
1.04485	0.0	0.320	1.10612	5.613	0.271
1.05650	1.324	0.305	1.11923	7.267	0.263
1.06203	2.235	0.301	1.14585	11.010	0.197
1.10043	4.700	0.290	1.14633	14.400	0.000

SOLUBILITY OF POTASSIUM IODIDE IN AQUEOUS SOLUTIONS OF URETHAN AT 25°.

(Palitzsch, 1928, 1929.)

Gm. Mols. per 1000 gms. H_2O		Solid Phase
$NH_2COOC_2H_5$	KI	
0.0	9.0355	KI
1.1225	8.979	"
20.79	8.73	"
46.72	9.66	" + $NH_2COOC_2H_5$
53.09	0.0	$NH_2COOC_2H_5$

SOLUBILITY OF POTASSIUM IODIDE IN LIQUID AMMONIA.

t°	Gms. KI per 100 gms. NH_3	Authority
0	184.2	(Linhard and Stephen, 1933, 1934.)
25	182.0	(Hunt, 1932.)

100 gms. Liquid Sulfur Dioxide dissolve 41.3 gms. KI at 0°. (Jander and Ruppolt, 1937.)

Data for equilibrium in the System KI + SO_2 are given by Walden and Centnerszwer, 1903. Results for the vapor pressure, temperature relations of the system are given by Foote and Fleischer, 1931.

Fusion point data have been determined for the following mixtures.

KI + K_2SO_4 (Ruff and Plato, 1903.)
" + AgI (Sandoninni, 1912a)
" + NaCl (Ruff & Plato, 1903; Waxberg, 1930.)
" + PbI_2 (van Klooster and Stearns, 1933.)
" + SO_2 (Walden and Centnerszwer, 1903.)

POTASSIUM IODOMERCURATE (Thoulet Solution).

A sat. solution at 22.9°, prepared by adding KI and HgI_2 in excess to water, contained 8.66% K, 22.49% Hg, 52.58 (57.7) % I and 10.97 (11.15)% H_2O, corresponding to 0.22 mol. alkali, 0.11 mol. Hg and 0.45 mol. I. (Duboin, 1905.)

POTASSIUM IODATE KIO_3

SOLUBILITY OF POTASSIUM IODATE IN WATER.

The results of Kremers, 1856(a); Meerburg, 1905; Flöttman, 1928; Hill and Brown, 1931; and Ricci, 1931; above 100°, Benrath, Gjedebo, Schiffers and Wunderlich, 1937; were plotted and the following values taken from the average curve.

t°	d of sat. sol.	Gms. KIO_3 per 100 gms. sat. sol.	t°	d. of sat. sol.	Gms. KIO_3 per 100 gms. sat. sol.	t°	Gms. KIO_3 per 100 gms. sat. sol.
0	—	4.4	30	—	9.3	125	27.5
5	1.043	5.15	40	—	11.2	150	32.2
10	—	5.9	50	1.110	13.3	175	37.0
15	1.0584	6.68	60	—	15.5	200	41.5
20	1.0643	7.48	80	—	19.9	250	49.8
25	1.0708	8.40	100	—	24.4	300	58.0

POTASSIUM Hydrogen IODATES

SOLUBILITY OF EACH IN WATER.

Compound	Formula	t°	Gms. Compound per 100 gms. H_2O	Authority
Potassium Hydrogen Iodate	$KH(IO_3)_2$	15	1.3	(Serullas)
" " "	"	17	5.4	"
" Dihydrogen "	$KH_2(IO_3)_2$	15	4.0	(Meineke, 1891.)

EQUILIBRIUM IN THE SYSTEM POTASSIUM IODATE, IODIC ACID, WATER AT 30°.

(Meerburg, 1905.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
HIO_3.	KIO_3.		HIO_3.	KIO_3.	
0	9.51	KIO_3	3.47	3.59	$KIO_3.2HIO_3$ (unstable)
0.65	9.49	" $+KIO_3.HIO_3$	4.80	2.90	" "
0.65	8.90	$KIO_3.HIO_3$	6.45	1.35	" "
0.67	6.6	"	9.35	0.64	$KIO_3.2HIO_3$
1.14	4.57	"	12.04	0.44	"
1.69	3.63	"	17.50	0.30	"
2.02	3.10	"	31.20	0.52	"
3.34	2.10	"	53.64	0.68	"
5	1.32	"	62.52	0.72	"
10 7.09	1	"	76.40	0.80	$+HIO_3$
8.04	0.85	" $+KIO_3.2HIO_3$	76.7	0	HIO_3

100 cc. anhydrous Hydrazine dissolve 1 gm. KIO_3 at room temp.

(Welsh and Broderson, 1915.)

SOLUBILITY OF POTASSIUM IODATE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE AND VICE VERSA.

(Hill and Brown, 1931.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	KNO_3	KIO_3	
	Results at 5°		
1.043	0.00	5.25	KIO_3
1.060	5.36	3.29	"
1.090	10.53	2.93	"
1.110	13.53	2.89	"
1.120	14.14	2.87	" + KNO_3
1.100	14.26	1.08	KNO_3
1.097	14.43	0.0	"
	Results at 25°		
1.072	0.0	8.46	KIO_3
1.084	5.48	5.92	"
1.110	8.51	5.25	"
1.156	16.77	4.57	"
1.160	18.19	4.48	"
	Results at 25° (con.)		
1.232	26.84	4.24	KIO_3 + KNO_3
1.215	27.25	2.65	KNO_3
1.210	27.30	2.06	"
1.192	27.79	0.00	"
	Results at 50.4°		
1.110	0.0	13.35	KNO_3
1.167	17.42	7.32	"
1.259	31.43	5.79	"
1.33	39.17	5.17	"
1.35	42.42	4.91	"
1.37	44.23	4.75	" + KNO_3
1.34	45.44	2.44	KNO_3
1.326	46.57	0.0	"

POTASSIUM IODATE KIO_3.

SOLUBILITY OF POTASSIUM IODATE IN AQUEOUS SOLUTIONS OF POTASSIUM HYDROXIDE AT 20°. (Brönsted, 1920 *a*.)

Gms. mols. per liter.		Gms. mols. per liter.		Gms. mols. per liter.		Gms. mols. per liter.	
KOH.	KIO_3.	KOH.	KIO_3.	KOH.	KIO_3.	KOH.	KIO_3.
4.71	0.0390	7.95	0.0179	11.10	0.0128	14.02	0.0154
5.06	0.0362	9.41	0.0144	12.19	0.0131	14.85	0.0194
6.35	0.0256	10.95	0.0130	12.92	0.0135		

SOLUBILITY OF POTASSIUM IODATE IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE AND VICE VERSA.

(Hill and Ricci, 1931.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	K_2SO_4	KIO_3	
	Results at 5°		
1.043	0.0	5.16	KIO_3
1.060	4.07	3.14	"
1.081	7.08	2.57	" + K_2SO_4
1.077	7.25	1.80	K_2SO_4
1.062	7.64	0.0	"
	Results at 25°		
1.071	0.0	8.45	KIO_3
1.085	4.75	5.66	"
1.103	7.74	4.72	"
1.117	9.65	4.30	" + K_2SO_4
	Results at 25° (con.)		
1.103	10.10	2.44	K_2SO_4
1.083	10.76	0.0	"
	Results at 50°		
—	0.0	13.21	KIO_3
—	7.90	8.68	"
—	11.43	7.39	"
—	12.0	7.06	" + K_2SO_4
—	13.0	3.78	K_2SO_4
—	14.18	0.0	"

IO

SOLUBILITY OF POTASSIUM IODATE IN AQUEOUS SOLUTIONS OF SODIUM IODATE AND VICE VERSA.

(Hill and Ricci, 1931.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$NaIO_3$	KIO_3	
	Results at 5°		
1.043	0.00	5.16	KIO_3
1.051	1.41	4.71	"
1.060	2.17	4.72	"+$NaIO_3.5H_2O$
1.046	2.48	3.19	$NaIO_3.5H_2O$
1.028	3.28	0.0	"
	Results at 25°		
1.071	0.0	8.45	KIO_3
1.098	4.26	7.09	"
1.126	7.13	6.73	"+$NaIO_3.H_2O$
	Results at 25° (con.)		
1.103	7.79	3.79	$NaIO_3.H_2O$
1.074	8.57	0.0	"
	Results at 50°		
—	0.0	13.21	KIO_3
—	3.92	11.92	"
—	7.70	11.14	"
—	10.92	10.61	"+$NaIO_3.H_2O$
—	11.41	7.93	$NaIO_3.H_2O$
—	12.55	4.24	"
—	13.49	0.0	"

POTASSIUM PerIODATE KIO_4.

100 gms. H_2O dissolve 0.66 gm. KIO_4 at 13°, d_{13} of sat. solution = 1.0051.

(Barker, 1908.)

Solubility of Potassium Periodate in Water.

(Hill, 1928.)

t^0	Gms. KIO_4 per 100 gms. sat. sol.	t^0	Gms. KIO_4 per 100 gms. H_2O
0.2	0.169	50	1.44
5.4	0.21	75	3.59
15.0	0.334	97	6.83
25.0	0.510		

Equilibrium in the System Potassium Periodate, Potassium Hydroxide and Water at 25°.

(Hill, 1928.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	KOH	KIO_4			KOH	KIO_4	
1.000	0.0	0.51	KIO_4	1.326	8.0	20.8	$K_4I_2O_9.9H_2O$
1.044	1.01	4.12	"	1.377	9.7	24.1	"
1.087	1.99	8.03	"	1.484	11.9	28.9	"
1.116	2.55	10.32	" + $K_4I_2O_9.H_2O$	1.64	14.5	35.2	"
1.165	4.55	13.15	$K_4I_2O_9.9H_2O$	—	16.4	39.0	"
1.221	6.03	16.12	"	—	19.1	44.6	"

IO

POTASSIUM Di-meso- Per **IODATE** $K_4I_2O_9.9H_2O$

Solubility of Potassium Di-meso-Periodate in Water.

(Hill, 1928.)

t^0	d. of sat. sol.	Gms. $K_4I_2O_9$ per 100 gms. sat. sol.	Solid Phase	t^0	d. of sat. sol.	Gms. $K_4I_2O_9$ per 100 gms. sat. sol.	Solid Phase
0.3	1.032	3.5	$K_4I_2O_9.9H_2O$	50	1.395	35.0	$K_4I_2O_9.9H_2O$
15.0	1.073	7.7	"	65	—	50.1	"
25.0	1.118	12.3	"	78	—	61.7	" + $K_4I_2O_9$
37.5	1.216	22.0	"	98.6	—	61.7	$K_4I_2O_9$

POTASSIUM Per **IODATE**

Solubility of Potassium Meta Periodate in Aqueous Solutions of Periodic Acid at 25°.

(Hill, 1928.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	HIO_4	KIO_4	
1.000	0.0	0.51	KIO_4
1.014	1.157	0.355	"
1.023	2.83	0.261	"

POTASSIUM PERMANGANATE $KMnO_4$.

SOLUBILITY IN WATER. (Baxter, Boylston, and Hubbard, 1906; Patterson, 1906.)

t°.	Gms. $KMnO_4$ per 100: Gms. Solution.	Gms. H_2O.	cc. Solution (P).	t°.	Gms. $KMnO_4$ per 100: Gms. Solution.	Gms. H_2O.
0	2.75	2.83	2.84	34.8	9.64	10.67
9.8	4.13	4.31	...	40	11.16	12.56
15	...	...	5.22	45	12.73	14.58
19.8	5.96	6.34	...	50	14.45	16.89
24.8	7.06	7.59	...	55	16.20	19.33
29.8	8.28	9.03	8.69	65	20.02	25.03

Sp. Gr. of saturated solution at 15° = 1.035.

Determination by Worden (1907), made with extreme care, gave results in very close agreement with the above.

SOLUBILITY OF POTASSIUM PERMANGANATE IN WATER.
(Voerman, 1905, 1906.)

t°.	Gms. $KMnO_4$ per 100 gms. sat. sol.	water.	Solid Phase	t°.	Gms. $KMnO_4$ per 100 gms. sat. sol.	water.	Solid Phase.
—0.18......	0.58	0.58	Ice	+10........	4.01	4.22	$KMnO_4$
—0.27......	0.99	1.01	»	15........	4.95	5.20	»
—0.48......	1.98	2.02	»	25........	7.00	7.53	»
—0.58 Eutec.	2.91	3.00	»+$KMnO_4$	40........	11.09	12.47	»
				50........	14.35	16.75	»

SOLUBILITY OF POTASSIUM PERMANGANATE IN WATER.
(Flöttmann, 1928.)

t^0	d. of sat. sol.	Gms. $KMnO_4$ per 100 gms. sat. sol.	Solid Phase
15	1.0342	4.997	$KMnO_4$
20	1.0397	5.946	"
25	1.0461	7.079	"
25	1.0461	7.097	" (Trimble, 1922.)

SOLUBILITY OF POTASSIUM PERMANGANATE AT 25° IN AQUEOUS SOLUTIONS OF :
(Trimble, 1922.)

Potassium Sulfate. $d_{\frac{25}{4}}$ of sat. sol.	Gms. per 100 gms. sat. sol. K_2SO_4	$KMnO_4$.	Solid Phase.	Sodium Sulfate. $d_{\frac{25}{4}}$ of sat. sol.	Gms. per 100 gms. sat. sol. Na_2SO_4.	$KMnO_4$.	Solid Phase.
1.0454	0.0	7.10	$KMnO_4$	1.0554	0.88	7.33	$KMnO_4$
1.0483	0.80	6.59	»	–	4.62	7.83	»
1.0537	1.98	5.92	»	1.1180	7.05	7.75	»
1.0730	5.47	4.52	»	–	9.34	7.67	»
1.0876	7.79	3.87	»	–	12.85	7.27	»
1.0979	9.26	3.55	»+K_2SO_4	–	17.05	6.68	»
1.0864	10.75	0.00	K_2SO_4	1.2363	19.43	6.25	»
				–	21.04	5.91	» + $Na_2SO_4.10H_2O$
				1.2071	21.80	0.0	$Na_2SO_4.10H_2O$

The author also gives data for the densities of aqueous solutions of $KMnO_4$, K_2SO_4 and of Na_2SO_4. He also gives a few determinations of the solubility of $KMnO_4$ in aqueous solutions of mixtures of K_2SO_4 and Na_2SO_4.

Solubility of Potassium Permanganate in Aqueous Solutions of Potassium Carbonate.

(Sackur and Taegener, 1912.)

Mols. $KMnO_4$ per Liter in:

t°.	0.1 *n* ½K_2CO_3.	1 *n* ½K_2CO_3.	2 *n* ½K_2CO_3.	4 *n* ½K_2CO_3.	6 *n* ½K_2CO_3.
0	0.1462	0.0629	0.0446	0.027	0.0156
25	0.4375	0.2589	...	0.093	...
40	0.7380	0.5007	0.3519	...	...

Solubility of Potassium Permanganate in Aqueous Solutions of Potassium Chloride.

(Sackur and Taegener, 1912.)

Mols. $KMnO_4$ per Liter in:

t°.	0.1 *n* KCl.	0.5 *n* KCl.	1 *n* KCl.	2 *n* KCl.
0	0.1395	0.076	0.0532	0.0379
25	0.4315	0.306	0.220	0.1432
40	0.738	0.584	0.444	0.288

Solubility of Potassium Permanganate in Aqueous Solutions of Potassium Hydroxide.

(Sackur and Taegener, 1912.)

MnO

Mols. $KMnO_4$ per Liter in:

t°.	H_2O.	1 *n* KOH.	2 *n* KOH.	4 *n* KOH.	6 *n* KOH.	8 *n* KOH.	10 *n* KOH.
0	0.176	0.050	0.031	0.027	0.023	0.017	0.012
10	0.278	0.112	0.068	0.048	0.042	0.028	0.016
20	0.411	0.179	0.119	0.079	0.074 (19°)	0.032	0.029
30	0.573	0.316 (32°)	0.213 (32°)	0.149 (32°)	0.114	0.062 (32°)	0.040
40	0.792	0.439	0.306	0.211	0.161	0.084	0.052
50	1.154 (53°)	0.638	0.462	0.304	0.219	0.111	...
70	1.812	1.172	0.869	0.572	0.390	0.188	0.082
80	...	1.513	1.190	...	0.500	0.231	...
90	...	...	...	...	0.649	0.297	...

Solubility of Potassium Manganate in Aqueous Solutions of Potassium Hydroxide.

(Sackur and Taegener, 1912.)

(The K_2MnO_4 was prepared by boiling $KMnO_4$ with very conc. KOH, draining by suction and washing with ice cold K_2CO_3 solution. The impurities were of no consequence since the determinations were made in alkaline solutions.)

Mols. K_2MnO_4 per Liter in:

t°.	2 *n* KOH.	4 *n* KOH.	6 *n* KOH.	8 *n* KOH.	10 *n* KOH.
0	0.907	0.554	0.155	0.063	0.0145
10	1.013	...	...	0.070	0.0152
15	...	0.681 (17°)	0.224	...	...
20	1.140	0.733 (25°)	0.261 (21°)	0.078	0.0160
30	1.252	0.772	0.303	0.096	0.0215
40	...	0.852	0.362	0.119	0.0305
45	1.424	0.889	0.388	...	...
50	...	0.938 (51°)	...	0.142	0.0462
60	...	1.003	0.469	0.167	0.062 (63°)
70	...	1.074	0.528	0.196	0.070
80	...	1.143	0.587	0.222	0.083

100 cc. anhy. hydrazine dissolve 2 gms. $KMnO_4$, with evolution of gas and formation of a brown precipitate, at room temp. (Welsh and Broderson, 1915.)

POTASSIUM Per MANGANATE

SOLUBILITY OF POTASSIUM PERMANGANATE IN AQUEOUS SOLUTIONS OF SALTS AT 25°.

(Herz and Hiebenthal, 1929.)

Results for Aqueous Solutions of:

Lithium Chloride

Gm. Mols. per liter	
$LiCl$	$1/5\text{-}KMnO_4$
0.0	2.25
0.51	2.18
0.87	2.09
2.56	1.51
3.81	1.16
4.56	0.95

Sodium Chloride

Gm. Mols. per liter	
$NaCl$	$1/5\text{-}KMnO_4$
0.59	2.32
0.96	2.29
2.26	2.13
3.35	1.86
4.22	1.73
+5.15	1.53

Ammonium Chloride

Gm. Mols. per liter	
NH_4Cl	$1/5\text{-}KMnO_4$
0.59	1.94
0.95	1.75
2.69	1.05
3.78	0.86
4.57	0.78
+5.45	0.72

Magnesium Chloride

Gm. Mols. per liter	
$1/2\text{-}MgCl_2$	$1/5\text{-}KMnO_4$
0.96	2.01
1.92	1.78
4.62	0.96
6.42	0.64
7.64	9.48
8.10	0.40
+9.52	0.16

Calcium Chloride

Gm. Mols. per liter	
$1/2\text{-}CaCl_2$	$1/5\text{-}KMnO_4$
0.0	2.25
1.70	2.00
4.96	1.20
6.80	0.91
8.10	0.80

Strontium Chloride

Gm. Mols. per liter	
$1/2\text{-}SrCl_2$	$1/5\text{-}KMnO_4$
0.0	2.25
0.64	2.27
2.45	1.94
3.92	1.64
4.52	1.50
+5.90	1.36

Mn(

Potassium Chloride

Gm. Mols. per liter		Gm. Mols. per liter	
KCl	$1/5\text{-}KMnO_4$	KCl	$1/5\text{-}KMnO_4$
0.36	1.56	2.32	0.58
0.61	1.30	2.89	0.51
1.65	0.74	4.06	0.40

SOLUBILITY OF POTASSIUM PERMANGANATE IN AQUEOUS SOLUTIONS OF ACETONE AT 13°.

(Herz and Knock, 1904.)

cc CH_3COCH_3 per 100cc solvent	Gms. $KMnO_4$ per 100cc sat. sol.	cc CH_3COCH_3 per 100cc solvent	Gms. $KMnO_4$ per 100cc sat. sol.
0.0	4.70	60	10.02
10.0	5.13	70	10.38
20	5.61	80	9.89
30	6.59	90	7.18
40	8.14	100	2.14
50	9.16		

SOLUBILITY OF MIXED CRYSTALS OF POTASSIUM PERMANGANATE AND RUBIDIUM PERMANGANATE AT 7°.

(Muthmann and Kuntze, calc. by Fock.)

Milligram Mols. per Liter.		Gms. per Liter.		Mol. per cent $KMnO_4$ in Crystals of Solid Phase.
$KMnO_4$.	$RbMnO_4$.	$KMnO_4$.	$RbMnO_4$.	
27.04	22.69	4.28	4.64	3.50
75	22.22	11.84	4.54	13.75
120.26	31.29	19.03	6.40	34.29
188.30	38.98	29.80	7.97	71.45
198.36	41.29	31.39	8.44	92.50
205.76	42.50	32.56	8.69	99.47
225.12	26	35.61	5.32	99 32
264.27	0	41.81	0	100

POTASSIUM MOLYBDATE K_2MoO_4

SOLUBILITY OF POTASSIUM MOLYBDATE IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE AT 25° AND VICE VERSA.

(Amadori, 1912a).

Gms. per 100 Gms. H_2O.		Gms. per 100 Gms. H_2O.	
K_2SO_4.	K_2MoO_4.	K_2SO_4.	K_2MoO_4.
0	184.6	1.50	99.49
0.46	180.7	2.13	45.89
0.72	177	3.95	17.48
0.98	127.2	8.55	4.73
1.27	107.5	12.10	0

Freezing-point data for K_2MoO_4 + K_2SO_4, K_2MoO_4 + K_2WO_4 and K_2Mo_2O + $K_2W_2O_7$ are given by Amadori (1913).

Results for K_2MoO_4 + MoO_3 and K_2MoO_4 + Li_2MoO_4 and K_2WO_4 + WO_3 are given by Hoermann, 1929.

POTASSIUM PHOSPHOMOLYBDATE $K_3PO_4.11MoO_3.1\frac{1}{2}H_2O$.

100 gms. H_2O dissolve 0.0007 gm. at 30°.
100 gms. aqueous 10% HNO_3 dissolve 0.204 gm. at 30°. (Donk, M. G., 1905.)

POTASSIUM PHOSPHOMOLYBDATE

SOLUBILITY OF POTASSIUM PHOSPHOMOLYBDATE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE. (Heidenhain, 1918.)

In order to avoid errors due to impurities in the phosphomolybdate, small quantities of the washed precipitate were digested for a time long enough to insure saturation, and the dissolved part determined either by evaporation and weighing or by titration. The temperature is not stated.

Gms. per 100 cc. Aq. solvent.		Gms. P_2O_5 per 100 cc. sat. sol.	Gms. per 100 cc. Aq. solvent.		Gms. P_2O_5 per 100 cc. sat. solution.
KNO_3.	HNO_3.		KNO_3.	HNO_3.	
10	0.0	1.30	10	0.0504	0.12
15	0.0	1.30	10	0.0252	0.18
20	0.0	1.30	10	0.0126	0.49
10	0.063	0.06			

POTASSIUM PHOSPHOTUNGSTATE

1000 cc. sat. solution of potassium phosphotungstate in water contain 0.135 gm. of the compound at 20°. (Moser and Ritschel, 1925.)

POTASSIUM AMIDE KNH_2.

100 gms. liquid ammonia dissolve 3.6 gms. KNH_2 at 25°. (Hunt an. Boncyk, 1933.)

Data for the freezing-points of mixtures of potassium amide and sodium amide are given by Kraus, 1923.

POTASSIUM AZIDE KN_3.

SOLUBILITY OF POTASSIUM AZIDE IN WATER.

(Wohlgemuth, 1934.)

The results are given in the form of a diagram but numerical values only for the following points.

N

t°	Gms. KN_3 per 100 gms. KN_3 + H_2O	Solid Phase
-12.9 (Eutec.)	26.2	$KN_3 + H_2O$
0	29.3	KN_3
10.5	31.7	"
15.5	32.8	"
17.0	33.2	"
100	51.4	"
354 (m. pt.)	100.0	"

The results at 10.5 , 15.5 and 17.0 are by Curtius and Rissom, 1898.

100 gms. Alcohol (d_{17} = 0.799) dissolve 0.16 gm. KN_3 at 0° and 0.54 gm. at b. pt.
100 gms. Alcohol (80 per cent) dissolve 1.8 gm. KN_3 at 0° and 5.9 gm. at b. pt.
100 gms. Benzene dissolve 0.15 gm. KN_3 at b. pt.
(Cranston and Livingstone, 1926.)

POTASSIUM NITRITE KNO_2.

NO

SOLUBILITY IN WATER.

(Oswald, 1912, 1914.)

t°.	Gms. KNO_2 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. KNO_2 per 100 Gms. Sat. Sol.	Solid Phase.
− 4.1	16.1	Ice	+ 17.5	74.5*	KNO_2
− 7.6	24.1	"	25	75.75	"
−13.8	40.2	"	40	77	"
−18.6	50.1	"	55	77.5	"
−24.6	61.7	"	75	78.5	"
−30	69.8	"	100	80.5	"
−31.6 Eutec.	71.8	" + KNO_2	111	80.7	"
− 6.5	73.2	KNO_2	119	81.15	"
0	73.6	"	125	81.8	"

* $d_{17.4}$ = 1.6464.

100 gms. H_2O dissolve about 300 gms. KNO_2 at 15.5°. (Divers, 1899.)
The figure 138.5 gms. KNO_2 per 100 gms. H_2O at 15°, given by von Niementowski and von Roszkowski (1897), is evidently low.

POTASSIUM NITRITE KNO_2.

SOLUBILITY OF POTASSIUM NITRITE IN WATER.

(Bureau, 1935a, 1937.)

t°	Gms. KNO_2 per 100 gms. sat. sol.	Solid Phase
- 5.20	13.01	Ice
-12.25	27.85	"
-20.45	41.0	"
-34.04	58.8	"
-40.2 (Eutec.)	64.9	" + $KNO_2.5H_2O$
-26.8	68.4	$KNO_2.5H_2O$

t°	d. of sat. sol.	Gms. KNO_2 per 100 gms. sat. sol.	Solid Phase	t°	Gms. per 100 gms. sat. sol.
-8.9 (tr.pt.)	—	71.9	KNO_2 + $KNO_2.5H_2O$	0	73.65
+20.0	1.649	74.3	KNO_2	20	75.41
56.0	1.671	76.36	"	40	77.00
64.7	1.673	77.0	"	60	77.75
79.5	1.687	78.5	"	80	78.98
98.5	1.714	78.9	"	98	80.35

NO The above results for the ice curve differ from those of Oswald, 1912, 1914. They also show the existence of the hydrate, $KNO_2.5H_2O$. The results between 0° and 98° are by Rakowski and Slawina, 1931. These authors also give results for the ice curve which agree with those of Oswald, 1912, 1914.

SOLUBILITY OF POTASSIUM NITRITE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE AND VICE VERSA.

(Bureau, 1937.)

Results in the form of a diagram are presented for the temperatures, 0°, 25°, 56.6° and 98.5° but numerical values are given only for the temperatures 25° and 98.5°.

Results at 25°

Gms. per 100 gms. sat. sol.		Solid Phase
KNO_2	KNO_3	
68.7	8.53	MC, KNO_2 + KNO_3
66.45	11.20	" " "
64.15	13.05	" " "
61.5	15.10	β KNO_3
55.8	14.95	"
35.85	15.05	α "
19.90	18.75	"

Results at 98.5°

Gms. per 100 gms. sat. sol.		Solid Phase
KNO_2	KNO_3	
64.80	14.80	MC, KNO_2 + KNO_3
57.0	13.80	" " "
51.10	35.15	" " "
46.70	39.15	" " "
39.70	43.80	KNO_3
20.45	55.40	"

MC, KNO_2 + KNO_3 = Mixed Crystals. Data for this system at 0°, 20°, 40°, 60°, 80° and 98° are also given by Rakowsky and Slavina, 1931, but the results are not in good accord with the above.

POTASSIUM Cobalti NITRITE $K_3Co(NO_2)_6$.

SOLUBILITY OF POTASSIUM COBALTI NITRITE IN AQUEOUS ALCOHOL AT 14°.

(Pierrat, 1921.)

NOTE. — Saturation was obtained by agitation for several hours. The saturated solution was evaporated to dryness in a current of air and enough water to yield the original volume of the solution was added. The nitrite in this solution then determined by calculations from the electrolytic conductivity.

Wt. per cent C_2H_5OH in solvent.	Gms. $K_3Co(NO_2)_6$ per liter sat. sol.	Wt. per cent C_2H_5OH in solvent.	Gms. $K_3Co(NO_2)_6$ per liter sat. sol.
0.0	0.21	27.3	0.036
8.7	0.09	42.4	0.033
15.7	0.056	94.7	0.026

Data for the fusion-points of mixtures of KNO_2 + KNO_3 are given by Meneghini, 1912, and for mixtures of KNO_2 + $NaNO_2$ by Ettinger, 1932.

POTASSIUM NITRATE

SOLUBILITY IN WATER.

(Mulder; Andrae, 1884; Gerardin, 1865; Etard, 1894; Ost, 1878; at 31.25°, Köhler, 1897; Euler, 1904; Tilden and Shenstone, 1884; Berkeley, 1904.)

Average Curve.

NO

t°.	Gms. KNO_3 per 100 Gms. Water.	Gms. KNO_3 per 100 Gms. Solution.	t°.	Gms. KNO_3 per 100 Gms. Water.	Gms. KNO_3 per 100 Gms. Solution.
0	13.3	11.7	70	138	58.0
10	20.9	17.3	80	169	62.8
20	31.6	24.0	90	202	66.9
25	37.3	27.2	100	246	71.1
30	45.8	31.4	110	300	75.0
40	63.9	39.0	120	394	79.8
50	85.5	44.0	125	493	83.1
60	110.0	52.0			

The very carefully determined figures of Berkeley are as follows:

t°.	d_4 of Sat. Sol.	Gms. KNO_3 per 100 Gms. H_2O.	t°.	d_4 of Sat. Sol.	Gms. KNO_3 per 100 Gms. H_2O.
0.40	1.0817	13.43	60.05	1.3903	111.18
14.90	1.1389	25.78	76	1.4700	156.61
30.80	1.2218	47.52	91.65	1.5394	210.20
44.75	1.3043	74.50	114 b. pt.	1.6269	311.64

1000 gms. H_2O dissolve 384.48 gms. KNO_3 at 25°. (Armstrong and Eyre, 1910–11.)

One liter sat. solution in water contains 2.8 mols. = 283.11 gms. KNO_3 at 20°. (Rosenheim and Weinheber, 1910–11.)

Recent determinations of the solubility of potassium nitrate in water, agreeing satisfactorily with the above data, are given by Chugaev and Khlopin (1914).

SOLUBILITY OF POTASSIUM NITRATE IN WATER.

Determination at temperatures up to 60° made by Massink, 1917-18; Gladstone and Saunders, 1923; Wright, 1927; Malquori, 1928; Nikolajew, 1929; Benrath and Wazelle, 1929; Ehret, 1932; Muller, 1933; Ricci, 1934; and Saslowsky and Ettinger, 1935; and for temperatures above 100° by Brönsted, 1913; Aronowa and Lumskaja, 1931 and Benrath, Gjedebo, Schiffers and Wunderlich, 1937, were plotted and the following values taken from the average curve drawn through them.

t°	Gms. KNO_3 per 100 gms. sat. sol.	t°	Gms. KNO_3 per 100 gms. sat. sol.	t°	Gms. KNO_3 per 100 gms. sat. sol.
-2.84 (Eutec.)	10.87	60	51.5	180	87.0
0	12.2	70	57.5	200	89.0
10	17.5	80	62.5	225	91.7
20	24.0	90	67.0	250	93.5
25	27.5	100	71.0	275	96.0
30	31.2	120	77.5	300	98.0
40	38.0	140	81.5	336 (m.pt.)	100.0
50	45.5	160	85.0		

NO

POTASSIUM NITRATE KNO_3.

SOLUBILITY ICE CURVE AND SUPERSOLUBILITY ICE CURVE.

(Jones, 1908.)

t° of Cryst.	Gms. KNO_3 per 100 Gms. H_2O.		t° of Cryst.	Gms. KNO_3 per 100 Gms. H_2O.	
	Solubility Ice Curve.	Supersolubility Ice Curve.		Solubility Ice Curve.	Supersolubility Ice Curve.
−1	3.336	1.011	−3	...	5.762
−2	7.582	3.538	−4	...	8.694
−2.8*	11.62	5.56	−5	...	11.12
			−5.3*	...	11.82

* Cryohydrate.

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 0°.

(Engel — Compt. rend. 104, 913, '87.)

Sp. Gr. of Solutions.	Equivalents per 10 cc. Solution.		Grams per 100 cc. Solution.	
1.079	12.5 KNO_3	0 HNO_3	12.65 KNO_3	0.00 HNO_3
...	9.9 "	5.87 "	10.02 "	3.71 "
1.093	8.28 "	13.2 "	8.38 "	8.38 "
1.117	7.4 "	21.55 "	7.49 "	13.58 "
1.144	7.4 "	31.1 "	7.49 "	19.47 "
1.202	7.6 "	48.0 "	7.68 "	30.04 "
1.289	10.3 "	68.0 "	10.42 "	42.86 "
1.498	28.3 "	120.5 "	28.64 "	75.95 "

Freezing-point data for $KNO_3 + HNO_3$ are given by Dernby (1918).

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 20°.

(Nichols, Howes et. al., 1919.)

Per cent HNO_3 in solvent.	Gms. KNO_3 per 100 gms. solvent.	Per cent HNO_3 in solvent.	Gms. KNO_3 per 100 gms. solvent.	Per cent HNO_3 in solvent.	Gms. KNO_3 per 100 gms. solvent.
0.0	31.4	40.0	15.2	70	29.6
10.0	19.1	50	18.6	80	34.2
20.0	14.5	60	19.6	90	48.8
30.0	11.4				

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 25°.

(Malquori, 1928c.)

Gms. per 100 gms. sat. sol. HNO_3	Gms. per 100 gms. sat. sol. KNO_3
0.00	27.31
10.30	25.03
13.97	24.13
20.11	26.12
29.56	35.10
44.17	43.28
50.01	49.99

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT SEVERAL TEMPERATURES. (Kazantzev, 1923, 1925.)

Constant agitation was employed for securing saturation. One to two hours was found sufficient in all cases for the attainment of equilibrium.

Results at 0°.

Gms. per 100 gms. sat. sol. HNO_3.	Gms. per 100 gms. sat. sol. KNO_3.	
0.0	11.9	
1.3	11.0	
4.7	8.5	
8.7	7.2	
13.2	6.4	
16.5	6.1	
25.5	6.4	
30.1	7.0	
33.5	7.5	
39.9	9.7	
48.0	16.5	
50.7	23.1	
52.2	30.2	
52.2	38.2	
52.2	39.4	
50.7	48.4	
57.5	34.4	(Solid Phase = $KNO_3.2HNO_3$)
73.0	25.5	(" " ")

Results at 15°.

Gms. per 100 gms. sat. sol. HNO_3.	Gms. per 100 gms. sat. sol. KNO_3.
0.0	20.7
7.5	14.2
18.0	10.7
23.3	10.1
24.0	10.2
29.2	10.5
40.0	13.6
45.1	17.7
49.3	25.1
51.0	32.7
51.6	38.1
51.3	44.1
50.0	49.2

Results at 30°.

Gms. per 100 gms. sat. sol. HNO_3.	Gms. per 100 gms. sat. sol. KNO_3.
0.0	31.5
5.4	25.6
11.0	20.9
18.2	17.2
27.2	15.7
40.1	18.9
47.7	27.7
49.0	33.2
50.1	39.5
50.6	42.5
49.7	49.9

Results at 75°.

Gms. per 100 gms. sat. sol. HNO_3.	Gms. per 100 gms. sat. sol. KNO_3.
0.0	60.0
5.1	53.6
17.7	41.3
21.8	38.9
29.3	37.4
32.2	36.7
38.5	37.6
42.5	39.9
45.5	43.9
46.7	50.0
46.2	52.6

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF POTASSIUM HYDROXIDE AT 20°. (Brönsted, 1920 a).

Gm. mols. per liter KOH.	Gm. mols. per liter KNO_3.	Gm. mols. per liter KOH.	Gm. mols. per liter KNO_3.	Gm. mols. per liter KOH.	Gm. mols. per liter KNO_3.
4.71	0.847	9.41	0.364	14.02	0.241
7.90	0.455	10.95	0.298	14.85	0.232
7.95	0.450	12.19	0.271	15.02	0.233

SOLUBILITY OF POTASSIUM NITRATE AND OF ACID POTASSIUM NITRATES IN NITRIC ACID.

(Groschuff — Ber. 37, 1490, '04.)

NOTE. — Determinations made by the so-called thermometric method, *i.e.*, by observing the temperature of the disappearance of the separated, finely divided solid from solutions of known concentration.

t°.	Grams per 100 Gms. Solution.		Solid Phase.	t°.	Gms. per 100 Gms. Solution.		Solid Phase.
	KNO_3.	HNO_3.			KNO_3.	HNO_3.	
− 6	24.4	75.41	$KNO_3.2HNO_3$ (¹)	22.5	47.2	52.93	$KNO_3.HNO_3$
+14	32.6	67.42	" (stabil)	23.5	47.8	52.11	" (stabil)
17	34.8	65.04	"	25.5	48.6	51.46	"
19.5	37.2	62.90	"	27.0	49.4	50.78	"
22	44.5	55.46	"	29.0	50.1	49.94	$KNO_3.HNO_3$
21.5	47.8	52.11	$KNO_3.2HNO_3$ (²)	30.5	50.9	49.15	" (labil)
21.5	48.6	51.46	" (labil)	21.0	49.4	50.78	KNO_3 (labil)
20	50.9	49.15	"	39.0	50.9	49.15	" (stabil)
− 4	37.2	62.81	$KNO_3.HNO_3$	50	51.7	48.32	
−16.5	44.5	55.46	" (labil)				

(¹) Solution in HNO_3. (²) Solution in KNO_3.

NO

CONDUCT OF ACID POTASSIUM NITRATE TOWARDS WATER.

t°.	Gms. per 100 Gms. Solution.		Solid Phase.	t°.	Gms. per 100 Gms. Solution.		Solid Phase.
	KNO_3.	HNO_3.			KNO_3.	HNO_3.	
22	44.5	55.5	$KNO_3.2HNO_3$	50	38.7	48.3	KNO_3
20.5	44.1	55.0	"	61	36.0	44.8	"
18	43.8	54.5	"	63	34.5	43.0	"
12	43.0	53.6	"	60.5	30.9	39.5	"
6	42.3	52.7	"	56	27.6	34.4	"
0	41.6	51.8	"	43	20.8	25.9	"
12	41.3	51.4	KNO_3	17	11.7	14.6	"
22	40.9	51.0	"	−5	5.54	6.91	"
40	39.9	49.8	"				

SOLUBILITY OF MIXTURES OF POTASSIUM NITRATE AND POTASSIUM CHLORIDE IN WATER.

(Etard — Ann. chim. phys. [7] 3, 283, '94; at 20°, Rüdorff — Ber. 6, 482, '73; Nicol — Phil. Mag. [5] 31, 385, '91.)

t°.	Gms. per 100 Gms. Solution.		t°.	Gms. per 100 Gms. Solution		t°.	Gms. per 100 Gms. Solution.	
	KNO_3.	KCl.		KNO_3.	KCl.		KNO_3.	KCl.
0	5.0	20.0	30	16.0	21.2	70	39.5	17.5
10	8.0	20.8	40	21.0	21.0	80	45.5	15.8
20	12.6	21.2	50	27.0	20.0	100	57.5	11.6
25	14.0	21.3	60	33.5	19.0	120	69.0	7.7

POTASSIUM NITRATE

EQUILIBRIUM IN THE SYSTEM POTASSIUM OXIDE, NITROGEN TRIOXIDE AND WATER AT 25°.

(Nikolajew, 1928.)

Acid Branch

Gms. per 100 gms. sat. sol.		Solid Phase
HNO_3	KNO_3	
0.0	27.87	KNO_3
9.89	19.00	"
16.68	15.27	"
32.29	14.02	"
42.57	17.15	"
49.53	25.37	"

Alkaline Branch

Gms. per 100 gms. sat. sol.		Solid Phase
KOH	KNO_3	
5.11	20.36	KNO_3
12.25	13.31	"
17.38	9.59	"
29.65	4.60	"
39.82	2.49	"
49.79	1.14	"
50.85	1.05	" + KOH
54.18	0.0	KOH

This author also gives results for equilibrium in the system KNO_3 + $NaNO_3$ + HNO_3 + H_2O at 25°.

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF HYDROGEN PEROXIDE AT 25°.

(Akerlof and Turck, 1935.)

Wt. Percent H_2O_2 in Aq. Solvent	Gm. Mols. KNO_3 per 1000 gms. Solvent
0.0	3.774
15.72	4.710
31.43	5.762

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF:

(Touren — Compt. rend. 131, 259, '00.)

Potassium Carbonate.

Results at 14.5°.

Mols. per Liter		Gms. per Liter.	
K_2CO_3	KNO_3.	K_2CO_3.	KNO_3.
0.0	2.228	0.0	225
0.48	1.85	66.4	188
1.25	1.39	172.9	141
2.58	0.86	356.9	87
3.94	0.64	544.9	65

Results at 25°.

Mols. per Liter		Gms. per Liter.	
K_2CO_3	KNO_3.	K_2CO_3.	KNO_3.
0.0	3.217	0.0	326
0.59	2.62	81.6	265
1.35	1.97	186.7	199
2.10	1.46	290.5	148
2.70	1.14	373.6	115
3.58	0.79	495.1	80

Potassium Bi Carbonate.

Results at 14.5°.

Mols. per Liter.		Grams per Liter.	
$KHCO_3$.	KNO_3.	$KHCO_3$.	KNO_3.
0.0	2.33	0.0	236
0.39	2.17	39.0	220
0.76	2.03	76.0	205
1.16	1.92	116	194
1.55	1.81	155	183

Results at 25°.

Mols. per Liter.		Grams per Liter.	
$KHCO_3$.	KNO_3.	$KHCO_3$.	KNO_3.
0.0	3.28	0.0	332
0.89	2.84	89	287
1.33	2.65	133	268
1.91	2.45	191	249

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF POTASSIUM CARBONATE AT 24.2°.

(Kremann and Zitek, 1909.)

Gms. per 1000 Gms. H_2O.		Solid Phase.	Gms. per 1000 Gms. H_2O.		Solid Phase.
KNO_3.	K_2CO_3.		KNO_3.	K_2CO_3.	
376.8	0	KNO_3	73	688.1	KNO_3
285	130.3	"	38.8	878.3	"
161.7	348.4	"	31.1	1112.2	" $+K_2CO_3$
141.8	371.9	"			

1000 gms. H_2O containing 1 mol. KCl (101.11 gms.) dissolve 324.85 gms. KNO_3 at 25°. (Armstrong and Eyre, 1910–11.)

Data for the system potassium nitrate, potassium sulfate, water at 35° are given by Massink (1916, 1917).

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE AND VICE VERSA AT SEVERAL TEMPERATURES.

(Inouye, 1921; Massink, 1918; Hamid, 1926.)

t°.	Gms. per 100 gms. sat. sol.		Solid Phase.	t°.	Gms. per 100 gms. sat. sol.		Solid Phase.
	KNO_3.	K_2SO_4.			KNO_3.	K_2SO_4.	
25...	27.64	0.0 (I)	KNO_3	25...	5.84	8.12 (I)	K_2SO_4
25...	27.33	1.64 (I)	»	25...	4.82	8.85 (H)	»
25...	26.01	1.98 (H)	»	35...	34.76	0.0 (M)	KNO_3
25...	25.91	3.00 (I)	»	35...	32.61	1.17 (M)	»
25...	25.37	3.95 (I)	» $+K_2SO_4$	35...	30.76	3.42 (M)	» $+K_2SO_4$
25...	23.99	4.45 (H)	» »	35...	16.29	6.47 (M)	K_2SO_4
25...	14.52	5.89 (I)	K_2SO_4	35...	0.0	12.17 (M)	»
25...	11.05	6.89 (H)	»	90...	65.92	0.63 (H)	» $+KNO_3$

100 gms. solution simultaneously saturated with potassium nitrate and sodium nitrate contain 45.26 gms. KNO_3 + 37.57 gms. $NaNO_3$ at 90°. (Hamid, 1926.)

Data for the quarternary system $KNO_3 + K_2SO_4 + NaNO_3 + Na_2SO_4 + H_2O$ at 25° and at 90° are given by Hamid, 1926.

SOLUBILITY OF MIXTURES OF POTASSIUM NITRATE AND POTASSIUM SULPHATE IN WATER.

(Euler — Z. physik. Ch. 49, 313, '04.)

t°.	Sp. Gr. of Sat. Solution.	Grams per 100 Grams Water.	
15	1.165	24.12 KNO_3	5.65 K_2SO_4
20	...	30.10 "	5.58 "
25	1.210	36.12 "	5.58 "

POTASSIUM NITRATE

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE AND VICE VERSA.

(Hering, 1936, 1937.)

d. of sat. sol.	Gms. per 100 gms. H_2O		Solid Phase
	KNO_3	K_2SO_4	
Results at -3.32° (Eutec)			
—	10.3	4.7	Ice+KNO_3+K_2SO_4
Results at 0°			
—	13.3	0.0	KNO_3
—	12.4	3.56	"
—	12.2	4.95	" + K_2SO_4
—	11.0	5.05	K_2SO_4
—	6.4	5.74	"
—	0.0	7.33	"
Result at 8.5°			
—	18.1	5.45	KNO_3+K_2SO_4
Result at 17.5°			
1.176	22.7	5.77	KNO_3+K_2SO_4
Result at 20°			
1.187	3.0	5.73	KNO_3+K_2SO_4
Results at 25°			
—	37.3	0.0	KNO_3
1.205	36.4	4.67	"
1.210	35.7	5.86	" + K_2SO_4
1.199	32.4	6.06	K_2SO_4
1.170	25.0	6.78	"
1.144	18.0	7.78	"
1.115	10.3	9.09	"
1.086	—	12.10	"
Result at 30°			
1.234	43.4	5.53	KNO_3+K_2SO_4
Results at 40°			
1.287	61.0	5.00	KNO_3+K_2SO_4
Results at 50°			
1.339	83.3	3.20	KNO_3
1.341	82.5	4.53	" + K_2SO_4.
1.301	68.7	4.54	K_2SO_4
1.203	34.9	7.9	"
1.171	24.9	9.2	"
1.152	18.0	10.6	"
1.104	0.0	16.5	"
Results at 75°			
1.467	150.5	3.33	KNO_3+K_2SO_4
1.433	131.2	3.71	K_2SO_4
1.380	105.5	4.53	"
1.335	86.2	5.18	"
1.268	60.5	7.01	"
1.197	39.1	9.75	"
1.148	17.8	13.8	"
1.116	0.0	20.6	"
Results at 100°			
1.572	242.	2.85	KNO_3+K_2SO_4
1.566	237.3	2.75	K_2SO_4
1.567	237.4	2.80	"
1.497	182.0	3.49	"
1.467	162.3	3.31	"
1.394	120.6	4.85	"
1.353	101.0	5.60	"
1.229	50.4	9.46	"
1.163	25.3	14.0	"
1.119	0.0	24.1	"

NO

POTASSIUM NITRATE

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF POTASSIUM SULPATE AND VICE VERSA.

(Jänecke, 1929.)

The results are expressed in terms of number of gram molecules of H_2O required to dissolve 100 gm. mols. of salt or salt mixture of determined molecular composition.

Mol. % KNO_3 in dissolved salt mixture	Gm. Mols. H_2O to dissolve 100 gms. mols. salt mixture	Solid Phase
Results at 0°		
0	1185	K_2SO_4
20	975	"
40	750	"
60	530	"
64	520	" + KNO_3
80	630	KNO_3
100	760	"
Results at 25°		
0	722	K_2SO_4
20	625	"
40	520	"
60	380	"
Results at 25° (con.)		
80	250	K_2SO_4
85	245	" + KNO_3
100	270	KNO_3
Results at 50°		
0	528	K_2SO_4
20	455	"
40	370	"
60	280	"
80	190	"
95	110	" + KNO_3
100	112	KNO_3

Results are also given for the reciprocal salt pair $KNO_3 + (NH_4)_2SO_4 \rightleftarrows K_2SO_4 + 2NH_4NO_3$.

EQUILIBRIUM IN SYSTEMS COMPOSED OF POTASSIUM AND SODIUM CHLORIDES, NITRATES AND SULFATES.

Complete experimental data, including densities, in the form of tabular results and diagrams for these complex systems at temperatures between 0° and 90° are given by Cornec and Krombach, 1929, and Cornec, Krombach and Spack, 1930. These authors have made use whenever necessary of the results for the ternary systems and quaternary systems previously reported from their own laboratory or by others, including Chretien, 1929; Cornec and Hering, 1925-7; Cornec and Krombach, 1929; Meyerhoffer and Saunders, 1899; D'Ans, 1915 and Blasdale, 1918.

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF MAGNESIUM NITRATE AND VICE VERSA.

(Benrath and Benrath, 1929(a), 1930; Benrath and Sichelschmidt, 1931.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$Mg(NO_3)_2$	KNO_3	
	Results at 0°		
1.079	0.0	11.7	KNO_3
1.091	2.26	11.5	"
1.106	5.45	8.35	"
1.146	11.06	6.48	"
1.174	17.55	4.29	"
1.296	27.29	4.35	"
1.350	33.42	4.40	" + $Mg(NO_3)_2.6H_2O$
1.389	37.6	*3.26	$Mg(NO_3)_2.6H_2O$
1.382	38.45	1.09	"
1.369	38.58	0.0	
	Results at 25°		
1.194	0.0	27.49	KNO_3
1.202	5.98	21.40	"
1.221	10.06	17.84	"
1.265	18.73	12.41	"
1.320	26.09	10.18	"
1.438	37.2	8.63	$MgNO_3.6H_2O$
1.462	39.3	7.67	"
1.431	40.49	3.98	"
1.394	42.0	0.0	"
	Results at 50°		
1.315	0.0	46.10	KNO_3
1.318	4.44	39.37	"
1.316	14.12	28.36	"
1.361	26.18	19.36	"
1.455	35.86	15.45	KNO_3
1.459	37.03	15.40	"
1.505	40.47	15.02	" + $Mg(NO_3)_2.6H_2O$
1.462	42.50	8.32	$Mg(NO_3)_2.6H_2O$
1.416	45.44	0.0	"
	Results at 75°		
1.470	0.0	60.53	KNO_3
1.445	3.78	54.17	"
1.432	13.52	40.68	"
1.426	23.30	30.76	"
1.510	34.07	24.04	"
1.510	40.41	22.30	"
1.645	44.58	22.00	" + $Mg(NO_3)_2.6H_2O$
1.599	45.69	16.96	$Mg(NO_3)_2.6H_2O$.
1.537	48.01	10.15	"
1.461	51.00	0.0	"
	Results at 99.5°		
1.529	0.0	70.8	KNO_3
1.532	12.14	54.52	"
1.555	23.19	42.90	"
1.672	37.93	32.05	"
1.690	38.46	30.93	"

NO

Results are also given for the reciprocal salt pair $(KNO_3)_2$ + $MgSO_4 \rightleftarrows Mg(NO_3)_2 + K_2SO_4$.

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF AMMONIA AT 0°.

(Guyer, Bieler and Schmid, 1934.)

The authors present their results in the form of diagrams but do not give their experimental determinations. The following approximate values have been estimated from the published diagram.

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
NH_3	KNO_3		NH_3	KNO_3	
0.0	12.0	KNO_3	60	8.5	KNO_3
10.0	8.0	"	70	10.5	"
20.0	5.0	"	80	13.0	"
30.0	3.5	"	86	13.5	"
40.0	5.0	"	90	13.0	"
50.0	7.0	"	100	9.5	"

SOLUBILITY OF POTASSIUM NITRATE IN LIQUID AMMONIA.

NO

t°	d. of sat. sol.	Gms. KNO_3 per 100 gms. sat. sol.	Gms. KNO_3 per 100 gms. NH_3	Authority
0.0	—	9.52	10.52	(Linhard and Stephan, 1933, 1934.)
0.1	0.695	9.7	10.74	(Schattenstein and Monossohn, 1932.)
25.0	—	9.42	10.4	(Hunt, 1932.)

THE SYSTEM AMMONIUM NITRATE + POTASSIUM NITRATE + WATER AT 25°.

(Ando, 1925.)

Saturation was obtained by constantant rotation in a thermostat. The salts form two series of solid solutions with a gap.

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
NH_4NO_3.	KNO_3.		NH_4NO_3.	KNO_3.	
67.70	0.0	Solid solutions of NH_4NO_3 saturated with KNO_3	51.56	16.69	$KNO_3 + NH_4NO_3$
65.63	2.71		51.16	16.90	"
61.41	7.26		39.45	19.27	Solid solutions of KNO_3 saturated with NH_4NO_3
59.93	8.62		25.56	21.38	
54.80	13.95		13.48	23.53	

Similar, but apparently les accurate results, determined at the ordinary temperature, are given by Caillart. 1918.

Very complete data for the complex system $KNO_3 + NH_4NO_3 + H_2O$, in which several modifications of the mix crystals (solid solutions) of the two salts are formed, are given by Jänecke, 1928, and very much more complete results by Jänecke, Hamacher and Rahlfs, 1932. These authors made more than 300 solubility determinations, including analyses of both the saturated solutions and solid phases. The results are presented in the form of tables of experimental determinations and diagrams which show the limits of composition and fields of existance of each of the several modifications of the mix crystals as well as the corresponding compositions of the saturated solutions at temperatures between -15° and +150°.

Data for the mix crystals, solutions and melts in the System (K,NH_4), $Cl,NO_3)$ are given by Jänecke, 1928.)

SOLUBILITY OF AMMONIUM AND POTASSIUM NITRATES AND SULFATES IN WATER AT 25°. (Osaka and Inouye, 1925.)

Mixtures of the salts in roughly calculated proportions were rotated in a thermostat for several days, and both the saturated solutions and the solid phases were analyzed. There are five series of solid solutions present as solid phases. These are

1. $(NH_4, K)_2SO_4$; 2. $(NH_4, K)_2(NO_3)_2\alpha$; 3. $(NH_4, K)_2(NO_3)_2\beta$;
4. $(NH_4, K)_2 0.5SO_4 0.5(NO_3)_2$; 5. $(NH_4, K)_2 0.4SO_4 0.6(NO_3)_2$.

Complete tables showing the composition of the liquid and solid phases for each of the five series of solid solutions are given. The results are presented in gram percentages, and in molal proportion according to the formula

$$100m\,H_2O.xK_2.(100-x)(NH_4)_2 ySO_4.(100-y)(NO_3)_2.$$

SOLUBILITY OF MIXTURES OF POTASSIUM NITRATE AND SODIUM CHLORIDE IN WATER.

(Etard — Ann. chim. phys. [7] 3, 283, '94; the older determinations of Rüdorff, Karsten, Mulder, etc., agree well with those of Etard.)

t°.	Gms. per 100 Gms. Solution.		t°.	Gms. per 100 Gms. Solution.		t°.	Gms. per 100 Gms. Solution.	
	KNO_3.	NaCl.		KNO_3.	NaCl.		KNO_3.	NaCl.
0	13	24	40	30.5	19	120	73	8.0
10	16	23	50	36	17	140	77	7.0
20	20	22	60	42.5	15	160	79.5	6.0
25	23	21.5	80	55	12	170	80.5	5.5
30	25	20.5	100	67	9.5			

NO

100 gms. H_2O, simultaneously sat. with potassium nitrate and sodium chloride, contain 41.14 gms. KNO_3 + 38.53 gms. NaCl at 25° and 168.8 gms. KNO_3 + 39.81 gms. NaCl at 80°. (Soch, 1898.)

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AND VICE VERSA. (Leather and Mukerji, 1913.)

Results at 20°.				Results at 30°.			
Sp. Gr. Sat. Sol.	Gms. per 100 Gms. H_2O.		Solid Phase.	Sp. Gr. Sat. Sol.	Gms. per 100 Gms. H_2O.		Solid Phase.
	KNO_3.	NaCl.			KNO_3.	NaCl.	
1.167	31.49	0	KNO_3	1.261	46.48	9.82	KNO_3
1.220	33.41	9.94	"	1.302	47.08	20.18	"
1.267	34.93	19.44	"	1.343	47.24	29.86	"
1.311	36.41	29.46	"	1.372	49.24	38.72	" +NaCl
1.344	37.30	37.73	" +NaCl	1.342	38.36	38.55	NaCl
1.330	31.41	37.57	NaCl	1.298	25.32	38.23	"
1.283	19.56	37.51	"	1.258	12.15	37.38	"
1.243	9.76	36.73	"	1.202	...	36.30	"
Results at 40°.				Results at 91°.			
1.288	64.74	0	KNO_3	1.552	202.8	0	KNO_3
1.320	64.66	11.32	"	1.573	204.2	12.81	"
...	64.05	23.41	"	1.601	208.1	28.45	"
1.396	64.13	35.08	"	1.645	213.3	37.92	"
1.411	64.77	38.79	" +NaCl	1.660	218.8	39.08	" +NaCl
1.376	52.81	39.51	NaCl	1.607	175.8	40.87	NaCl
1.323	34.98	38.98	"	1.517	126.9	44.33	"
1.267	17.33	37.74	"	1.378	57.53	42.90	"

At the higher temperatures, results for $NaNO_3$ in certain solutions are reported.

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF SODIUM NITRATE AND VICE VERSA. (Leather and Mukerji, 1913.)

Results at 30°.			Results at 40°.			Results at 91°.			
Sp. Gr. Sat. Sol.	Gms per 100 Gms. H_2O.		Sp. Gr. Sat. Sol.	Gms. per 100 Gms. H_2O.		Sp. Gr. Sat. Sol.	Gms. per 100 Gms. H_2O.		Solid Phase in Each Case.
	KNO_3.	$NaNO_3$.		KNO_3.	$NaNO_3$.		KNO_3.	$NaNO_3$.	
1.317	45.73	25.90	1.358	63.21	23.85	1.615	200.8	43.4	KNO_3
1.403	47.25	52.53	1.428	63.86	49.79	1.674	207.2	92.90	"
1.472	50.93	79.27	1.505	66.44	79.46	1.751	229.5	156.2	"
1.544	54.34	103.3	1.570	74.06	116.2	1.790	251.8	206.5	" $+NaNO_3$
1.520	47.67	103.1	1.573	68.72	116.7	1.774	211.7	200	$NaNO_3$
1.481	30.25	101.6	1.526	43.92	112.2	1.695	128.5	186	"
1.451	14.30	99.10	1.476	20.33	109.9	1.610	55.75	173.1	"
1.406	0	95.90	1.421	0	105.2	1.521	0	160.8	"

Results at 20° are also given.

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF SODIUM NITRATE AND VICE VERSA AT 20°.

(Carnelly and Thomson — J. Ch. Soc. 53, 782, '88; Nicol — Phil. Mag. 31, 369, '91.)

KNO_3 in Aq. $NaNO_3$ Solutions.		$NaNO_3$ in Aq. KNO_3 Solutions.	
Grams per 100 Grams H_2O.		Grams per 100 Grams H_2O.	
$NaNO_3$.	KNO_3	KNO_3.	$NaNO_3$.
0	31.6	0	88
10	30.5	10	90
20	31.0	20	92
40	33.0	25	93
60	35.5	30	94
80	41.0	35	96

NO

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF SODIUM NITRATE AND VICE VERSA AT 10° AND AT 24.2°.

(Kremann and Zitek, 1909.)

t°.	Gms. per 1000 Gms. H_2O.		Solid Phase.	t°.	Gms. per 1000 Gms. H_2O.		Solid Phase.
	KNO_3.	$NaNO_3$.			KNO_3.	$NaNO_3$.	
10	208.9	0	KNO_3	24.2	422	931.3	KNO_3
10	301.9	848.3	" $+NaNO_3$	24.2	437	1019	" $+NaNO_3$
10	0	805	$NaNO_3$	24.2	123.6	910.6	$NaNO_3$
24.2	377.3	0	KNO_3	24.2	0	913	"
24.2	390	346.7	"				

SOLUBILITY OF MIXTURES OF POTASSIUM NITRATE, SODIUM CHLORIDE AND SODIUM NITRATE IN WATER.

(Cornec and Krombach, 1929.)

t^o	d. of sat. sol.	Gms. per 100 gms. H_2O			Solid Phase
		KNO_3	NaCl	$NaNO_3$	
0	1.384	16.4	28.4	39.6	KNO_3 + NaCl + $NaNO_3$
5	—	19.7	27.4	44.4	" " "
20	—	34.0	24.3	58.6	" " "
25	1.475	40.3	23.5	64.3	" " "
40	—	66.7	20.8	82.7	" " "
50	1.585	90.3	19.3	96.9	" " "
60	—	119.7	18.3	114.1	" " "
75	1.695	176.0	17.5	145.0	" " "
80	—	200.5	17.6	158.1	" " "
87.5	1.750	241.5	18.0	179.5	" " "
100	1.700	337.6	19.6	232.6	" " "

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF SODIUM NITRATE AND VICE VERSA.

(Cornec and Krombach, 1929.)

Results at 0°

d. of sat. sol.	Gms. per 100 gms. sat. sol. $NaNO_3$	Gms. per 100 gms. sat. sol. KNO_3	Solid Phase
—	0.0	11.7	KNO_3
1.422	39.0	10.4	" + $NaNO_3$
1.352	42.3	0.0	$NaNO_3$

Results at 25°

d. of sat. sol.	Gms. per 100 gms. sat. sol. $NaNO_3$	Gms. per 100 gms. sat. sol. KNO_3	Solid Phase
1.189	0.0	27.7	KNO_3
1.512	40.3	19.1	" + $NaNO_3$
1.391	47.9	0.0	$NaNO_3$

Results at 50°

d. of sat. sol.	Gms. per 100 gms. sat. sol. $NaNO_3$	Gms. per 100 gms. sat. sol. KNO_3	Solid Phase
1.332	0.0	46.2	KNO_3
1.434	19.1	35.9	"
1.529	31.7	31.3	"
1.602	39.8	28.9	" + $NaNO_3$
1.557	43.3	21.6	$NaNO_3$
1.502	47.6	12.3	"
1.427	53.2	0.0	"

Results at 62.5°

d. of sat. sol.	Gms. per 100 gms. sat. sol. $NaNO_3$	Gms. per 100 gms. sat. sol. KNO_3	Solid Phase
—	0.0	53.8	KNO_3
1.648	38.7	34.3	" + $NaNO_3$
—	56.4	0.0	$NaNO_3$

Results at 75°

d. of sat. sol.	Gms. per 100 gms. sat. sol. $NaNO_3$	Gms. per 100 gms. sat. sol. KNO_3	Solid Phase
1.462	0.0	60.4	KNO_3
1.545	18.7	47.7	"
1.635	31.3	41.5	"
1.700	38.3	39.1	" + $NaNO_3$
1.644	42.4	30.9	$NaNO_3$
1.568	49.0	18.0	"
1.469	58.7	0.0	"

Results at 87.5°

d. of sat. sol.	Gms. per 100 gms. sat. sol. $NaNO_3$	Gms. per 100 gms. sat. sol. KNO_3	Solid Phase
—	0.0	66.2	KNO_3
1.746	37.3	43.9	" + $NaNO_3$
—	61.2	0.0	$NaNO_3$

Results at 100°

d. of sat. sol.	Gms. per 100 gms. sat. sol. $NaNO_3$	Gms. per 100 gms. sat. sol. KNO_3	Solid Phase
1.569	0.0	70.9	KNO_3
1.658	18.7	57.7	"
1.744	29.7	51.4	"
1.793	36.7	48.1	" + $NaNO_3$
1.744	41.1	40.0	$NaNO_3$
1.647	49.5	25.3	"
1.507	63.7	0.0	"

NO

These authors also give results showing the effect of increasing amounts of sodium chloride upon the solubility of mixtures of potassium nitrate and sodium nitrate. They also give results for the quaternary systems composed of the chlorides, nitrates and sulfates of potassium and sodium at various temperatures.

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF SODIUM NITRATE AND VICE VERSA.

(Saslawsky and Ettinger, 1935, 1937.)

1. Results at 0°

d. of sat. sol.	Gms. per 100 gms. sat. sol. $NaNO_3$	Gms. per 100 gms. sat. sol. KNO_3	Solid Phase
1.085	0.0	12.13	KNO_3
1.424	39.22	10.53	" + $NaNO_3$
1.348	42.77	0.0	$NaNO_3$

Results at 20°

d. of sat. sol.	Gms. per 100 gms. sat. sol. $NaNO_3$	Gms. per 100 gms. sat. sol. KNO_3	Solid Phase
1.162	0.0	24.13	KNO_3
1.494	42.03	17.13	" + $NaNO_3$
—	40.38	16.41	" "
1.406	46.27	0.0	$NaNO_3$

Results at 40°

d. of sat. sol.	Gms. per 100 gms. sat. sol. $NaNO_3$	Gms. per 100 gms. sat. sol. KNO_3	Solid Phase
1.250	0.0	39.00	KNO_3
—	39.70	24.60	" + $NaNO_3$
1.441	51.20	0.0	$NaNO_3$

Results at 60°

d. of sat. sol.	Gms. per 100 gms. sat. sol. $NaNO_3$	Gms. per 100 gms. sat. sol. KNO_3	Solid Phase
1.343	0.0	52.0	KNO_3
—	38.13	33.05	" + $NaNO_3$
1.467	55.50	0.0	$NaNO_3$

Results are also given for the quarternary mixtures in the system composed of KNO_3 + $NaNO_3$ + $Al(NO_3)_2$ + H_2O at temperatures between 0° and 60°.

SOLUBILITY OF MIXTURES OF POTASSIUM AND SODIUM NITRATES IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 25°.

(Nikolajew, 1929.)

Gms. per 100 gms. sat. sol.			Solid Phase	Gms. per 100 gms. sat. sol.			Solid Phase
HNO_3	KNO_3	$NaNO_3$		HNO_3	KNO_3	$NaNO_3$	
0	19.7	40.25	$KNO_3 + NaNO_3$	38.98	16.74	7.15	$KNO_3 \cdot 2HNO_3 + NaNO_3$
5.20	17.68	35.26	" "	42.61	11.68	5.75	" "
10.66	16.04	30.01	" "	54.04	6.52	4.10	" "
16.17	15.74	23.64	" "	58.62	3.48	3.82	" "
21.18	16.06	19.24	" "	62.59	1.02	3.32	" "
32.65	16.70	11.20	" "				

SOLUBILITY OF MIXTURES OF POTASSIUM AND SODIUM NITRATES IN AQUEOUS SOLUTIONS OF POTASSIUM HYDROXIDE AND OF SODIUM HYDROXIDE AT 25°.

(Nikolajew, 1929.)

NO

Results for Aq. KOH

Gms. per 100 gms. sat. sol.			Solid Phase
KOH	KNO_3	$NaNO_3$	
0.0	19.17	40.25	$KNO_3 + NaNO_3$
1.19	15.65	41.57	" "
2.84	10.48	43.00	" "
4.58	6.86	43.22	" "
7.35	3.12	42.48	" "
10.54	0.0	40.40	" "

Results for Aq. NaOH

Gms. per 100 gms. sat. sol.			Solid Phase
NaOH	KNO_3	$NaNO_3$	
1.17	16.60	38.70	$KNO_3 + NaNO_3$
4.33	13.84	35.75	" "
7.04	11.46	32.68	" "
8.20	10.56	31.63	" "
14.75	6.47	23.67	" "
28.53	3.34	10.29	" "
31.87	3.29	7.64	" "
40.43	5.20	3.14	" "

EQUILIBRIUM IN THE SYSTEM LEAD NITRATE, POTASSIUM NITRATE AND WATER.

(Glasstone and Saunders. 1923.)

Results at 25°. Gms. per 100 gms. sat. sol.		Results at 50°. Gms. per 100 gms sat. sol		Results at 100°. Gms. per 100 gms. sat. sol		Solid Phase at each temp.
KNO_3.	$Pb(NO_3)_2$.	KNO_3	$Pb(NO_3)_2$.	KNO_3.	$Pb(NO_3)_2$	
0.0	37.17	0.0	44.79	0.0	55.65	$Pb(NO_3)_2$
2.75	37.37	5.90	44.44	3.79	53.44	»
4.90	37.95	11.26	44.75	15.98	49.93	»
8.42	39.27	16.16	44.61	36.90	44.5	»
14.73	40.86	19.38	44.38	–	–	»
–	–	27.47	43.45	–	–	»
–	–	30.98	43.05	–	–	»
24.67	41.93	33.14	42.14		–	» · KNO_3
24.92	40.99	36.33	32.32	51.24	27.04	KNO_3
25.93	28.05	37.69	26.47	71.00	0.0	»
26.93	9.24	41.72	12.03	–	–	»
27.03	15.14	45.51	0.00	–	–	»
27.39	0.0	–	–	–	–	»

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF LEAD NITRATE AND VICE VERSA AT 0°.

(Ehret, 1932.)

Gms. per 100 gms. sat. sol. KNO_3	Gms. per 100 gms. sat. sol. $Pb(NO_3)_2$	Solid Phase	Gms. per 100 gms. sat. sol. KNO_3	Gms. per 100 gms. sat. sol. $Pb(NO_3)_2$	Solid Phase
12.24	0.0	KNO_3	14.30	37.37	$Pb(NO_3)_2$
13.67	22.95	"	8.95	32.94	"
14.33	26.05	"	4.15	29.63	"
14.89	36.27	"	0.0	26.66	"
14.86	37.14	" + $Pb(NO_3)_2$			

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF STRONTIUM NITRATE AND VICE VERSA AT 20° AND AT 40°.

(Findlay, Morgan and Morris, 1914.)

t°.	Gms. per 100 Gms. Sat. Sol. KNO_3.	Gms. per 100 Gms. Sat. Sol. $Sr(NO_3)_2$.	Solid Phase.	t°.	Gms. per 100 Gms. Sat. Sol. KNO_3.	Gms. per 100 Gms. Sat. Sol. $Sr(NO_3)_2$.	Solid Phase.
20	22.90	5.49	KNO_3	20	12.65	41.12	$Sr(NO_3)_2.4H_2O$
20	21.70	9.17	"	20	10	40.70	"
20	21.01	17.10	"	40	30.26	23.70	KNO_3
20	19.60	31.24	"	40	26.90	38.52	" $+Sr(NO_3)_2.4H_2O$
20	19.49	34.91	"	40	22.50	40.22	$Sr(NO_3)_2.4H_2O$
20	19.69	39.56	" $+Sr(NO_3)_2.4H_2O$	40	11.19	44.19	"
20	17.56	40.37	$Sr(NO_3)_2.4H_2O$	40	0	47.7	"

1000 gms. H_2O, simultaneoſsly saturated with both salts, contain 552 gms. KNO_3 + 1074 gms. $Sr(NO_3)_2$ at 25°. (LeBlanc and Noyes, 1890.) NO

SOLUBILITY OF MIXED CRYSTALS OF POTASSIUM NITRATE AND THALLIUM NITRATE IN WATER AT 25°.

(Fock.)

Grams per Liter. $TlNO_3$.	Grams per Liter. KNO_3.	Mg. Mols. per Liter. $TlNO_3$.	Mg. Mols. per Liter. KNO_3.	Mol. per cent $TlNO_3$ in Solution.	Sp. Gr. of Solutions.	Mol. per cent $TlNO_3$ in Solid Phase.
0.00	351.0	0.0	3468.2	0.00	1.2632	0.00
2.37	329.0	8.9	3251.5	0.43	1.1903	0.08
6.15	332.4	23.1	3285.1	0.70	1.1956	0.20
17.64	333.7	66.3	3298.1	1.97	1.2050	0.57
49.74	333.3	186.9	3294.4	5.37	1.2196	1.78
63.60	321.0	239.0	3172.4	7.01	1.2436	2.19
86.18	330.5	323.8	3265.8	9.02	1.2617	2.77
123.8	428.3	465.2	4232.6	9.90	1.2950	6.00 27.04
101.3	245.1	380.6	2423.3	13.58	1.2050	93.33
116.1	0.0	463.1	0.0	100.00	1.0964	100.00

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF URANYL NITRATE AND VICE VERSA AT 25°.

(Colani, 1928.)

Gms. per 100 gms. sat. solution $UO_2(NO_3)_2$	Gms. per 100 gms. sat. solution KNO_3	Solid Phase	Gms. per 100 gms. sat. solution $UO_2(NO_3)_2$	Gms. per 100 gms. sat. solution KNO_3	Solid Phase
0.0	27.44	KNO_3	48.65	10.36	KNO_3
3.16	23.15	"	53.88	10.40	$UO_2(NO_3)_2.6H_2O$
6.46	21.23	"	53.90	9.51	"
9.71	19.94	"	54.21	5.30	"
25.80	12.74	"	54.68	3.36	"
40.60	11.11	"	56.08	0.0	

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF METHYL ALCOHOL AT 25°.

(Akerlof and Turck, 1935.)

Wt. % CH_3OH in Aq. Solvent	Gm. Mols. KNO_3 per 1000 gms. Solvent	Wt. % CH_3OH in Aq. Solvent	Gm. Mols. KNO_3 per 1000 gms. Solvent
0.00	3.774	59.94	0.3125
4.98	3.046	70.05	0.1898
9.45	2.503	78.46	0.1123
21.04	1.522	89.45	0.0607
40.30	0.7130		

100 gms. Aq. 50 wt. % Ethyl Alcohol (C_2H_5OH) dissolve 3.7 gms. KNO_3 at 20°. (Wright, 1926.)

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS ALCOHOL SOLUTIONS

(Gerardin — Ann. chim. phys. [4] 5. 151, '65.)

t °.	Grams KNO_3 per 100 Grams Aqueous Alcohol of Sp. Gr.:							
	0.9904 = 5.5 Wt. %.	0.9843 = 9.35 Wt. %.	0.9793 = 13.5 Wt. %.	0.9726 = 19.1 Wt. %.	.09571 = 30 Wt. %.	0.939 = 40 Wt. %.	0.8967 = 60 Wt. %.	0.8429 = 90 Wt. %.
10	17	13	10	7	4.5	3	1	0.2
18	22.5	18.5	14.5	10	6.2	4.5	1.6	0.3
20	24	20	16	11	7.0	5	2	0.3
25	29	24.5	20	13.5	9.0	6.5	2.5	0.4
30	36	30	25	17	11.5	8	3.0	0.5
40	52	43	36	27	16.5	11	4	0.6
50	72	61	50	38	23.0	16	6	0.7
60	93	79	69	52	31.0	21	8	1.1

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS ALCOHOL AT 18°

(Bodländer — Z. physik. Ch. 7, 316, '91.)

Sp. Gr. of Solution.	Gms. per 100 cc. Solution.			Sp. Gr. of Solution.	Gms. per 100 cc. Solution.		
	C_2H_5OH.	H_2O.	KNO_3.		C_2H_5OH.	H_2O.	KNO_3.
1.1480	...	89.80	25.0	1.0120	23.33	69.81	8.06
1.1085	3.30	87.44	20.11	0.9935	28.11	64.74	6.50
1.1010	5.24	86.26	18.60	0.9585	37.53	54.21	4.11
1.0805	8.69	83.18	16.18	0.9450	42.98	48.15	3.37
1.0755	9.06	83.10	15.39	0.9050	51.23	27.32	1.95
1.0655	14.08	77.93	14.54	0.8722	61.65	24.74	0.83
1.0490	16.27	76.36	12.27	0.8375	69.60	13.95	0.20
1.0375	19.97	72.93	10.8				

SOLUBILITY OF POTASSIUM NITRATE IN DILUTE ETHYL ALCOHOL AT 25°.

(Armstrong and Eyre, 1910–11.)

Wt. % C_2H_5OH in Solvent.	Gms. KNO_3 per 100 Gms. Sat. Solution.
0	27.77
1.14	26.69
2.25	25.79
4.41	23.81

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS ALCOHOL AND IN AQUEOUS ACETONE.

(Batnrick, 1896.)

In Aqueous Alcohol.			In Aqueous Acetone at 40°.	
Wt. Per cent Alcohol.	Gms. KNO_3 per 100 Gms. Aq. Alcohol.		Wt. Per cent Acetone.	Gms. KNO_3 per 100 Gms. Solvent.
	At 30°.	At 40°.		
0	45.6	64.5	0	64.5
8.25	32.3	47.1	8.5	51.3
17	22.4	33.3	16.8	38.9
25.7	15.1	24.1	25.2	22.8
35	11.4 (34.4°)	16.7	34.3	24.7
44.9	7	11.6 (44°)	44.1	17
54.3	4.5	7.2 (55°)	53.9	11.9
65	2.7	4.4	64.8	7.2
75.6	1.3	2 (76.3°)	76	3
88	0.4	0.6 (88.5°)	87.6	0.7

100 gms. H_2O saturated with sugar and KNO_3 dissolve 224.7 gms. sugar + 41.9 gms. KNO_3, or 100 gms. of the saturated solution contain 61.36 gms. sugar + 11.45 gms. KNO_3 at 31.25°. (Köhler, 1897.)

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF METHYL ALCOHOL, ETHYL ALCOHOL AND MIXTURES OF THE TWO AT 30°.

(Schreinemakers, 1908–09.)

In Aq. CH_3OH.		In Aq. C_2H_5OH.		In Aq. $(CH_3OH + C_2H_5OH)$.*	
Gms. per 100 Gms. Sat. Sol.		Gms. per 100 Gms. Sat. Sol.		Gms. per 100 Gms. Sat. Sol.	
CH_3OH.	KNO_3.	C_2H_5OH.	KNO_3.	$(CH_3OH+C_2H_5OH)$	KNO_3.
0	31.3	10.1	20.7	0	31.3
7.8	23.3	23.8	12.1	12.7	18.9
17.3	16.3	32.2	9	29.2	12.8
27.8	11.2	43.1	6.1	41	6.7
38.4	7.7	56.9	3.3	47.8	5.1
57	3.8	76.8	0.88	56.4	3.5
98.58	0.43	92.3	0.15	74.8	1.2

* The mixture contained 51.7% CH_3OH and 48.3% C_2H_5OH.

100 gms. trichlorethylene dissolve 0.01 gm. KNO_3 at 15°. (Wester and Bruins, 1914.)

100 cc. anhydrous hydrazine dissolve 14 gms. KNO_3 at room temp. (Welsh and Broderson, 1915.)

100 gms. aq. 40 weight % C_2H_5OH, simultaneously saturated with the two salts, dissolve 13.74 gms. KNO_3 + 15.78 gms. NaCl at 25°. (Soch, 1898.)

SOLUBILITY OF POTASSIUM NITRATE IN GLACIAL ACETIC ACID SOLUTIONS OF AMMONIUM CHLORIDE AND OF AMMONIUM NITRATE AT 25°.

(Seward and Humblet, 1939.)

Results for $CH_3COOH + NH_4Cl$

Gms. per liter		Solid Phase
NH_4Cl	KNO_3	
0.097	2.122	KNO_3
0.195	2.218	"
0.405	2.464	"
0.653	2.829	"

Results for $CH_3COOH + NH_4NO_3$

Gms. per liter		Solid Phase
NH_4NO_3	KNO_3	
0.00	1.848	KNO_3
0.592	1.919	"
2.035	1.982	"

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF URETHAN AT 25°.

(Palitsch, 1928, 1929.)

Gm. Mols. per 1000 gms. H_2O		Solid Phase	Gm. Mols. per 1000 gms. H_2O		Solid Phase
KNO_3	$NH_2COOC_2H_5$		KNO_3	$NH_2COOC_2H_5$	
3.772	0.0	KNO_3	1.911	13.35	KNO_3
3.372	1.1225	"	1.592	27.76	"

RECIPROCAL SOLUBILITY OF POTASSIUM NITRATE AND UREA DETERMINED BY THE FREEZING-POINT METHOD.

(Howells, 1931.)

t°	Gms. KNO_3 per 100 gms. Mixture	Solid Phase	t°	Gms. KNO_3 per 100 gms. Mixture	Solid Phase
151.6	36.90	KNO_3	110.1	24.6	KNO_3
136.1	32.64	"	109.5 Eutec.	24.59	" + NH_2CONH_2
129.8	31.09	"	110.9	21.79	NH_2CONH_2
129.0 tr.pt.	—		115.6	14.75	"
124.9	29.61	"	121.2	8.93	"
120.1	27.79	"	128.9	2.52	"
			132.2 m. pt.	0.0	"

tr. pt. is the point of transition of rhombohedral KNO_3 into rhombic KNO_3

Fusion-point data have been determined for the following mixtures:

KNO_3 + $LiNO_3$	(Corveth, 1898; Harkins and Clark, 1915.)
" + KOH	(Retortille & Moles, 1933.)
" + NH_4NO_3	(Perman and Saunders, 1923; Jänecke, 1928.)
" + " + $Pb(NO_3)_2$	(Glass, Laybourn and Madgin, 1932, 1933.)
" + $NaNO_3$	(Kagan and Kamyschan, 1932.)
" + $NaNO_3$	(Carvetti, 1898; Hissink, 1900; Quartaralli, 1920; Briscoe and Madgin, 1923; Glass, Labourn and Madgin, 1932, 1933.)
" + " + $PbNO_3$	(Laybourn and Madgin, 1932.)
" + " + $Sr(NO_3)_2$	(Harkins and Clark, 1915.)
" + $Pb(NO_3)_2$ + Pb_3O_4	(Freeman, Laybourn and Madgin, 1933.)
" + $RbNO_3$	(Puschin and Radoicic, 1937.)
" + $Sr(NO_3)_2$	(Hawkins and Clark, 1915.)
" + TlBr	(Rostkowski, 1929.)
" + $TlNO_3$	(Van Eyk, 1899, 1905.)

POTASSIUM OXIDE K_2O

The fusion-points of mixtures of K_2O + V_2O_5 are given by Canneri, 1928.

POTASSIUM HYDROXIDE KOH.

SOLUBILITY IN WATER.

(Pickering, 1893; at 15°, Ferchland, 1902.)

t°.	Gms. KOH per 100 Gms.		Solid Phase.	t°.	Gms. KOH per 100 Gms.		Solid Phase.
	Water.	Solution.			Water.	Solution.	
− 2.2	3.7	3.6	Ice	15	107	51.7	$KOH.2H_2O$
−20.7	22.5	18.4	"	20	112	52.8	"
−65.2	44.5	30.8	"	30	126	55.76	"
−36.2	36.2	26.6	$KOH.4H_2O$	32.5	135	57.44	$KOH.2H_2O+$
−32.7	77.94	43.8	"	50	140	58.33	$KOH.H_2O$
−33	80	44.4	$KOH.4H_2O+KOH.2H_2O$	100	178	64.03	$KOH.H_2O$
−23.2	85	45.9	$KOH.2H_2O$	125	213	68.06	"
0	97	49.2	"	143	311.7	75.73	"
10	103	50.7	"				

Sp. Gr. of sat. solution at 15° = 1.5355.

100 gms. sat. solution in H_2O contain 50.48 gms. KOH at 15°.
(de Forcrand, 1909.)

100 gms. sat. solution in H_2O contain 53.1 gms. KOH at 15°.
(Greenish and Smith, 1901.)

1000 gms. H_2O dissolve 21.2 gm. mols. KOH at 25°.
(Akerlof and Short, 1937.)

SOLUBILITY OF POTASSIUM HYDROXIDE IN WATER.

(Holzl, 1937.)

t°	Gms. KOH per 100 gms. sat. sol.	Solid Phase	t°	Gms. KOH per 100 gms. sat. sol.	Solid Phase
0	48.85	$KOH.2H_2O$	40	58.03	$KOH.H_2O$
11.5	51.07	"	65.3	60.36	"
25	54.23	"	80	61.73	"
33	57.53	" + $KOH.H_2O$	100	65.15	"

The original results are given in terms of K_2O

FREEZING-POINTS OF AQUEOUS SOLUTIONS OF POTASSIUM HYDROXIDE.

(Klein and Svanberg, 1920.)

....	−0.343.	−0.875.	−1.773
Gms. KOH per 100 cc. sol......	0.5611	1.403	2.805

SOLUBILITY AND TRANSITION-POINTS OF POTASSIUM HYDROXIDE IN WATER.

(Shibata, Oda and Furukawa, 1932.)

t°		Gms. KOH per 100 gms. sat. sol.	Solid Phase
25		53.1	$KOH.2H_2O$
27.27	tr. pt.	—	$KOH.2H_2O + KOH.1\frac{1}{2}H_2O$
33.43	"	—	$KOH.1\frac{1}{2}H_2O + KOH.H_2O$
37.33	" (unstable)	—	$KOH.2H_2O + KOH.H_2O$

Data for the system $KOH + NH_3 + H_2O$ are given by Jänecke, 1933(a). Weighed amounts of the three components were placed in small glass ampules which were then sealed. By warming or cooling these ampules, the upper and lower temperatures were determined at which a solid phase, two liquid layers or a combination of solid and liquid layers appeared or disappeared. The temperatures at which certain of the ampules exploded are also given.

SOLUBILITY OF POTASSIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 30°. (deWaal, 1910.)

Gms. per 100 Gms. Sat. Sol.			Solid Phase.	Gms. per 100 Gms. Sat. Sol.			Solid Phase.
KOH.	C_2H_5OH.	H_2O.		KOH.	C_2H_5OH.	H_2O.	
55.75	0	44.25	$KOH.2H_2O$	27.67	69.92	2.41	$KOH.2H_2O$
54.81	0.43	44.76	"	27.20	73.01	negative*	"
Two liquid layers are formed here.				26.25	81.95	"	"
31	57.50	11.50	$KOH.2H_2O$				
28.99	65.07	5.94	"				

* Negative on account of reaction $KOH + C_2H_5OH \rightarrow C_2H_5OK + H_2O$.

SOLUBILITY OF POTASSIUM HYDROXIDE IN METHYL ALCOHOL AND IN ETHYL ALCOHOL.

(Murray, 1929.)

The mixtures were shaken occasionally during about three weeks.

t°	Solvent	Formula	d. of sat. sol.	Gms. KOH per 100: cc sat. sol.	Gms. KOH per 100: gms. sat. sol.	Normality of sat. sol.
28	Methyl Alcohol	CH_3OH	1.14	40.3	35.5	7.19
28	Ethyl Alcohol	C_2H_5OH	1.04	29.0	27.9	5.17

SOLUBILITY OF POTASSIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF ACETONE AT 0°.

(Gibby, 1934.)

OH

The binodal curve was determined by titrating acetone into aqueous KOH solutions until a permanent separation into two layers occurred. Tie lines, •, were located by means of mixtures which yielded sufficient amounts of the two layers to be used for titrating the KOH in each.

Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.	
KOH	C_3H_6O	KOH	C_3H_6O	KOH	C_3H_6O	KOH	C_3H_6O
0.4	80.1	2.2	55.1	15.1	11.1	25.0	—
0.6	70.1	3.0	50.4	16.2	9.8	27.2	2.0
0.7	70.5	4.4	41.7	17.9	7.8	28.4	1.3
1.7	58.6	4.8	41.1	20.7	5.5	28.8	— •
2.0	52.7	8.2	26.6	21.3	5.2	37.9	— •
				24.1	— •	43.8	0.4

Data for equilibrium in the system potassium hydroxide, phenol, water at 25° are given by van Meurs (1916).

Freezing-point data for KOH + RbOH and KOH + NaOH are given by von Hevesy (1900). Results for KOH + KI are given by Scarpa (1915).

POTASSIUM Dihydrogen PHOSPHATE KH_2PO_4

SOLUBILITY OF POTASSIUM DIHYDROGEN PHOSPHATE IN WATER.

(Kazancev, 1939.)

t°	Gms. KH_2PO_4 per 100 gms. sat. sol.	t°	Gms. KH_2PO_4 per 100 gms. sat. sol.	t°	Gms. KH_2PO_4 per 100 gms. sat. sol.
	12.88 (12.48)	25	20.04 (20.07)	50	29.00
5	14.00	30	21.90	60	33.40
10	15.50	35	23.65	70	37.05
15	16.87 (16.78)	40	25.10	80	41.30
20	18.45	45	26.90	90	45.50

The results in parenthesis are by Menzel and Gäbler, 1929. The earlier results of Muthman and Kunze, 1894; Apfel, 1911; Jänecke, 1927, and Askenasy and Nessler, 1930 are not in good agreement with the above, especially at the lower temperatures.

SOLUBILITY OF MONO POTASSIUM PHOSPHATE IN WATER. (Apfel, 1911.)

t°.	Mols. KH_2PO_4 per 1000 gms. sat. sol.	Gms. KH_2PO_4 per 100 gms. sat. sol.	t°.	Mols. KH_2PO_4 per 1000 gms. sat. sol.	Gms. KH_2PO_4 per 100 gms. sat. sol.
0	0.77	10.48	50	2.15	29.27
7	1.465	19.95	70	2.693	36.67
25	1.48	20.15	83	3.08	41.94

SOLUBILITY OF MONO POTASSIUM PHOSPHATE IN AQUEOUS SOLUTIONS OF SALTS AT 25°. (Apfel, 1911.)

Salt.	Gms. salt per 100 gms. sat. sol.	Gms. KH_2PO_4 per 100 gms. sat. sol.	Salt.	Gms. salt per 100 gms. sat. sol.	Gms. KH_2PO_4 per 100 gms. sat. sol.
None	0.0	20.15	KNO_3	5.56	16.33
K_2SO_4	1.39	19.46	»	12.03	14.03
»	3.13	18.24	CH_3COOK	4.91	17.43
»	6.27	17.70	»	9.62	14.43
»	6.79	17.02	K_2CO_3	1.66 (3.22?)	23.01
»	6.27	16.74	»	5.74 (11.85?)	31.85

In the case of the solubility in aq. K_2CO_3 carbon dioxide is liberated and the results do not show equilibrium.

SOLUBILITY OF POTASSIUM ACID PHOSPHATE, $KH_2PO_4.H_3PO_4$, IN WATER.

(Parravano and Mieli, 1908.)

Determinations by Synthetic (sealed tube) Method.

t°.	Gms. $KH_2PO_4.H_3PO_4$ per 100 Gms. Sat Sol.	Solid Phase.	t°.	Gms. $KH_2PO_4.H_3PO_4$ per 100 Gms. Sat. Sol.	Solid Phase.
−0.6	3.337	Ice	65.2	68.44	KH_2PO_4
−2.5	12.13	"	78	72.43	"
−6.7	29.43	"	87.5	77.6	"
−9.2	36.98	"	105.5	85.9	"
−13 Eutec.	44	" $+KH_2PO_4$	120 tr. pt.	92.1	" $+KH_2PO_4.H_3PO_4$
0 (?)	45.8	KH_2PO_4	135	96.1	$KH_2PO_4.H_3PO_4$
+10.9	50.3	"	139	100	

EQUILIBRIUM IN THE SYSTEM POTASSIUM OXIDE, PHOSPHORUS PENTOXIDE AND WATER AT 0° AND AT 25°.

(Jänecke, 1927.)

The results are presented in terms of Gms. of H_2O required to dissolve 100 gms. of mixtures of $K_2O + P_2O_5$ containing determined percentages of K_2O.

Percent K_2O in dissolved $K_2O + P_2O_5$	Gms. H_2O required to dissolve 100 gms. $K_2O + P_2O_5$ at: 0°	25°	Percent K_2O in dissolved $K_2O + P_2O_5$	Gms. H_2O required to dissolve 100 gms. $K_2O + P_2O_5$ at: 0°	25°
2.4	73.5	47.8	58.5	82.0	82.0
10.0	44.0	44.0	61.0	104.0	80.2
13.1	131.0	92.0	63.9	147.0	101.5
19.5	80	58.0	66.5	152.0	117.5
24.7	172.0	121.0	68.5	153.0	119.0
25.0	63.0	59.0	70.8	160.0	118.0
30.0	260.0	185.0	73.5	153.0	119.0
33.0	280.0	249.0	76.3	153.0	119.0
39.8	460.0	435.0	79.5	171.0	131.0
48.3	363.0	292.0	82.2	173.0	130.0
50.5	219.0	159.0	86.5	156.0	102.0
52.4	92.0	88.0	90.5	146.0	98.0
56.0	97.1	76.0	96.0	107.0	97.0

(over)

The diagram drawn from the above results showed the existance in the strongly alkaline solutions of the hitherto unknown $K_3PO_4.8H_2O$. This salt was obtained in pure form and its solubility in water determined with the following results.

t°	Gms. K_3PO_4 per 100 gms. sat. solution
7.5	44.2
23.3	49.0
43.2	57.0
45.1	59.7

SOLUBILITY OF POTASSIUM ACID PHOSPHATE, $KH_2PO_4.H_3PO_4$, IN ANHYDROUS PHOSPHORIC ACID.

(Parravano and Mieli, 1908.)

Determinations by Synthetic (sealed tube) Method.

t°.	Gms. per 100 Gms. Sat. Solution.		
	$KH_2PO_4.H_3PO_4$	=	KH_2PO_4.
38.5	18.17		10.56
84	58.42		33.97
110	77.53		45.08
126.5	92.26		51.90

PO

EQUILIBRIUM IN THE SYSTEM POTASSIUM HYDROXIDE, PHOSPHORIC ACID, WATER AT 25°.

(D'Ans and Schreiner, 1910a; Parker, 1914.)

The results of these investigators agree satisfactorily when plotted on cross-section paper. The following figures were read from the curves. Some uncertainty exists in regard to the solid phase in contact with some of the solutions.

Mols. per 1000 Gms. Sat. Sol.		Solid Phase.	Mols. per 1000 Gms. Sat. Sol.		Solid Phase.
K.	PO_4.		K.	PO_4.	
9.62	0	$KOH.2H_2O$	7	4	$K_3PO_4+K_2HPO_4$
9.76	0.24	" $+K_3PO_4.3H_2O$	6	3.6	K_2HPO_4
9.15	0.5	$K_3PO_4.3H_2O$	5	3.15	"
8.2	1	"	4	2.65	" or KH_2PO_4(?)
7.5	1.5	"	3	2.2	" " (?)
8.2	2	"	2	1.7	" " (?)
7.5	2.5	"	1.5	1.5	" " (?)
8.8	2.9	"	1.6	2	KH_2PO_4
9.7	2.9	" $+K_3PO_4$	2.1	4	"
9.5	3	K_3PO_4	2.5	6	"
8.5	3.4	"	3	8	"
8	3.6	"	1.65	6	$KH_2PO_4.H_3PO_4$ (Parker)
7.5	3.75	"	1.35	8	" "

Fusion-point data for $KPO_3 + K_4P_2O_7$ are given by Parravano and Calcagni (1908, 1910).

EQUILIBRIUM IN THE SYSTEM POTASSIUM DIHYDROGEN PHOSPHATE AMMONIUM DIHYDROGEN PHOSPHATE AND WATER AT 0°.

(Askenasy and Nessler, 1930.)

This pair of salts form a continuous series of mix-crystals. The results are expressed in accordance with the terms adopted by Jänecke. Additional results for the quarternary system $(K,NH_4)(Cl,H_2PO_4) + H_2O$ are also given.

d. of sat. sol.	Mols. KH_2PO_4 per 100 mols. of dissolved $KH_2PO_4 + NH_4H_2PO_4$	Mols. H_2O to dissolve 100 mols. of $KH_2PO_4 + NH_4H_2PO_4$	Mol. Percent KH_2PO_4 in the Mix-Crystals forming the Solid Phase
1.1043	0.0	2815	0.0
1.1312	12.4	2450	6.5
1.1350	15.3	2350	9.0
1.1447	18.2	2280	13.2
1.1568	26.4	2200	23.2
1.1574	31.2	2130	30.7
1.1611	35.2	2105	35.9
1.1604	36.4	2120	42.4
1.1603	38.1	2130	48.8
1.1571	44.2	2240	71.1
1.1577	49.3	2325	81.9
1.1472	54.7	2540	87.8
1.1393	67.4	2950	94.5
1.1169	80.6	3400	96.7
1.1151	100.0	4125	100.0

Additional data for the solubility of mixtures of various Potassium and Ammonium Phosphates in Water at 0° and 25° are given by Jänecke, 1927. Attention was directed particularly to the system $K_3PO_4 + NH_4H_2PO_4 + H_2O$ in which the following solid phases occur at either 0° or 25°; $K_3PO_4.8H_2O$, K_2HPO_4, $(NH_4)_3PO_4.3H_2O$, $(NH_4)_2HPO_4$, KH_2PO_4 and $NH_4H_2PO_4$. The determinations were made by the synthetic method. The solid phases were identified by the polarization microscope. Nine binary mixtures composed of the three potassium and three ammonium salts were studied. The results however are given in an abridged form chosen to show the most important features of the system.

SOLUBILITY OF POTASSIUM DIHYDROGEN PHOSPHATE IN AQUEOUS SOLUTIONS OF HYDROGEN PEROXIDE AT 0°.

(Menzel and Gäbler, 1929.)

Gms. per 100 gms. sat. sol.	
H_2O_2	KH_2PO_4
0.0	12.48
6.590	16.07
8.242	18.67

SOLUBILITY OF POTASSIUM DIHYDRODEN PHOSPHATE IN AQUEOUS SOLUTIONS OF URETHAN AT 25°.

(Palitzsch, 1928, 1929)

Gm. Mols. per 1000 gms. H_2O		Solid Phase
KH_2PO_4	$NH_2COOC_2H_5$	
1.82	0.0	KH_2PO_4
1.39	1.1225	"
0.75	5.401	"
0.130	22.25	"

POTASSIUM HYPOPHOSPHATE, etc.

SOLUBILITY IN WATER.

(Salzer — Liebig's Ann. 211, 1, 82.)

Salt.	Formula.	Gms. Salt per 100 Gms. H_2O. Cold.	Hot.
Potassium Hypophosphate	$K_4P_2O_6.8H_2O$	400	. . .
" Hydrogen Hypophosphate	$K_3HP_2O_6.3H_2O$	200	. . .
" Di Hydrogen Hypophosphate	$K_2H_2P_2O_6.3H_2O$	33	100
" Tri Hydrogen Hypophosphate	$KH_3P_2O_6$	66.6	200
" Penta Hydrogen Hypophosphate	$K_3H_5(P_2O_6)_2.2H_2O$	40	125
" Hydrogen Phosphite	KH_2PO_3	172 (20°)	. . .
" Hypophosphite	KH_2PO_2	200 (25°)	333
" Hypophosphite	KH_2PO_2*	14.3 (25°)	28

* Solvent alcohol.

POTASSIUM PerRHENATE $KReO_4$.

SOLUBILITY OF POTASSIUM PERRHENATE IN WATER.

(Hölemann and Kleese, 1938.)

ReO

The previous determinations, at temperatures up to 100°, by Puschin and Kovac, 1931; Lewino, Noddack and Noddack, 1931; and Roth and Becker, 1932, although varying among themselves, give, when plotted, average values which agree closely with the present, very careful determinations. The determinations above 100° were made by the synthetic method. The solid phase is $KReO_4$ in all cases.

t°	d of sat. solution	Gms. $KReO_4$ per 100 gms. sat. sol.	t°	Gms. $KReO_4$ per 100 gms. sat. sol.	t°	Gms. $KReO_4$ per 100 gms. sat. sol.
-0.06	(Eutec)	0.34	109	12.6	366	84.6
+10.5	1.0028	0.62	112	14.0	401	89.3
25.0	1.0067	1.19	154	26.3	445	94.4
50	1.0128	3.19	194	36.7	456	95.4
60	1.0210	4.38	220	50.7	470	96.8
75	1.0303	6.95	239	59.9	498	97.4
85	1.0412	8.98	290	71.9	518 m.pt.	100.
99	1.060	12.20	335	80.1		

1 liter 89.7 Wt. percent Ethyl Alcohol, C_2H_5OH, dissolve 0.302 gm. $KReO_4$ at 18.5°. (Tollert, 1932.)

POTASSIUM SULFIDE K_2S.

Fusion-point data are given for the following systems:

S

$K_2S + K_2SO_4$ (Garibeau, Kolb and Kroll, 1938.)

$K_2S + S$ (Thomas and Rule, 1917; Pearson and Robinson, 1931.)

POTASSIUM Antimony SULFIDE $K_3SbS_4.5H_2O$.

POTASSIUM SulfoANTIMONATE $K_3SbS_4.5H_2O$.

SOLUBILITY IN WATER. (Donk, 1908.)

t°.	Gms. K_3SbS_4 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. K_3SbS_4 per 100 Gms. Sat. Sol.	Solid Phase.
− 1.3	9.5	Ice	−34	62	Ice+$K_3SbS_4.6H_2O$
− 2.6	17.1	"	−10	65.5	$K_3SbS_4.6H_2O$
− 4	24.2	"	− 4.5	69.1	"
− 7.2	35.4	"	0	75.4	$K_3SbS_4.5H_2O$
−10.6	42.9	"	+10	76.2	"
−13.5	48.8	"	30	75.1	"
−18.5	52.6	"	50	77.7	$K_3SbS_4.3H_2O$
−28.8	59.6	"	80	79.2	"

SOLUBILITY OF POTASSIUM SULFOANTIMONATE IN AQ. SOLUTIONS OF POTASSIUM HYDROXIDE AT 30° AND VICE VERSA.

(Donk, 1908.)

Gms. per 100 Gms. Sat. Sol. K_3SbS_4.	Gms. per 100 Gms. Sat. Sol. KOH.	Solid Phase.
75	0	$K_3SbS_4.5H_2O$
68.4	3.4	$K_3SbS_4.3H_2O$
56.8	11	"
50.9	16.1	K_3SbS_4
37.7	25.5	"

Gms. per 100 Gms. Sat. Sol. K_3SbS_4.	Gms. per 100 Gms. Sat. Sol. KOH.	Solid Phase.
19.8	40.5	K_3SbS_4
11.5	49.9	" $+KOH.2H_2O$
9.4	49.2	$KOH.2H_2O$
0	56.3	"

SOLUBILITY OF POTASSIUM SULFOANTIMONATE IN AQ. ETHYL ALCOHOL.

(Donk, 1908.)

Results at 10°.

Gms. per 100 Gms. Sat. Sol. K_3SbS_4.	Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	Solid Phase.
0	94	$K_3SbS_4.5H_2O$
0	90.5	"
Two Liquid Layers Formed Here.		
69.2	0.8	"
76.1	0	"

Results at 30°.

Gms. per 100 Gms. Sat. Sol. K_3SbS_4.	Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	Solid Phase.
0	97	$K_3SbS_4.3H_2O$
Two Liquid Layers Formed Here.		
75.1	0	"

Composition of the Liquid Layers. (10°)

Gms. per 100 Gms.

Alcoholic Layer. K_3SbS_4.	Alcoholic Layer. C_2H_5OH.	Aqueous Layer. K_3SbS_4.	Aqueous Layer. C_2H_5OH.
0	85	67.4	1.1
2.2	54.7	49	3.4
4.2	46.9	45.6	3.8
27.4	16	...	...
...	...	12.7	31.1

Composition of the Liquid Layers. (30°)

Gms. per 100 Gms.

Alcoholic Layer. K_3SbS_4.	Alcoholic Layer. C_2H_5OH.	Aqueous Layer. K_3SbS_4.	Aqueous Layer. C_2H_5OH.
0	93.1	70.5	±0.5
0	85.6	65.2	1.2
2.2	56.8	47.8	5.7
8.5	41.1	37.1	9.2

SOLUBILITY OF POTASSIUM SULFOANTIMONATE IN AQ. METHYL ALCOHOL AT 15°.

(Donk, 1908.)

Gms. per 100 Gms. Sat. Sol. K_3SbS_4.	Gms. per 100 Gms. Sat. Sol. CH_3OH.	Solid Phase.
0.5	99.5	K_3SbS_4
0.45	99.5	"
1.5	93.9	"
1.8	92	"
Two Liquid Layers Formed Here.		
62.7	7.5	$K_3SbS_4.9H_2O$
68.4	3.5	"
75.5	0	"
Two Liquid Layers Formed Here.		
0.5	98.1	"

Composition of the Liquid Layers.

Gms. per 100 Gms.

Alcoholic Layer. K_3SbS_4.	Alcoholic Layer. CH_3OH.	Aqueous Layer. K_3SbS_4.	Aqueous Layer. CH_3OH.
5	82.5	62.5	8
4.9	76.3	...	...
7	66.9	...	...
13.6	54	...	...
19.1	45.5	...	...
...	...	31.1	31.3
...	...	41.1	22.2
...	...	47.2	18.2
...	...	57.2	11.1

POTASSIUM SULFITE K_2SO_3.

SOLUBILITY OF POTASSIUM SULFITE IN WATER.

(Fœrster, Brosche and Norberg-Schultz, 1924.)

The determinations were made with the greatest care. Constant stirring was employed to secure saturation and an atmosphere of hydrogen to prevent oxidation.

t°.	Gms. K_2SO_3 per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. K_2SO_3 per 100 gms. sat. sol.	Solid Phase.
— 1.69......	5.78	Ice	—30.........	51.0	K_2SO_3
— 2.71......	9.20	»	—15.........	51.3	»
— 4.10......	13.37	»	— 6.7.......	51.45	»
— 5.71......	17.57	»	— 3.9.......	51.35	»
— 6.81......	20.02	»	+ 0.1.......	51.4	»
—10.88......	26.70	»	24.0.......	51.37	»
—14.06......	30.6	»	30.0.......	51.76	»
—31.0.......	44.0	»	54.4.......	51.90	»
—45.5 Eutec	51.0	» + K_2SO_3	97.2.......	52.88	»

EQUILIBRIUM IN THE SYSTEM POTASSIUM SULFITE, POTASSIUM OXIDE AND WATER.

(Hölzl, 1937.)

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms. sat. sol.		Solid Phase
	K_2O	K_2SO_3			K_2O	K_2SO_4	
0	0.0	47.52	K_2SO_3	40	0.0	50.37	K_2SO_3
"	40.71	0.43	" + $KOH.2H_2O$	"	48.32	0.40	" + $KOH.H_2O$
"	41.01	0.0	$KOH.2H_2O$	"	48.71	0.0	$KOH.H_2O$
11.5	0.0	48.06	K_2SO_3	65.3	0.0	52.27	K_2SO_3
"	42.41	0.48	" + $KOH.2H_2O$	"	50.14	0.45	" + $KOH.H_2O$
"	42.87	0.0	$KOH.2H_2O$	"	50.65	0.0	$KOH.H_2O$
25	0.0	49.01	K_2SO_3	80	0.0	53.15	K_2SO_3
"	45.03	0.47	" + $KOH.2H_2O$	"	51.50	0.39	" + $KOH.H_2O$
"	45.51	0.0	$KOH.2H_2O$	"	51.81	0.0	$KOH.H_2O$
33	0.0	49.99	K_2SO_3	100	0.0	55.53	K_2SO_3
"	47.81	0.37	" + $KOH.H_2O$	"	54.29	0.40	" + $KOH.H_2O$
"	48.16	0.0	$KOH.H_2O$ + $KOH.1\frac{1}{2}H_2O$	"	54.67	0.0	$KOH.H_2O$
"	48.29	0.0	" + $KOH.2H_2O$				

EQUILIBRIUM IN THE SYSTEM POTASSIUM SULFITE, SULFUROUS ACID AND WATER.

(Hölzl, 1937.)

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms. sat. sol.		Solid Phase
	H_2SO_3.	K_2SO_3			H_2SO_3	K_2SO_3	
0							
0	0.44	50.36	K_2SO_3+$K_2S_2O_5$.2/3H_2O	40	2.64	53.01	K_2SO_3+$K_2S_2O_5$
"	7.49	14.06	$K_2S_2O_5$.2/3H_2O	65.3	4.37	55.12	" "
11.5	1.11	50.96	K_2SO_3 + $K_2S_2O_5$	80	5.48	55.82	" "
25	1.83	51.92	" "	100	7.0	56.60	" "

SOLUBILITY OF POTASSIUM SULFITE IN AQUEOUS SOLUTIONS OF TERTIARY BUTYL ALCOHOL AT 30°.

(Ginnings and Robbins, 1930.)

Wt. Percent $(CH_3)_3$.COH in Aq. Solvent	Gms. K_2SO_3 per 100 gms. sat. sol.	Wt. Percent $(CH_3)_3$COH in Aq. Solvent	Gms. K_2SO_3 per 100 gms. sat. sol.
0.0	51.76	9.1	9.8
0.4	34.2	16.1	5.8
0.9	26.7	18.9	4.8
3.5	17.0	39.3	1.8
5.9	13.3	57.8	0.7

POTASSIUM Pyro SULFITE $K_2S_2O_5$ and $K_2S_2O_5.{}^2/_3H_2O$.

SOLUBILITY IN WATER.

(Fœrster, Brosche and Norberg-Schultz, 1924.)

The numerous determinations of the authors were plotted and the following values read from the curves.

Results for $K_2S_2O_5$.

t°.	Gms. $K_2S_2O_5$ per 100 gms. sat. sol.	Solid Phase.
— 1.07	3.73	Ice
— 2.0	6.8	»
— 4.0	13.8	»
— 5.0	17.5	»
— 5.6 Eutec.	19.5	» + $K_2S_2O_5$
— 30	20.7	$K_2S_2O_5$
± 0.0	22.1	»
+ 2.0	22.8	»
10.0	26.5	»
20.0	30.8	»
25.0	32.8	»
30.0	34.8	»
40.0	39.0	»
50.0	42.5	»
60.0	46.0	»
80.0	51.9	»
94.0	55.5	»

Results for $K_2S_2O_5.{}^2/_3H_2O$.

t°.	Gms. $K_2S_2O_5$ per 100 gms. sat. sol.	Solid Phase.
— 1.0	4.0	Ice
— 2.0	7.5	»
— 4.0	13.5	»
— 5.0	16.0	»
— 6.0 Eutec.	18.0	» + $K_2S_2O_5.{}^2/_3H_2O$
— 4.0	19.2	$K_2S_2O_5.{}^2/_3H_2O$
— 3.0	19.9	»
— 2.0	20.5	»
± 0.0	21.7	»
+ 2.0	22.8	»
4.0	24.1	»
6.0	25.1	»
8.0	26.2	»
10.0	27.4	»
15.0	30.1	»
20.0	33.5	»

100 gms. Liquid Sulfur Dioxide saturated with Potassium Pyro Sulfite (Meta bi Sulfite), contain 0.035 gm. $K_2S_2O_5$ at 0°. (Jander and Wickert, 1936.)

SO

POTASSIUM Sodium SULFITE $KNa_2H(SO_3)_2.4H_2O$.

100 gms. H_2O dissolve 69 gms. of the salt at 15°. (Schwicker, 1889.)

POTASSIUM SULFATE K_2SO_4.

SOLUBILITY IN WATER.

(Mulder; Andrae, 1884; Trevor, 1891 Tilden and Shenstone, 1884; Berkeley, 1904; see also Etard, 1894.)

t°.	Gms. K_2SO_4 per 100 Gms		t°	Gms K_2SO_4 per 100 Gms.		t°.	Gms K_2SO_4 per 100 Gms.	
	Water.	Solution.		Water.	Solution		Water.	Solution
0	7.35	6.85	40	14.76	12.86	90	22.8	18.57
10	9.22	8.44	50	16.50	14.16	100	24.1	19.42
20	11.11	10	60	18.17	15.38	120	26.5	20.94
25	12.04	10.75	70	19.75	16.49	143	28.8	22.36
30	12.97	11.48	80	21.4	17.63	170	32.9	24.76

Sp. Gr. of solution saturated at 18° = 1.083.

The determinations of Berkeley (1904), which were made with exceptional care, are as follows:

t°.	Sp. Gr. of Sat. Solution.	Gms. K_2SO_4 per 100 Gms H_2O.	t°.	Sp. Gr of Sat. Solution	Gms K_2SO_4 per 100 Gms H_2O.
0.40	1.0589	7.47	58.95	1.1089	18.01
15.70	1.0770	10.37	74.85	1.1157	20.64
31.45	1.0921	13.34	89.70	1.1194	22.80
42.75	1.1010	15.51	101.1 b. pt.	1.1207	24.21

Individual determination in good agreement with the above, are given by LeBlanc and Schmandt (1911); Greenish and Smith (1901); Osaka (1903-8); Nacken (1910); Smith and Ball (1917).

SOLUBILITY OF POTASSIUM SULFATE IN WATER.

The closely agreeing determinations of Caven and Johnston, 1927, 1928; Wright, 1927; Flöttmann, 1928; Blasdale, 1923; Hill and Moskowitz, 1929; Starrs and Storck, 1930; Malhorta and Suri, 1930; Benrath and Wazelle, 1929; Babajewa, 1913; Rakowski and Babajewa, 1931; Schröder and Schlackmann, 1934; and Benrath, Gjedebo, Schiffers and Wunderlich, 1937 for temperatures above 100°, were plotted and the following values taken from the average curve.

t°	Gms. K_2SO_4 per 100 gms. sat. sol.	t°	Gms. K_2SO_4 per 100 gms. sat. sol.	t°	Gms. K_2SO_4 per 100 gms. sat. sol.	t°	Gms. K_2SO_4 per 100 gms. sat. sol.
0	6.9	40	12.9	100	19.4	310	23.3
10	8.5	50	14.2	179	25.4	327	16.2
15	9.2	60	15.4	208	25.7	337	12.3
20	10.0	70	16.55	245	25.9	344	8.36
25	10.75	80	17.6	292	26.0	357	3.9
30	11.5	90	18.6				

The densities of the saturated solutions are: 1.0757 at 15° 1.0807 at 20° and 1.0853 at 25°. (Flöttmann, 1928.)

SO Data for the Solubility of Potassium Sulfate in Water at 25° and under Pressures up to 10,000 bars (metric atmospheres) are given by Adams, 1932.

EQUILIBRIUM IN THE SYSTEM POTASSIUM SULFATE SULFURIC ACID AND WATER.

(Babajewa, 1931.)

Results at 30°		Results at 50°		Results at 75°		
Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Solid Phase at each temperature
H_2SO_4	K_2SO_4	H_2SO_4	K_2SO_4	H_2SO_4	K_2SO_4	
0.0	11.50	0.0	14.16	0.0	17.10	K_2SO_4
5.38	15.70	4.92	18.66	6.77	24.27	"
8.75	18.80	7.45	20.09	8.07	25.55	"
11.22	20.80	11.60	26.03	8.96	26.38	"
—	—	14.40	29.61	12.43	31.24	"
12.00	22.00	16.40	32.80	18.03	40.43	" + $K_2SO_4.KHSO_4$
17.61	22.56	19.37	33.80	18.80	40.81	$K_2SO_4.KHSO_4$
20.95	22.99	21.49	35.37	21.03	42.76	"
21.20	24.80	22.40	36.40	—	—	" + $K_2SO_4.6KHSO_4$
23.49	17.64	23.21	31.66	—	—	$K_2SO_4.6KHSO_4$ + $KHSO_4$
—	—	—	—	24.40	46.38	$K_2SO_4.KHSO_4$ + $KHSO_4$
28.41	10.83	23.73	30.47	25.16	42.82	$KHSO_4$
33.92	6.43	24.42	28.15	26.97	37.27	"
37.38	3.56	27.63	22.03	30.05	28.80	"
52.20	2.18	32.49	14.25	40.00	13.98	"
54.59	2.00	36.80	9.27	54.23	8.88	"
63.16	3.35	43.79	6.34	60.48	9.50	"
68.93	4.84	—	—	—	—	K_x
—	—	56.13	4.41	—	—	$KHSO_4$
—	—	63.98	5.75	—	—	"
—	—	68.08	9.96	—	—	"
75.67	4.12	72.00	19.78	—	—	K_x
—	—	74.52	13.41	—	—	"

K_x is perhaps the hydrate $K_2SO_4.KHSO_4.H_2O$.

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 18°.

(Stortenbecker, 1902.)

Mols. per 100 Mols. $K_2SO_4+H_2SO_4+H_2O$.		Solid Phase.	Mols. per 100 Mols. $K_2SO_4+H_2SO_4+H_2O$.		Solid Phase.
K_2SO_4.	H_2SO_4.		K_2SO_4.	H_2SO_4.	
1.10	0	K_2SO_4	2.80	5.79	$K_2SO_4.3KHSO_4$
1.59	0.95	"	2.61	5.61	$K_2SO_4.6KHSO_4$
2.49	2.70	"	2.25	6.19	" $+KHSO_4$
2.75	3.17	$K_2SO_4.KHSO_4$	1.08	7.94	$KHSO_4$
2.75	3.74	"	0.77	9.2	"
2.83	5.08	"	0.44	22.7	"

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 0°.

(D'Ans, 1909a.)

Mols. per 1000 Gms. Sat. Sol.		Solid Phase.	Mols. per 1000 Gms. Sat. Sol.		Solid Phase.
K_2SO_4.	H_2SO_4.		K_2SO_4.	H_2SO_4.	
0.53	0.37	K_2SO_4	0.61	2.12	K_a+K_b
0.64	0.75	"	0.54	2.29	K_b
0.74	1.08	" $+K_3H(SO_4)_2$	0.53	2.30	" $+KHSO_4$
0.73	1.13	$K_3H(SO_4)_2$	0.43	2.48	$KHSO_4$
0.71	1.44	"	0.28	3.04	"
0.69	1.66	"	0.12	4.43	"
0.69	1.88	" $+K_a$	0.09	5.27	"

K_a and K_b are acid sulfates between $K_3H(SO_4)_2$ and $KHSO_4$. Their compositions were not determined.

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°.

(D'Ans, 1909a, 1913; see also Herz, 1911–12.)

Mols. per 1000 Gms. Sat. Sol.		Solid Phase.	Mols. per 1000 Gms. Sat. Sol.		Solid Phase.
K_2SO_4.	H_2SO_4.		K_2SO_4.	$H_2SO_4+SO_3$.	
1.27	1.31	$K_2SO_4+K_3H(SO_4)_2$	0.250	8.10	$KH_3(SO_4)_2.H_2O$
1.33	1.99	$K_3H(SO_4)_2+Ky$	0.352	8.15	"
1.24	2.03	Ky	0.364	8.16	" $+KH_3(SO_4)_2$
1.13	2.17	"	0.341	8.29	$KH_3(SO_4)_2$
1.04	2.35	" $+KHSO_4$	0.322	8.33	"
1.032	2.345	$KHSO_4$	0.325	8.45	"
0.67	2.83	"	0.346	6.62	"
0.22	4.13	"	0.384	8.57	"
0.15	5.36	"	0.412	8.71	"
			0.583	8.82	"
K_2SO_4.	$H_2SO_4+SO_3$.		0.880	8.65	" $+KHS_2O_7$.
0.171	6.42	$KHSO_4$	0.899	8.63	KHS_2O_7 (unstable)
0.190	6.60	"	0.882	8.70	"
0.266	6.91	" $+KH_3(SO_4)_2.H_2O$	0.561	8.96	"
0.182	7.26		0.365	9.80	"
0.157	7.62		0.43	9.78	"
0.167	7.88		0.665	9.80	"
0.201	8		0.937	9.66	"

K_y = an acid sulfate between $K_3H(SO_4)_2$ and $KHSO_4$ of which the exact composition was not determined.

POTASSIUM Bi SULFATE $KHSO_4$

SOLUBILITY OF POTASSIUM BISULFATE IN WATER.

(Kremers, 1854; Platt and Hudson, 1928.)

t°	Gms. $KHSO_4$ per 100 gms. sat. sol.	t°	Gms. $KHSO_4$ per 100 gms. sat. sol.	t°	Gms. $KHSO_4$ per 100 gms. sat. sol.
0	26.6	35	36.6	60	43.3
15	31.3	40	37.9	65	44.6
20	32.7	45	38.2	70	46.1
25	34.0	50	40.3	75	47.8
30	35.4	55	41.7	100	54.9

EQUILIBRIUM IN THE SYSTEM POTASSIUM SULFATE, SODIUM SULFATE AND SULFURIC ACID AT 12.6°.

(Montemartini and Losana, 1928.)

SO

d. of sat. solution	Gms. per 100 gms. sat. sol.			Solid Phase
	Na_2SO_4	K_2SO_4	H_2SO_4	
1.1862	3.64	13.58	0.0	$3K_2SO_4.Na_2SO_4$
1.2680	4.77	17.59	10.96	"
1.3846	10.75	18.84	18.12	$5K_2SO_4.Na_2SO_4$
1.4870	14.12	18.34	20.53	" + $K_2SO_4.KHSO_4.H_2O$ + $Na_2SO_4.NaHSO_4.5H_2O$
1.4882	21.84	9.02	23.98	$K_2SO_4.KHSO_4.5H_2O$ + $Na_2SO_4.NaHSO_4.5H_2O$ + traces of $5K_2SO$ Na_2SO_4
1.4802	22.86	3.54	29.12	$KHSO_4.H_2O$ + $NaHSO_4.H_2O$
1.4126	9.56	1.64	36.88	" "
1.4760	3.12	1.02	52.24	" "
1.5800	3.54	1.43	60.56	$KHSO_4.H_2SO_4.H_2O$ + $NaHSO_4$
1.6642	4.26	2.02	69.96	$KHSO_4.H_2SO_4$ + $NaHSO_4.H_2SO_4$
1.7806.	5.40	3.02	80.72	" "
1.9260	9.30	6.72	83.68	$NaHSO_4.KNSO_4.2H_2SO_4$

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS SOLUTIONS OF HYDROGEN PEROXIDE AT 25°.

(Akerlof and Turck, 1935.)

Wt. Percent H_2O_2 in Aq. Solvent	Gm. Mols. K_2SO_4 per 1000 gms. solvent
0.0	0.6905
15 72	1.287
31.43	1.945

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE, BROMIDE, AND IODIDE.

(Blarez, 1891.)

Interpolated from the original results.

Grams Halogen Salt per 100 cc. Solution.	Grams K_2SO_4 per 100 cc. in Aq. Solutions of: KCl at 12.5°.	KBr at 14°.	KI at 12.5°.
0	9.9	10.16	9.9
2	8.3	9.1	9.2
4	7.0	8.2	8.4
6	5.7	7.4	7.7
8	4.6	6.6	7.2
10	3.5	6.0	6.6
12	...	5.5	6.0

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS SOLUTIONS OF POTASSIUM HYDROXIDE AT 25°.

(D'Ans and Schreiner, 1910.)

Mols. per 1000 Gms. Sat. Solution		Gms. per 100 Gms. Sat. Solution.		Mols. per 1000 Gms. Sat. Solution.		Gms. per 100 Gms. Sat. Solution.	
$(KOH)_2$.	K_2SO_4.	KOH.	K_2SO_4.	$(KOH)_2$.	K_2SO_4.	KOH.	K_2SO_4.
0	0.617	0	10.75	2.86	0.035	32.06	0.61
0.258	0.433	2.892	7.544	3.42	0.009	38.33	0.16
0.433	0.280	4.854	4.878	4.809	0	53.51	0
1.13	0.137	12.67	2.386				

SO

SOLUBILITY DATA FOR THE RECIPROCAL SALT PAIR

$K_2SO_4 + BaCO_3 \rightleftarrows K_2CO_3 + BaSO_4$.

(Meyerhoffer, 1905.)

t°.	Gms. per 100 Gms. Sat. Sol. K_2SO_4.	K_2CO_3.	Solid Phase.	t°.	Gms. per 100 Gms. Sat. Sol. K_2SO_4.	K_2CO_3.	Solid Phase.
25	10.76	0	$K_2SO_4+BaSO_4$	25	0.602	7.35	$BaCO_3+BaSO_4$
25	6.76	5.85	" "	25	0.173	2.85	"
25	3.92	12.6	" "	80	0.613	2.49	"
25	2.485	17.81	" "$+BaCO_3$	80	1.39	4.88	"
25	1.72	22.1	$K_2SO_4+BaCO_3$	80	7.1	15.33	"$+K_2SO_4$
25	0.0886	28.5	" "	100	0.797	2.36	$BaCO_3+BaSO_4$
25	0.023	53.1	" $+K_2CO_3.2H_2O$	100	1.83	4.51	" "
25	0	53.2	$K_2CO_3.2H_2O+BaCO_3$	100	9.42	13.6	" $+K_2SO_4$

SOLUBILITY OF THE THREE HYDRATES OF POTASSIUM FERROSULFATE IN WATER AT DIFFERENT TEMPERATURES.

(Küster and Thiel, 1899.)

t°.	$K_2SO_4.FeSO_4.6H_2O$.		$K_2SO_4.FeSO_4.4H_2O$.		$K_2SO_4.FeSO_4.2H_2O$.	
	cc. N/10 $KMnO_4$ per 2cc. Solution.	Gms K_2SO_4.$FeSO_4$ per 100 cc. Sol.	cc. N/10 $KMnO_4$ per 2 cc. Solution.	Gms. K_2SO_4.$FeSO_4$ per 100 cc. Sol.	cc. N/10 $KMnO_4$ per 2 cc. Solution.	Gms. K_2SO_4.$FeSO_4$ per 100 cc. Sol.
0.5	12.4	18.36	15.5	22.94	15.4	22.79
17.2	17.0	25.16	18.1	26.79	21.6	31 98
40.1	24.8	36.72	21.9	32.41	27.6	40 86
60	29.0	42.93	24.1	35.68	28.8	42.63
80	30.6	45.29	27.3	40.46	28.6	42.34
90	...	...	29.6	43.82	28.9	42.73
95	...	...	29.8	44.11	27.7	41.01

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS SOLUTIONS OF MAGNESIUM SULFATE AND VICE VERSA AT 25°.

(Van Klooster, 1917.)

Gms. per 100 Gms. Sat. Sol. $MgSO_4$.	K_2SO_4.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. $MgSO_4$.	K_2SO_4.	Solid Phase.
26.76	0	$MgSO_4.7H_2O$	13.26	10.34	$MgK_2(SO_4)_2.6H_2O$
26.67	1.68	"	12.88	10.51	"
26.57	2.34	"	12.68	10.70	" $+K_2SO_4$
26.36	3.76	"	12.06	10.77	K_2SO_4
26.39	4.02	" $+MgK_2(SO_4)_2.6H_2O$	10.69	10.84	"
18.76	7.02	$MgK_2(SO_4)_2.6H_2O$	7.8	11.10	"
16.36	8.43	"	4	11.03	"
14.27	9.63	"	0	10.77	"

SOLUBILITY OF MAGNESIUM SULFATE IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE AT 30° AND VICE VERSA. (Weston, 1922.)

SO

Gms. per 100 gms. sat. sol. $MgSO_4$.	K_2SO_4.	Solid Phase.	Gms. per 100 gms. sat. sol. $MgSO_4$.	K_2SO_4.	Solid Phase.
29.03	0.0	$MgSO_4.7H_2O$	18.08	8.59	$MgSO_4.K_2SO_4.6H_2O$
27.69	3.21	Mixed Crystals	13.19	11.66	»
27.48	4.36	»	12.88	12.47	»
26.20	5.98	»	9.49	12.64	K_2SO_4
26.28	6.60	»	3.45	11.98	»
26.05	6.93	»	0.08	11.20	»

The author also gives data for the quaternary system $MgSO_4 + K_2SO_4 + (NH_4)_2SO_4 + H_2O$

EQUILIBRIUM IN THE SYSTEM MAGNESIUM SULFATE, POTASSIUM SULFATE AND WATER AT VARIOUS TEMPERATURES. (Levi, 1923.)

t°.	Gms. per 100 gms. sat. sol. $MgSO_4$.	K_2SO_4.	Solid Phase	t	Gms. per 100 gms. sat. sol. $MgSO_4$.	K_2SO_4.	Solid Phase.
0.0...	21.09	3.42	$MgSO_4.12H_2O+1.1.6$	34.4...	14.38	11.66	$K_2SO_4+1.1.6$
19.8...	25.34	3.83	$MgSO_4.7H_2O$ + »	44.7...	17.00	12.08	» + »
26.1...	26.45	4.26	» + »	49.6...	18.09	12.46	» + ?
37.8...	29.80	4.13	» + »	55.2...	18.38	12.86	» + 1.1.4
0.....	8.73	7.86	K_2SO_4 + »	63.4...	17.20	14.35	» + »
20.4..	12.08	10.10	» + »				

1.1.6 = Schönite, $MgSO_4.K_2SO_4.6H_2O$; 1.1.4 = Leonite, $MgSO_4.K_2SO_4.4H_2O$.

The author considers that the results of Van der Heide are incorrect, due to incomplete saturation. The errors in the data of others are also pointed out.

SOLUBILITY OF POTASSIUM MAGNESIUM SULFATE IN WATER.

(Tobler, 1855.)

t°	Gms. $K_2Mg(SO_4)_2$ per 100 gms. H_2O	Solid Phase	t°	Gms. $K_2Mg(SO_4)_2$ per 100 gms. H_2O	Solid Phase
0	14.1	$K_2SO_4.MgSO_4.6H_2O$	45	40.5	$K_2SO_4.MgSO_4.6H_2O$
20	25.0	"	60	50.2	"
30	30.4	"	75	59.8	"

100 gms. H_2O dissolve 30.52 gms. $K_2Mg(SO_4)_2.6H_2O$ at 15°.
(Lothian, 1909.)

EQUILIBRIUM IN THE SYSTEM POTASSIUM SULFATE, MAGNESIUM SULFATE AND WATER AT VARIOUS TEMPERATURES.

Results at 0° (Benrath & Benrath, 1930.)

d. of sat. sol.	Gms. per 100 gms. sat. sol. $MgSO_4$	Gms. per 100 gms. sat. sol. K_2SO_4	Solid Phase
1.025	0.0	6.68	K_2SO_4
1.061	1.26	7.03	"
1.108	4.17	7.51	"
1.115	4.59	7.77	" + 1.1.6
1.163	8.60	7.85	1.1.6
1.165	8.94	7.53	"
1.192	11.79	6.76	"
1.265	20.78	3.03	" + $MgSO_4.7H_2O$
1.271	20.74	7.93*	$MgSO_4.7H_2O$
1.274	20.68	4.34*	"
1.359	20.94	2.17	"
1.236	20.82	0.0	"

Results at 25° (Benrath & Benrath, 1929(a))

d. of sat. sol.	Gms. per 100 gms. sat. sol. $MgSO_4$	Gms. per 100 gms. sat. sol. K_2SO_4	Solid Phase
1.088	0.0	10.75	K_2SO_4.
1.123	2.60	10.86	"
1.149	5.05	10.85	"
1.230	12.61	10.99	" + 1.1.6
1.249	14.28	9.89	1.1.6
1.267	17.02	9.18	"
1.294	20.32	7.32	"
1.347	26.02	4.90	" + $MgSO_4.7H_2O$
1.324	26.61	2.11	$MgSO_4.7H_2O$
1.305	26.65	0.0	"

SO

Results at 30° (in terms of gms. per 100 gms. H_2O) (Starrs and Clark, 1930.)

d. of sat. sol.	$MgSO_4$	K_2SO_4	Solid Phase
—	0.0	13.11	K_2SO_4
—	4.80	14.24	"
—	12.03	15.26	"
—	16.04	15.32	"
—	17.72	15.33	" + 1.1.6
—	18.51	14.45	1.1.6
—	26.17	11.29	"
—	31.78	8.89	"
—	37.43	7.19	"
—	39.91	6.55	" + $MgSO_4.7H_2O$
—	39.13	5.53	$MgSO_4.7H_2O$
—	39.29	5.79	"
—	39.10	0.0	"

1.1.6 = Schönite, $K_2SO_4.MgSO_4.6H_2O$.

Bozza, 1934, also gives a compilation with diagrams of all available data upon this system at temperatures between 0° and 100° calculated to the terms proposed by Janecke.

POTASSIUM SULFATE

EQUILIBRIUM IN THE SYSTEM POTASSIUM SULFATE, MAGNESIUM SULFATE AND WATER AT VARIOUS TEMPERATURES. (Continued.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$MgSO_4$	K_2SO_4	
Results at 35° (Bozza, 1934.)			
1.148	5.04	12.40	K_2SO_4
—	7.16	12.28	"
1.242	13.13	11.67	"
1.250	14.40	11.90	" + 1.1.6
—	16.15	10.20	1.1.6
1.283	17.82	9.33	"
1.284	20.37	7.55	"
—	24.60	5.61	"
1.360	28.45	4.35	" + $MgSO_4.7H_2O$
1.336	28.41	1.78	$MgSO_4.7H_2O$
1.332	29.20	0.0	"
Results at 50° (Benrath and Benrath, 1929(a))			
1.087	0.0	14.14	K_2SO_4
1.148	5.05	14.13	"
1.255	13.86	13.47	"
1.292	16.96	13.10	" + 1.1.2
1.290	17.36	13.06	1.1.2
1.322	21.88	10.32	"
1.337	24.39	8.14	"
1.370	28.59	5.98	"
1.394	32.35	4.30	" + $MgSO_4.6H_2O$
1.380	32.76	2.60	$MgSO_4.6H_2O$
1.383	33.50	0.0	"
Results at 66° (Benrath and Sicnelschmidt, 1931.)			
—	0.0	16.16	K_2SO_4
—	7.73	15.01	"
—	14.01	14.37	"
—	17.08	14.46	" + 1.1.2
—	19.33	13.04	1.1.2
—	26.97	7.67	"
—	32.53	5.86	"
—	33.89	4.48	"
—	35.66	4.01	" + $MgSO_4.H_2O$
—	35.40	2.08	$MgSO_4.H_2O$
—	35.52	0.0	"

1.1.6 = Schonite $K_2SO_4.MgSO_4.6H_2O$; 1.1.2 = $K_2SO_4.MgSO_4.2H_2O$ (Leonite).

EQUILIBRIUM IN THE SYSTEM POTASSIUM SULFATE, MAGNESIUM SULFATE AND WATER AT VARIOUS TEMPERATURES. (Continued.)

d of sat. sol.	Gms. per 100 gms. sat. sol. $MgSO_4$	Gms. per 100 gms. sat. sol. K_2SO_4	Solid Phase
Results at 75° (Benrath and Sichelschmidt, 1931.)			
1.095	0.0	17.05	K_2SO_4
1.151	8.51	16.13	"
1.225	12.70	15.70	"
1.302	17.18	15.22	" + 1.1.2
1.320	18.12	14.09	1.1.2
1.351	23.32	11.14	"
1.402	26.44	8.70	"
1.419	30.70	7.71	" + 1.2
1.421	31.66	5.44	1.2
1.424	32.13	4.41	"
1.449	35.54	4.02	" + $MgSO_4.H_2O$
1.437	35.23	2.30	$MgSO_4.H_2O$
1.435	37.11	1.25	"
1.432	37.30	0.0	"
Results at 85° (Starrs and Storck, 1930.)			
—	6.08	18.25	K_2SO_4
—	13.60	17.71	"
—	17.33	16.94	" + 1.1.4
—	19.97	14.86	1.1.4
—	25.49	17.16	" + 1.2
—	24.66	9.56	1.2
—	27.74	6.58	"
—	32.01	3.27	" + $MgSO_4.H_2O$
—	32.9	0.0	$MgSO_4.H_2O$

SO

1.1.2 = K_2SO .MgSO .2H O (Leonite); 1.2 = K_2SO .2MgSO (Langbenite); 1.1.4 = $K_2SO_4.MgSO_4.4H_2O$.

EQUILIBRIUM IN THE SYSTEM POTASSIUM SULFATE, MAGNESIUM SULFATE AND WATER AT 100°.

(Benrath and Benrath, 1930.) (Starrs and Storck, 1930.)

d. of sat. sol.	Gms. per 100 gms. sat. solution $MgSO_4$	Gms. per 100 gms. sat. solution K_2SO_4	Solid Phase	Gms. per 100 gms. sat. solution $MgSO_4$	Gms. per 100 gms. sat. solution K_2SO_4	Solid Phase
1.119	0.0	19.42	K_2SO_4	0.0	19.53	K_2SO_4
1.217	7.34	19.46	"	8.69	19.83	"
1.339	16.25	18.75*	"	15.64	19.03*	"
—	18.00	18.84*	"	17.33	18.68*	"
1.305	14.47	18.64	" + 1.2	13.75(21.9)	19.00(14.0)	" + 1.2
1.304	18.12	14.26	1.2	16.49	14.98	1.2
1.319	22.63	9.04	"	20.71	10.40	"
1.332	27.44	5.54	"	25.60	6.50	"
1.361	31.00	3.31	" + $MgSO_4.H_2O$	29.90(34.0)	3.69(3.4)	" + $MgSO_4.H_2O$
1.367	33.27	0.0	$MgSO_4.H_2O$	31.75(33.5)	0.0	$MgSO_4.H_2O$

* Metastable

This system was also studied by Campbell, Downs and Samis, 1934, but their results give a curve which differs considerably from that of Benrath and of Starrs and Storck. Their values for the triple points are shown in parentheses.

Data are given for the reciprocal salt pair $K_2SO_4 + Mg(NO_3)_2 \rightleftarrows MgSO_4 + K_2(NO_3)_2$ at 0° and 99.5°, Benrath and Benrath, 1930; at 25° and 50°, Benrath and Benrath, 1929a; at 75°, Benrath and Sichelschmidt, 1931.

Data for the system $K_2SO_4 + MgSO_4 + (NH_4)_2SO_4 + H_2O$ at 30°, calculated from the results of Weston, 1922, are given by Jänecke, 1937, 1938.

Data for the system $K_2SO_4 + MgSO_4 + KCl + MgCl_2 + H_2O$ at 100° are given by Campbell, Downes, and Samis, 1934.

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS SOLUTIONS OF MANGANESE SULFATE AND VICE VERSA AT 0°.

(Caven and Johnston, 1927.)

Gms. per 100 gms. sat. sol.		Solid Phase
$MnSO_4$	K_2SO_4	
0.0	6.82	K_2SO_4
6.21	7.75	"
8.21	7.97	"
11.80	8.48	"
13.68	8.88	" + $MnSO_4.K_2SO_4.4H_2O$
17.39	7.60	$MnSO_4.K_2SO_4.4H_2O$
23.64	5.54	"
25.50	5.00	"
27.62	4.48	$MnSO_4.K_2SO_4.4H_2O$
30.28	4.00	"
34.30	3.35	"
34.38	2.81	"
34.53	1.85	"
34.49	1.68	"
34.78	0.00	"

SO

EQUILIBRIUM IN THE SYSTEM POTASSIUM SULFATE, MANGANESE SULFATE AND WATER AT VARIOUS TEMPERATURES.

(Benrath, 1930.)

t°	Gms. per 100 gms. sat. solution		Solid Phase
	$MnSO_4$	K_2SO_4	
17.5	14.85	10.85	K_2SO_4 + Mn5
30	15.46	12.05	" + 1.1.4
"	33.64	5.50	1.1.4 + 1.2
35	15.65	13.10	K_2SO_4.1.1.2
"	30.40	6.6	1.1.4 + 1.2
40	14.26	13.78	K_2SO_4 + 1.1.2
"	27.18	7.22	1.2 + "
"	34.66	3.34	" + Mn1
50	0.0	14.17	K_2SO_4
"	2.77	15.02	"
"	7.36	15.11	"
"	11.78	15.34	" + 1.1.2
"	14.43	13.40	1.1.2
"	16.45	12.34	"
"	17.17	11.85	"
"	18.30	11.55	"
"	18.70	11.41	" + 1.2
"	21.52	9.51	1.2
"	24.82	7.30	"
"	27.9	5.85	"
"	35.22	3.49	" + Mn1
"	37.3	0.0	Mn1
55	10.50	15.91	K_2SO_4 + 1.1.2
"	16.71	12.83	1.2 + "
"	33.6	3.1	" + Mn1
66	8.63	16.75	K_2SO_4 + 1.1.2
"	11.35	14.77	1.2 + "
80	0.0	17.92	K_2SO_4
"	3.98	18.60	"
"	5.41	18.40	"
"	5.84	18.40	" + 1.2
"	6.16	17.13	1.2
"	6.92	13.80	"
"	8.81	10.82	"
"	14.57	6.66	"
"	16.65	6.19	"
"	20.42	4.85	"
"	29.58	2.61	" + Mn1
"	30.24	0.0	Mn1
97	0.0	19.42	K_2SO_4
"	2.09	19.78	"
"	3.63	19.89	" + 1.2
"	4.05	16.84	1.2
"	4.31	12.80	"
"	5.46	9.68	"
"	7.08	7.25	"
"	11.65	6.00	"
"	17.0	4.18	"
"	25.92	2.48	" + Mn1
"	28.49	0.0	Mn1

1.1.2 = $MnSO_4.K_2SO_4.2H_2O$; 1.1.4 = $MnSO_4.K_2SO_4.4H_2O$; 1.2 = $K_2SO_4.2MnSO_4$
Mn1 = $MnSO_4.H_2O$; Mn5 = $MnSO_2.5H_2O$.

SOLUBILITY OF MANGANESE SULFATE IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE AT 25° AND VICE VERSA. (Caven and Johnston, 1926.)

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
$MnSO_4$.	K_2SO_4.		$MnSO_4$.	K_2SO_4.	
39.10	0.0	$MnSO_4.4H_2O$	35.58	4.30	1.1.4
39.03	0.43	"	30.47	5.27	"
38.54	1.87	"	19.27	10.06	"
38.42	2.46	"	16.58	12.31	" $+K_2SO_4$
38.21	3.03	"	15.22	12.04	K_2SO_4
37.92	4.15	" +1.1.4	6.36	11.27	"
37.28	4.20	1.1.4	0.00	12.59	"

1.1.4 = $MnSO_4.K_2SO_4.4H_2O$.

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS AMMONIA SOLUTIONS AT 20°.

(Girard, 1885.)

Gms. NH_3 per 100 cc. solution	0	6.086	15.37	24.69	31.02
Gms. K_2SO_4 per 100 cc. solution	10.80	4.10	0.83	0.14	0.04

One liter sat. solution in water contains 105.7 gms. K_2SO_4 at 20°.
One liter sat. solution in 5.2% NH_3 contains 45.2 gms. K_2SO_4 at 20°.

(Konowalow, 1899b.)

EQUILIBRIUM IN THE SYSTEM AMMONIUM SULFATE + POTASSIUM SULFATE + WATER. (Weston, 1922.)

Results at 25°.				Results at 30°.			
Gms. per 100 gms. sat. sol.		Gms. per 100 gms. Solid Phase.		Gms. per 100 gms. sat. sol.		Gms. per 100 gms. Solid Phase.	
K_2SO_4.	$(NH_4)_2SO_4$.	K_2SO_4.	$(NH_4)_2SO_4$.	K_2SO_4.	$(NH_4)_2SO_4$.	K_2SO_4.	$(NH_4)_2SO_4$.
0.0	43.5	0.0	100	0.0	44.2	0.0	100.0
1.83	40.9	12.0	86	1.2	42.7	3.3	96.7
3.09	38.6	28	72	2.4	40.9	12.2	87.8
4.00	37.0	40	60	4.1	37.8	28.7	71.3
4.40	35.1	53	47	5.9	33.5	43.6	56.4
5.42	31.4	69	31	6.4	31.0	61.3	38.7
7.35	22.3	84	16	9.1	18.5	74.2	25.8
9.52	10.7	94	6	10.7	8.4	98.2	1.8
10.70	0.0	100	0	11.2	0.0	100.0	0.0

The solid phase at both temperatures consists of a continuous series of mixed crystals. The author also gives complete data for the quarternary system $(NH_4)_2SO_4 + MgSO_4 + K_2SO_4 + H_2O$. The results are expressed in terms of the H_2O required for the solution of 100 gm. quantities of various mixtures of the three salts.

SOLUBILITY OF MIXED CRYSTALS OF POTASSIUM SULFATE AND AMMONIUM SULFATE AT 25°.

(Fock, 1897.)

Grams per Liter.		Milligram Mols. per Liter.		Mol. per cent K_2SO_4 in Solution.	Sp. Gr. of Solution.	Mol. per cent K_2SO_4 in Solid Phase.
K_2SO_4.	$(NH_4)_2SO_4$.	K_2SO_4.	$(NH_4)_2SO_4$.			
127.9	0.0	734	0.0	100	1.086	100
135.7	115.7	778.5	874.6	47.1	1.149	91.28
84.20	281.1	483	2126	18.5	1.200	80.05
59.28	355.0	340	2685	11.13	1.226	68.63
40.27	482.7	231	3650	5.98	1.246	27.53
0.00	542.3	0.0	4100	0.00	1.245	0.00

Results are also given for 14°, 15°, 16°, 30°, 46°, and 47°.

EQUILIBRIUM IN THE SYSTEM POTASSIUM SULFATE, AMMONIUM SULFATE AND WATER AT 0° AND AT 50°.

(Janecke, 1929.)

Results at 0°		Results at 50°	
Gm. Mol. Percent $(NH_4)_2SO_4$ in dissolved K_2SO_4 + $(NH_4)_2SO_4$	Gm. Mols. H_2O to dissolve 100 gms. Mols. Salt mixture	Gm. Mol. Percent $(NH_4)_2SO_4$ in dissolved K_2SO_4 + $(NH_4)_2SO_4$	Gm. Mols. H_2O to dissolve 100 gms. Mols. Salt mixture
100	100	100	75
90	130	90	85
80	185	80	100
70	250	70	120
60	335	60	145
50	430	50	780
0	1160	0	535

The solid phases consist of a series of mixed crystals containing the two salts in a continuous ratio.

The author also gives results for the quarternary systems in the reciprocal salt pair $K_2SO_4 + 2NH_4SO_4 \rightleftarrows 2KNO_3 + (NH_4)_2SO_4$ at 0°, 25° & 50°. Similar data for the reciprocal salt pair $[K_2(NH_4)_2][SO_4,CrO_4]$ at 25° are given by Ishikawa, 1926.)

SO

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE.

Results at 25°. (Smith and Ball, 1917.)		Results at 34° and at 60° (Nacken, 1910.)				
Gms. per 100 Gms. H_2O.		Gms. per 100 Gms. Sat. Sol at 34°.		Gms. per 100 Gms. Sat. Sol at 60°.		Solid Phase at 34° and at 60°.
Na_2SO_4.	K_2SO_4.	Na_2SO_4.	K_2SO_4.	Na_2SO_4.	K_2SO_4.	
0	12.05	0	11.9	0	15.3	K_2SO_4
1.78	12.33	7.1	10.7	6.6	13.9	" +Glaserite
3.58	12.65	31.4	4.3	27.1	8.2	Na_2SO_4+Mix crystals
5.38	12.89	33.1	0	31.3	0	Na_2SO_4
7.19	13.12					

Additional data for the above system at 15°, 25°, 40°, 50°, 60°, 70° and 80° are given by Okada (1914). The results show that potassium and sodium sulfates form a double salt of the composition $K_3Na(SO_4)_2$. This double salt dissolves sodium sulfate as a solid solution but not potassium sulfate.

EQUILIBRIUM IN THE SYSTEM POTASSIUM SULFATE, SODIUM SULFATE AND WATER.

(Hamid, 1926.)

Constant stirring for about 40 hrs. at 25° and 10 hrs. at 90° was employed.

	Gms. per 100 gms. sat. sol.		
t°.	Na_2SO_4.	K_2SO_4	Solid Phase.
25......	19.93	7.06	$Na_2SO_4.10H_2O$ + Mixed crystals of $K_3Na(SO_4)_2$ + Na_2SO_4
25......	5.58	11.27	K_2SO_4 + $K_3Na(SO_4)_2$
90......	27.05	8.33	Na_2SO_4 + Mixed crystals of $K_3Na(SO_4)_2$ + Na_2SO_4
90......	9.23	14.97	K_2SO_4 + $K_3Na(SO_4)_2$

The above results at 25° are taken from Meyerhoffer and Saunders, 1899.

POTASSIUM SULFATE

EQUILIBRIUM IN THE SYSTEM POTASSIUM SULFATE, AMMONIUM SULFATE AND WATER AT VARIOUS TEMPERATURES.

(Bovalini and Fabris, 1936.)

Gms. per 100 gms. sat. solution		Wt. % K_2SO_4 in Mixed Crystals composing Solid Phase
K_2SO_4	$(NH_4)_2SO_4$	
Results at -3.3°		
6.802	6.201	95.6
Results at -13.63°		
4.448	30.54	83.15
Results at -17.82°		
2.568	36.46	33.9
Results at -18.76°		
1.447	38.29	6.32
Results at 0°		
6.513	7.222	99.1
6.429	12.894	97.8
6.010	18.98	96.1
5.245	25.23	90.1
4.790	30.71	72.8
3.925	31.69	71.6
2.928	35.21	52.0
2.688	36.99	32.7
2.431	38.82	11.6
0.852	40.90	5.1
Results at 35°		
11.80	5.450	99.5
9.651	13.42	89.1
9.072	19.41	80.9
7.134	28.50	72.3
5.468	34.32	63.6
3.860	38.60	54.1
2.191	42.22	26.0
0.698	43.30	5.2

Gms. per 100 gms. sat. solution		Wt. % K_2SO_4 in Mixed Crystals composing Solid Phase
K_2SO_4	$(NH_4)_2SO_4$	
Results at 50°		
13.27	6.09	98.9
10.05	19.67	89.6
7.5	29.06	81.6
6.09	35.54	70.9
5.49	36.35	64.2
4.41	39.91	40.0
3.652	40.03	33.0
0.790	45.23	4.1
0.580	45.49	1.6
Results at 70°		
16.04	4.58	98.7
14.61	9.64	97.2
11.98	20.01	92.2
9.28	27.65	82.8
7.149	34.14	73.9
5.061	39.49	53.0
3.23	43.21	36.8
1.19	45.66	11.1
Results at 96.5°		
17.56	11.82	93.6
9.59	32.30	69.5
7.04	39.23	47.8
Result at 103.6° (b.pt.)		
17.10	12.62	86.2
Result at 106.7° (b.pt.)		
8.62	37.23	49.2
Result at 107.2° (b.pt.)		
6.69	42.53	35.0

SO

---

* Congealing temperature with ice.

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE AT 25° AND VICE VERSA.

(Salstrom and Smith, 1930.)

Gms. per 100 gms. H_2O		Solid Phase	Gms. per 100 gms. H_2O		Solid Phase
Na_2SO_4	K_2SO_4		Na_2SO_4	K_2SO_4	
0.0	12.05	K_2SO_4	27.75	0.0	$Na_2SO_4.10H_2O$
2.842	12.485	"	29.574	3.486	"
5.684	12.943	"	31.632	6.759	"
7.92	12.33	$5K_2SO_4.2Na_2SO_4$	32.53	8.288	"
10.63	11.37	"			

EQUILIBRIUM IN THE SYSTEM POTASSIUM SULFATE, SODIUM SULFATE AND WATER AT VARIOUS TEMPERATURES.

(Cornec and Krombach, 1928, 1929.)

SO

t°	d. of sat. sol.	Gms. per 100 gms. sat. solution		Solid Phase
		Na_2SO_4	K_2SO_4	
0	1.120	5.26	7.75	K_2SO_4 + Na10
1.8	1.120	5.4	7.8	" + "
10	1.160	9.75	7.53	Gl + "
"	1.128	5.40	8.99	" + K_2SO_4
20	1.228	17.24	6.94	" + Na10
"	1.139	5.51	10.33	" + K_2SO_4
28	1.314	26.26	5.49	" + Na10
"	1.144	5.47	11.37	" + K_2SO_4
30.9	1.363	31.07	4.80	" + Na
34.0	1.357	30.73	5.03	" + "
50	1.339	29.40	5.85	" + "
"	1.157	5.68	13.77	" + K_2SO_4
75	1.322	27.84	7.38	" + Na
"	1.167	5.64	16.43	" + K_2SO_4
100	1.315	26.97	9.15	" + Na
"	1.173	5.52	18.80	" + K_2SO_4

Na = Na_2SO_4; Na10 = $Na_2SO_4.10H_2O$; Gl = Glaserite; $3K_2SO_4.Na_2SO_4$, a double salt capable of dissolving Na_2SO_4 but not K_2SO_4 to form solid solutions (mixed crystals) with a variation in content of K_2SO_4 from 78.6 to 61.8 percent.

These authors also give data for equilibrium in water, including densities, of potassium and sodium sulfates and nitrates at 50° to 90°.

Complete experimental data for equilibrium in aqueous solutions of mixtures of potassium and sodium sulfates, nitrates and chlorides (including densities) at temperatures between 0° and 90° are given by Cornec and Krombach, 1929 and Cornec, Krombach and Spack, 1930. These authors have made use, whenever necessary, of the results for ternary and quaternary systems previously reported from their own laboratory or by others, including Cretien, 1929; Cornec and Hering, 1925-7; Cornec and Krombach, 1929; Meyerhoffer and Saunders, 1899; d'Ans 1915 and Blasdale, 1918.

Data for the system K_2SO_4 + Na_2SO_4 + K_2CO_3 + Na_2CO_3 at 35°, 50° & 75° are given by Teeple, 1929.

EQUILIBRIUM IN THE SYSTEM POTASSIUM SULFATE, NICKEL SULFATE AND WATER AT DIFFERENT TEMPERATURES.

(Benrath, 1932.)

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms. sat. sol.		Solid Phase
	K_2SO_4	$NiSO_4$			K_2SO_4	$NiSO_4$	
0	6.80	0.14	K_2SO_4 + 1.1.6	40	2.08	33.35	$NiSO_4.6H_2O$ + 1.1.6
"	1.09	21.62	$NiSO_4 7H_2O$+1.1.6	55	14.76	1.2	K_2SO_4 + 1.1.6
25	1.18	29.52	" " "	"	2.30	35.0	$NiSO_4.6H_2O\beta$ + 1.1.6
30	1.30	32.4	" "+	88	2.99	41.19	" "
			$NiSO_4.6H_2O\alpha$	100	20.21	5.19	K_2SO_4 + 1.1.6
40	13.15	0.51	K_2SO_4 + 1.1.6	"	3.60	42.3	$NiSO_4.6H_2O\beta$ + 1.1.6

1.1.6 = $K_2SO_4.NiSO_4.6H_2O$

SOLUBILITY OF MIXTURES OF POTASSIUM AND LEAD SULFATES AND OF POTASSIUM AND STRONTIUM SULFATES IN WATER.

(Barre, 1909.)

Results for $K_2SO_4 + PbSO_4$.			Results for $K_2SO_4 + SrSO_4$.		
t°.	Gms. K_2SO_4 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. K_2SO_4 per 100 Gms. Sat. Sol.	Solid Phase.
7	0.56	$PbSO_4.K_2SO_4$	17.5	1.27	$K_2SO_4.SrSO_4+SrSO_4$
17	0.62	"	50	1.88	"
50	1.09	"	75	2.71	"
75	1.37	"	100	3.90	"
100	1.69	"			

SO

EQUILIBRIUM IN THE SYSTEM POTASSIUM SULFATE, PRASEODIMIUM SULFATE AND WATER AT 25°.

(Restaino, 1934.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$Pr_2(SO_4)_3$	K_2SO_4		$Pr_2(SO_4)_3$	K_2SO_4	
—	4.07	$5K_2SO_4.Pr_2(SO_4)_3.H_2O$	0.32	0.88	$3K_2SO_4.Pr_2(SO_4)_3.2H_2O$
—	4.01	"	0.40	0.67	$3K_2SO_4.2Pr_2(SO_4)_3.8H_2O$
—	3.20	$4\frac{1}{2}K_2SO_4.Pr_2(SO_4)_3$	0.52	0.34	—
0.16	1.47	$4K_2SO_4.Pr_2(SO_4)_3.H_2O$	1.87	0.27	$K_2SO_4.Pr_2(SO_4)_3.2H_2O$
0.18	1.03	$3K_2SO_4.Pr_2(SO_4)_3.2H_2O$	2.63	0.19	—

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS SOLUTIONS OF ZINC SULFATE AND VICE VERSA AT 25°. (Caven and Johnston, 1926.)

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
K_2SO_4.	$ZnSO_4$		K_2SO_4.	$ZnSO_4$.	
10.59	0.0	K_2SO_4	2.27	33.01	$K_2SO_4.ZnSO_4.6H_2O$
10.71	1.11	»	1.95	35.58	»
10.94	1.91	»$+K_2SO_4.ZnSO_4.6H_2O$	1.82	36.00	»
6.52	4.73	$K_2SO_4.ZnSO_4.6H_2O$	1.85	36.39	»$+ZnSO_4.7H_2O$
5.99	5.40	»	1.44	36.42	$ZnSO_4.7H_2O$
3.19	25.11	»	0.0	36.61	»

EQUILIBRIUM IN THE SYSTEM POTASSIUM SULFATE, ZINC SULFATE AND WATER AT VARIOUS TEMPERATURES.

(Benrath, 1930.)

t°	Gms. per 100 gms. sat. sol.		Solid Phase
	$ZnSO_4$	K_2SO_4	
0	0.0	6.88	K_2SO_4 + 1.1.6
"	3.68	2.91	1.1.6
"	29.83	0.99	1.1.6 + $ZnSO_4.7H_2O$
12	0.37	9.69	K_2SO_4 + 1.1.6
"	32.60	1.82	1.1.6 + $ZnSO_4.7H_2O$
41	3.18	13.78	K_2SO_4 + 1.1.6
"	40.30	2.50	1.1.6 + $ZnSO_4.6H_2O$
50	4.34	14.28	K_2SO_4 + 1.1.6
"	43.20	2.15	1.1.6 + $ZnSO_4.6H_2O$
68	39.90	4.20	" + $ZnSO_4.H_2O$
80	0.0	17.55	K_2SO_4
"	2.07	17.87	"
"	8.48	18.17	"
"	11.80	18.24	"
"	13.46	17.77	"
"	13.67	18.14	" + 1.1.6
"	14.32	16.91	1.1.6
"	16.29	14.36	"
"	21.04	13.15	"
"	23.00	12.17	"
80	27.30	10.26	1.1.6
"	31.00	8.60	"
"	36.84	6.51	"
"	38.38	6.60	" + $ZnSO_4.H_2O$
"	38.62	6.02	$ZnSO_4.H_2O$
"	38.92	3.59	"
"	40.56	0.0	"
100	0.0	19.42	K_2SO_4
"	9.05	20.50	"
"	10.16	21.43	"
"	23.18	20.07	" + 1.1.6
"	24.96	19.13	1.1.6
"	24.40	18.85	"
"	25.82	17.69	"
"	30.62	15.08	"
"	36.70	13.51	" + $ZnSO_4.H_2O$
"	36.95	7.15	$ZnSO_4.H_2O$
"	38.85	2.23	"
"	37.71	0.0	"

1.1.6 = $K_2SO_4.ZnSO_4.6H_2O$.

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS SOLUTIONS OF URANYL SULFATE AND VICE VERSA AT 25°.

(Colani, 1928.)

Gms. per 100 gms. sat. solution		Solid Phase
UO_2SO_4	K_2SO_4	
0.0	10.40	K_2SO_4
0.91	10.67	"
1.59	11.02	"
2.39	11.17	"
2.41	9.01	$K_2(UO_2)(SO_4)_2.2H_2O$
2.43	7.31	"
4.73	3.50	"
9.91	2.69	"
31.69	1.91	$K_2(UO_2)(SO_4)_2.2H_2O$
35.97	1.79	"
39.73	1.77	"
51.70	0.71	$K_2(UO_2)_2(SO_4)_3.5H_2O$
59.20	0.54	"
61.50	0.45	"
61.25	0.23	$UO_2SO_4.3H_2O$
61.18	0.0	"

Solubility of Potassium Sulfate in Aqueous Alcohol.

(Gerardin, 1865; Schiff, 1861.)

In Aq. Alcohol of 0.939 Sp. Gr. = 40 Wt. %.

t°.	Gms. K_2SO_4 per 100 Gms. Alcohol.
40	0.16
80	0.21
60	0.92

In Alcohol of Different Strengths at 15°.

Weight per cent Alcohol.	Gms. K_2SO_4 per 100 Gms. Sat. Sol.
10	3.90
20	1.46
30	0.56
40	0.21

Solubility of Potassium Sulfate in Aqueous Alcohol at 25°.

(Fox and Gauge, 1910.)

Gms. per 100 Gms. Sat. Solution.		
K_2SO_4.	C_2H_5OH.	H_2O.
9.17	1.35	89.48
6.90	4.80	88.30
4.96	7.80	87.24
4.32	9.70	85.98
3.57	12.34	84.09
2.71	14.51	82.78

Gms. per 100 Gms. Sat. Solution.		
K_2SO_4.	C_2H_5OH.	H_2O.
2.66	15.26	82.08
1.83	20.50	77.67
0.97	26.91	72.12
0.41	35.97	63.62
0.22	43.90	55.88
0.016	69.26	30.72

Solubility of Potassium Sulfate at 25° (Fox and Gauge, 1910.) in:

Aqueous Chloral Hydrate Solutions.

Gms. per 100 Gms. Sat. Solution.		
K_2SO_4.	$CCl_3CH(OH)_2$.	H_2O
9.13	6.44	84.43
8.41	9.09	82.50
7.79	12.38	79.83
7.31	13.20	79.49
5.88	22.07	72.05
4.54	33.15	62.31
3.36	44.40	52.24
2.92	47.30	49.78
2	62.82	35.18
1.75	70.28	27.97
1.40	80.36	18.24
1.08	85.26	13.66

Aqueous Glycerol Solutions.

Gms. per 100 Gms. Sat. Solution.		
K_2SO_4.	$(CH_2OH)_2CHOH$.	H_2O.
8.87	8.96	82.17
7.69	13.36	78.95
6.47	20.34	73.19
5.83	24.15	70.02
4.44	33.73	61.83
3.65	40.40	55.95
3.38	43.52	53.10
2.69	50.18	47.13
2.07	57.22	40.71
1.53	67.94	30.53
0.98	78.18	20.84
0.73	98.28	0.99

Solubility of Potassium Sulfate at 25° (Fox and Gauge, 1910.) in:

Aqueous Acetone Solutions.

Gms. per 100 Gms. Sat. Solution.		
K_2SO_4.	$(CH_3)_2CO$.	H_2O.
7.20	4.92	87.88
5.02	10.06	84.92
2.96	16.23	80.81
1.50	24.31	74.19
0.47	37.19	62.34
0.20	46.29	53.51
0.03	62.40	37.57

Aqueous Pyridine Solutions.

Gms. per 100 Gms. Sat. Solution.		
K_2SO_4.	$CH<(CH.CH)_2>N$.	H_2O.
7.95	4.23	87.82
4.77	13.90	81.33
2.75	24.51	72.74
1.47	34.19	64.34
0.45	46.29	53.26
0.12	55.93	43.95
0.006	75.90	24.09

SOLUBILITY OF POTASSIUM SULFATE AT 25° (Fox and Gauge, 1910.) IN:

Aqueous Ethylene Glycol Solutions.

Gms. per 100 Gms. Sat. Solution.

K_2SO_4.	$(CH_2OH)_2$.	H_2O.
9.67	3.16	87.17
7.69	9.79	82.53
5.74	18.47	75.79
3.57	32.11	64.32
1.83	49.03	49.14

Aqueous Mannitol Solutions.

Gms. per 100 Gms. Sat. Solution.

K_2SO_4.	$(CHOH)_4(CH_2OH)_2$.	H_2O.
10.32	3.20	86.48
9.61	8.35	82.04
9.19	11.26	79.55
8.66	14.30	77.04
8.35	17.22	74.43

SOLUBILITY OF POTASSIUM SULFATE AT 25° IN:

Aq. Sucrose Solutions.
(Fox and Gauge, 1910.)

Gms. per 100 Gms Sat. Solution.

K_2SO_4.	$C_{12}H_{22}O_{11}$.	H_2O.
9.65	9.56	80.79
8.65	18.55	72.80
7.42	28.16	64.42
6.35	37.24	56.41
5.21	47.55	47.24
4.24	57	38.76

Aq. Potassium Acetate Solutions.
(Fox, 1909.)

Gms. per 100 Gms. Sat. Solution.

K_2SO_4.	CH_3COOK.	H_2O.
6.65	6.11	87.24
5.09	8.68	86.23
3.99	11.29	84.72
2.35	15.59	82.06
1.23	20.12	78.65
0.39	29.95	69.66

100 gms. glycerol of $d = 1.255$ dissolve 1.316 gms. K_2SO_4 at ord. temp. (Vogel, 1867.)

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS ACETIC ACID AND IN AQUEOUS PHENOL SOLUTIONS AT 25°.

(Rothmund and Wilsmore, 1902.)

In Aq. Acetic Acid.

Mols. per Liter.		Grams per Liter.	
CH_3COOH.	K_2SO_4	CH_3COOH.	K_2SO_4.
0.0	0.6714	0.0	117.0
0.07	0.6619	4.2	115.4
0.137	0.6559	8.22	114.4
0.328	0.6350	19.68	110.8
0.578	0.6097	34.68	106.3
1.151	0.5556	69.06	96.87
2.183	0.4743	128.58	82.70

In Aq. Phenol.

Mols. per Liter.		Grams per Liter.	
C_6H_5OH.	K_2SO_4	C_6H_5OH.	K_2SO_4.
0.0	0.6714	0.0	117.0
0.032	0.6598	3.01	115.0
0.064	0.6502	6.02	113.3
0.127	0.6310	11.94	110.0
0.236	0.6042	22.19	105.3
0.308	0.5834	28.97	101.7
0.409	0.5572	38.46	97.2
0.464	0.5480	43.63	95.5
0.498 (sat.)	0.5377	46.82	93.8

100 gms. water dissolve 10.4 gms. K_2SO_4 + 219 gms. sugar at 31.25°, or 100 gms. sat. solution contain 3.18 gms. K_2SO_4 + 66.74 gms. sugar. (Köhler, 1897.)

100 gms. 95% formic acid dissolve 36.5 gms. K_2SO_4 at 21°. (Aschan, 1913.)

100 gms. 95% formic acid dissolve 14.6 gms. $KHSO_4$ at 19.3°. "

100 cc. anhydrous hydrazine dissolve 5 gms. K_2SO_4 at room temp. (Welsh and Broderson, 1915.)

100 gms. hydroxylamine dissolve 3.5 gms. K_2SO_4 at 17–18°. (de Bruyn, 1892.)

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS SOLUTIONS OF METHYL ALCOHOL AT 25°.

(Akerlof and Turck, 1935.)

Wt. Percent CH_3OH in Aq. Solvent	Gm. Mols. K_2SO_4 per 1000 gms. Aq. Solvent	Wt. Percent CH_3OH in Aq. Solvent	Gm. Mols. K_2SO_4 per 1000 gms. Aq. Solvent
0.0	0.6905	29.99	0.0536
9.7	0.3049	40.10	0.0221
15.09	0.1933	59.94	0.00342
21.30	0.1134		

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS ETHYL ALCOHOL.

(Wright, 1927.)

t°	Wt. Percent C_2H_5OH in Aq. Solvent	Gms. K_2SO_4 per 100 gms. Aq. Solvent
20	50.0	0.14
100	50.0	0.51

SO

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS SOLUTIONS OF VARIOUS COMPOUNDS AT 25°.

(Weber, 1929.)

Aqueous Solution of:	Gm. Mols. K_2SO_4 per liter in Aq. Solution of:			
	0.125 Normality	0.25 Normality	0.5 Normality	1.0 Normality
Water alone	0.5562	0.5562	0.5562	0.5562
Cane Sugar	0.5537	0.5555	0.5532	0.5430
Mannite	0.5518	0.5538	0.5496	0.5421
Methyl Alcohol	0.5415	0.5295	0.5000	0.4518
Acetonitrile	0.5398	0.5259	0.4381	0.4332
Ethyl Alcohol	0.5356	0.5187	0.4783	0.4023
Acetone	0.5313	0.5086	0.4574	0.3827
Methyl Acetate	0.5408	0.5249	0.4938	0.4336
Propyl Alcohol	0.5311	0.5068	0.4577	0.3861
Methyl Ethyl Ketone	0.5308	0.5030	0.4545	0.3744
Diethyl Amine	0.5293	0.5040	0.4623	0.3662
Phenol	0.5291	0.5030	0.4556	--
Aniline	0.5224	0.5079 (1)	—	—
Paraldehyde	0.5229	0.4931	0.4287	—
Ethyl Acetate	0.5365	0.5186	0.4828	—
Butyric Acid	0.5410	0.5292	0.5055	0.4618
Ter. Amyl Alcohol	0.5178	0.4797	0.4141	0.3153
Valerianic Acid	0.5392	0.5236	—	—
Iso Amyl Alcohol	0.5158	0.5065 (2)	—	—
Hexyl Alcohol	0.5476 (3)	0.5407 (4)	—	—

(1) = 0.2 Normality instead of 0.25; (2) = 0.185 Normality instead of 0.25; (3) = 0.0208 Normality instead of 0.125; (4) = 0.0416 Normality instead of 0.25.

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS SOLUTIONS OF ETHYLENE GLYCOL AT 30°.

(Trimble, 1931.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		d. of sat. sol.	Gms. per 100 gms. sat. sol.	
	CH_2OHCH_2OH	K_2SO_4		CH_2OHCH_2OH	K_2SO_4
1.0881	0.0	11.14	1.0646	38.58	2.41
1.0812	4.21	9.84	1.0708	49.75	1.45
1.0737	9.01	8.11	1.0823	65.62	0.63
1.0651	18.64	5.66	1.1060	100.00	0.00
1.0627	28.91	3.67			

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS SOLUTIONS OF URETHAN AT 25°.

(Pallitsach, 1928, 1929.)

Gm. Mols. per 1000 gms. H_2O		Solid Phase
K_2SO_4	$NH_2COOC_2H_5$	
0.690	0.0	K_2SO_4
0.468	1.1225	"
0.026	23.49	"
0.016	50.45	"

SO

SOLUBILITY OF SOME POTASSIUM DOUBLE SULFATES IN WATER AT 25°.

(Locke, 1902.)

Double Salt.	Formula.	Gms. Anhydrous Salt per 100 Gms. H_2O.
Potassium Cobalt Sulfate	$K_2Co(SO_4)_2.6H_2O$	12.88
" Copper "	$K_2Cu(SO_4)_2.6H_2O$	11.69
" Nickel "	$K_2Ni(SO_4)_2.6H_2O$	6.88
" Zinc "	$K_2Zn(SO_4)_2.6H_2O$	13.19

SOLUBILITY OF POTASSIUM NICKEL SULFATE AND ALSO OF POTASSIUM ZINC SULFATE IN WATER, EACH SEPARATELY DETERMINED AT DIFFERENT TEMPERATURES.

t°.	Gms. per 100 Gms. H_2O.		t°.	Gms. per 100 Gms. H_2O.	
	$K_2Ni(SO_4)_2.6H_2O$.	$K_2Zn(SO_4)_2.6H_2O$.		$K_2Ni(SO_4)_2.6H_2O$.	$K_2Zn(SO_4)_2.6H_2O$.
0	6	13	40	23	45
10	9	19	50	28	56
20	14	26	60	35	72
25	16	30	70	43	88
30	18	35			

SOLUBILITY OF POTASSIUM NICKEL SULFATE IN WATER.

(Lattey, 1928.)

t°	Gms. $K_2Ni(SO_4)_2$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $K_2Ni(SO_4)_2$ per 100 gms. sat. sol.	Solid Phase
0	3.26	$K_2Ni(SO_4)_2.6H_2O$	40	8.97	$K_2Ni(SO_4)_2.6H_2O$
10	4.31	"	50	11.02	"
15	4.93	"	60	13.33	"
20	5.61	"	70	15.88	"
25	6.36	"	80	18.68	"
30	7.17	"	90	21.74	"
			100	25.04	"

100 gms. H_2O sat. with Potassium Neodymium Sulfate, $KNd(SO_4)_2.H_2O$, contain 1.7 gm. $KNd(SO_4)_2$ at 0° and 1.3 gms. at 20°. (Meyer and Kittlemann, 1931.)

One liter sat. solution of Potassium Zinc Sulfate in Water contains 85.94 gms. $K_2Zn(SO_4)_2$ at 6.8°. (Haber-Chuwis, 1926.)

Fusion-point data are given for the following mixtures:

$K_2SO_4 + H_2SO_4$	(Kendall and Landon, 1920; Cambi and Bozza, 1923.)
$KHSO_4 + K_2S_2O_7$	(Cambi and Bozza, 1923.)
$K_2SO_4 + K_2WO_4$	(Amadori, 1913.)
" $+ NH_4NO_3$	(Bowen, 1926.)
" $+ NaCl$	(Sackur, 1911-12.)
" $+ Na_2SO_4$	(Jänecke, 1908; Nacken, 1907 (b)(c); Sackur, 1911-12.)
" $+ RbCl$	(Dombrovskaya, 1933.)
" $+ Rb_2SO_4$	" "
" $+ SrSO_4$	(Grahmann, 1913; Calcagni, 1912, 1912a.)

POTASSIUM Ethyl **SULFATE** $K(C_2H_5)SO_4$.

SOLUBILITY IN WATER.

(Illingworth and Howard, 1884.)

t°.	Gms. $K(C_2H_5)SO_4$ per 100 Gms. Sat. Sol.
−14.2	45.01
0	53.71
+15	62.35

80

SOLUBILITY OF POTASSIUM ETHYL SULFATE, POTASSIUM METHYL SULFATE AND OF POTASSIUM AMYL SULFATE IN WATER, DETERMINED BY THE FREEZING-POINT METHOD.

(Illingworth and Howard, 1884.)

Results for $K(C_2H_5)SO_4 + H_2O$.

t°. of Solidification.	Gms. $K(C_2H_5)SO_4$ per 100 Gms. Sol.	Solid Phase.
− 2.2	10	Ice
− 4.9	20	"
− 8.2	30	"
−12.1	40	"
−14.2	45.01	"$+K(C_2H_5)SO_4$
− 6	50	$K(C_2H_5)SO_4$
0	53.71	"
+15	62.35	"

Results for $K(CH_3)SO_4 + H_2O$.

t° of Solidification.	Gms. $K(CH_3)SO_4$ per 100 Gms. Sol.	Solid Phase.
− 2.3	10	Ice
− 3.6	15	"
− 5	20	"
− 8	30	"
−11.8	39.84	" $+K(CH_3)SO_4$
−11.5	40	$K(CH_3)SO_4$
0	47.1	"
+12.3	54.8	"

Results for $K(C_5H_{11})SO_4 + H_2O$.

t° of Solidification.	Gms. $K(C_5H_{11})SO_4$ per 100 Gms. Sol.	Solid Phase.
− 1.9	10	Ice
− 4.3	20	"
− 5.4	24	"
		$+K(C_5H_{11})SO_4$
− 4.8	25	$K(C_5H_{11})SO_4$
0	33.44	"
+17.3	59.46	"

100 gms. methyl alcohol dissolve 1.72 gms. Potassium ethyl sulfate at 15° and 13.87 gms. at the b. pt. (65.8°). (Henstock, 1934.)

SOLUBILITY OF POTASSIUM ETHYL SULFATE IN MIXTURES OF METHYL ALCOHOL AND ACETONE AT 20°.

(Henstock, 1934.)

The results are given only in the form of a diagram from which the following approximate values were read.

Percent Acetone in Mixed Solvent	Gms. $K(C_2H_5)SO_4$ per 100 gms. Solvent	Percent Acetone in Mixed Solvent	Gms. $K(C_2H_5)SO_4$ per 100 gms. Solvent
0 (=CH_3OH)	2.2	60	2.25
10	2.55	70	1.75
20	2.8	80	1.25
30	2.95	90	0.70
40	2.8	100 (=CH_3COCH_3)	0.0

POTASSIUM Ethyl **SULFATE** $KC_2H_5.SO_4$ α and β forms.

SOLUBILITY OF POTASSIUM ETHYL SULFATE IN WATER. (Hammick and Mullaby, 1921.)

This compound is dimorphous. On crystallizing from methyl alcohol or water there first appear tufts of long feathery crystals which redissolve as the solution cools and give place to the ordinary foliated form. Analysis showed no difference in composition between the two forms. The temperatures were determined at which the edges of crystals, present in synthetic mixtures contained in sealed tubes, changed from rounded to sharp or vice versa. No matter at what temperature crystallization occurred the unstable β form was always the first to separate. It was easy to distinguish which solid phase was present at the different temperatures. The transition point was found to be at 51°.8. The ice curve was determined by the freezing-point method.

t°.	Gms $KC_2H_5SO_4$ per 100 gms. sat. sol.	Solid Phase.
— 1.195	5.480	Ice
— 1.142	6.37	»
— 2.130	9.434	»
— 2.98	12.953	»
— 3.22	13.770	»
— 4.93	19.808	»
— 6.68	25.953	»
— 9.55	33.714	»
—12.9 (eutec.)	-	» + α form
—15.2 »	-	» + β »

t° of solution for α form.	t° of solution for β form.	Gms. $KC_2H_5SO_4$ per 100 gms. sat. sol.
— 4.5	—13.5	49.5
— 1.9	-	51.946
+ 8.7	— 5.2	58.81
21.0	+12.1	66.6
26.0	20.1	70.015
35.0	32.0	75.29
39.9	38.2	77.99
45.5	45.0	80.084
51.14	51.1	82.04
59.46		84.44
65.8		85.47
69.1		86.23
81.3		87.94
91.2		89.62

POTASSIUM N-Phenyl β Amino Ethyl Hydrogen **SULFATE** $C_6H_5NH.C_2H_4.O.SO_3.K$.

100 cc. sat. sol. of the above compound in water contain 23.0 gms. $C_6H_5NH.C_2H_4.OSO_3.K$ at 15°. (Saunders, 1922.)

POTASSIUM Phenyl **SULFATE**, $C_6H_5O_4SK$, etc,

SOLUBILITY OF EACH SEPARATELY IN WATER AND ALCOHOL.
(Burkhardt and Lapworth, 1926.)

Compound.	Formula.	Solvent.	t°.	Gms cmpd. per 100 gms. H_2O.
Potassium phenyl sulfate	$C_6H_5O_4SK$	Water	17	16.28
» » »	»	Alcohol	17	0.704
» *m* carboxy phenyl sulfate.	$C_7H_5O_6SK$	Water	17	3.2
» α naphthyl »	$C_{10}H_7O_4SK$	»	17	2.5
» β » »	$C_{10}H_7O_4SK.4H_2O$	»	17	1.43

POTASSIUM Per**SULFATE** $K_2S_2O_8$.

SOLUBILITY IN WATER.
(Tarugi, 1904.)

t°.	Gms. $K_2S_2O_8$ per 100 cc. Sat. Sol.	t°.	Gms. $K_2S_2O_8$ per 100 cc. Sat. Sol.	t°.	Gms. $K_2S_2O_8$ per 100 cc. Sat. Sol.
0	1.620	15	3.140(3.7)	30	7.190(7.7)
5	2.156	20	4.490	35	8.540
10	2.600	25	5.840	40	9.890

The results in parentheses are the averages of a large number of determinations by Pajetta (1906). This investigator employed constant agitation for various lengths of time. Tarugi approached equilibrium from above as well as below but stirred the solutions only at intervals. The determination of the dissolved persulfate was made by boiling a measured volume of the clear saturated solution for 20 min. and titrating the H_2SO_4 liberated, according to the equation $K_2S_2O_8 + H_2O = K_2SO_4 + H_2SO_4 + O$. Tarugi also reports that the presence of a number of sodium and other salts in solution, does not appreciably alter the solubility of $K_2S_2O_8$ in water.

100 gms. H_2O dissolve 1.77 gms. $K_2S_2O_8$ at 0°. (Marshall, 1891.)

SOLUBILITY OF POTASSIUM PERSULFATE IN SATURATED AQUEOUS SALT SOLUTIONS AT 12°.

(Pajetta, 1906.)

(An excess of the salt and of $K_2S_2O_8$ was, in each case, added to water and the mixture stirred at constant temperature for 10 to 20 hours.)

Salt.	Gms. $K_2S_2O_8$ per 100 Gms. Sat. Sol.	Salt.	Gms. $K_2S_2O_8$ per 100 Gms. Sat. Sol.
Water alone	3.196	K_2SO_4	0.798
$Na_2SO_4.10H_2O$	6.238	$KHSO_4$	0.336
$NaHSO_4$	8.842	KNO_3	0.904
$Na_2HPO_4.12H_2O$	4.766	K_2CO_3	0.0146
$Na_2B_4O_7.10H_2O$	3.825	$KHCO_3$	0.317
$NaNO_3$	19.302	$MgSO_4.7H_2O$	2.990
$Na_2CO_3.10H_2O$	5.682	$CaSO_4.2H_2O$	3.384
$NaHCO_3$	5.042		

Additional determinations made with salt solutions of lower concentrations than saturation, gave the following results at 12.5°.

Salt.	Gms. Salt per 100 Gms. H_2O.	Gms. $K_2S_2O_8$ per 100 Gms. Sat. Sol.	Salt.	Gms. Salt per 100 Gms. H_2O.	Gms. $K_2S_2O_8$ per 100 Gms. Sat. Sol.
Na_2CO_3	2.304	4.297	$NaHSO_4$	5.218	4.556
$NaHCO_3$	3.652	4.230	$NaNO_3$	3.696	4.613
$Na_2SO_4.10H_2O$	7	4.554	Na_2HPO_4	3.086	4.446

POTASSIUM THIOSULFATE $K_2S_2O_3$.

SOLUBILITY IN WATER. (Jo, 1911,1912.)

t°.	Gms. $K_2S_2O_3$ per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. $K_2S_2O_3$ per 100 Gms. H_2O	Solid Phase.
0	96.1	$K_2S_2O_3.2H_2O$	56.1	234.5	$K_2S_2O_3.H_2O+3K_2S_2O_3.H_2O$
17	150.5	$3K_2S_2O_3.5H_2O$	60	238.3	$3K_2S_2O_3.H_2O$
20	155.4	"	65	245.8	"
25	165	'	70	255.2	"
30	175.7	"	75	268	"
35	202.4	" $+K_2S_2O_3.H_2O$	78.3	292	" $+K_2S_2O_3$
40	204.7	$K_2S_2O_3.H_2O$	80	293.1	$K_2S_2O_3$
45	208.6	"	85	298.5	"
50	215.2	"	90	312	"
55	227.7	"			

POTASSIUM Sodium THIOSULFATE $KNaS_2O_3.2H_2O$.

100 gms. H_2O dissolve 213.7 gms. $KNaS_2O_3.2H_2O$ (*a*) at 15°. (Schwicker 1889.)
100 gms. H_2O dissolve 205.3 gms. $KNaS_2O_3.2H_2O$ (*b*) at 15°. "

POTASSIUM THIONATES

SOLUBILITY OF EACH SEPARATELY IN WATER.

(Results for Dithionate by deBaat, 1926; for the others by Kurtenacker and Fluss, 1933.)

t°	Gms. per 100 gms. sat. solution			
	K Dithionate $K_2S_2O_6$	K Trithionate $K_2S_3O_6$	K Tetrathionate $K_2S_4O_6$	K Pentathionate $K_2S_5O_6$ (.1-1/2 H_2O)
0	2.52	8.14	12.60	15.50
12	4.28	—	—	—
20	6.23	18.43	23.18	24.78
30	8.54	—	—	—

POTASSIUM THIONATES

EQUILIBRIUM IN THE SYSTEM POTASSIUM TRITHIONATE, POTASSIUM TETRATHIONATE AND WATER.

(Kurtenacker and Fluss, 1933.)

t°	Gms. per 100 gms. sat. sol. $K_2S_3O_6$	Gms. per 100 gms. sat. sol. $K_2S_4O_6$	Solid Phase	t°	Gms. per 100 gms. sat. sol. $K_2S_3O_6$	Gms. per 100 gms. sat. sol. $K_2S_4O_6$	Solid Phase
0	6.68	12.00	$K_2S_4O_6+K_2S_3O_6$	20	14.51	14.17	$K_2S_3O_6$
20	1.80	21.85	$K_2S_4O_6$	"	16.70	11.94	"
"	2.30	21.60	"	"	16.23	5.75	"
"	6.86	18.82	"	"	17.67	2.37	"
"	11.50	18.90	"	"	6.68	12.00	"
"	13.26	18.65	" + $K_2S_3O_6$				

EQUILIBRIUM IN THE SYSTEM POTASSIUM TETRATHIONATE, POTASSIUM PENTATHIONATE AND WATER.

(Kurtenacker and Fluss, 1933.)

SO

t°	Gms. per 100 gms. sat. sol. $K_2S_4O_6$	Gms. per 100 gms. sat. sol. $K_2S_5O_6$	Solid Phase	t°	Gms. per 100 gms. sat. sol. $K_2S_4O_6$	Gms. per 100 gms. sat. sol. $K_2S_5O_6$	Solid Phase
0	4.71	14.49	$K_2S_4O_6+K_2S_5O_6\cdot 1\frac{1}{2}H_2O$	20	10.53	19.81	$K_2S_4O_6$
20	2.53	21.39	$K_2S_5O_6\cdot 1\frac{1}{2}H_2O$	"	11.71	17.62	"
"	5.86	20.59	"	"	14.03	14.30	"
"	7.53	20.19	"	"	17.39	8.70	"
"	10.34	20.86	"	"	18.93	6.44	"
"	10.88	20.10	" + $K_2S_4O_6$	"	22.46	0.82	"

EQUILIBRIUM IN THE SYSTEM POTASSIUM TRITHIONATE, POTASSIUM PENTATHIONATE AND WATER.

(Kurtenacker and Fluss, 1933.)

t°	Gms. per 100 gms. sat. sol. $K_2S_3O_6$	Gms. per 100 gms. sat. sol. $K_2S_5O_6$	Solid Phase	t°	Gms. per 100 gms. sat. sol. $K_2S_3O_6$	Gms. per 100 gms. sat. sol. $K_2S_5O_6$	Solid Phase
0	7.6	2.87	$K_2S_3O_6+K_2S_5O_6\cdot 1\frac{1}{2}H_2O+S$	20	10.84	9.98	$K_2S_3O_6+S$
20	6.35	7.20	$K_2S_5O_6\cdot 1\frac{1}{2}H_2O+S$	"	14.04	3.74	"
"	8.13	8.17	"	"	14.12	4.37	"
"	10.50	8.72	" + $K_2S_3O_6+S$	"S	14.99	2.46	"

High accuracy is not claimed for the above results since the polythionates begin to decompose after short periods of shaking.

POTASSIUM SELENITE $K_2SeO_3 \cdot 5H_2O$.

SOLUBILITY OF POTASSIUM SELENITE IN WATER.

(Janickis, 1937; Janickis and Gutmanaite, 1936.)

t°		d. of sat. sol.	Gms. K_2SeO_3 per 100 gms. sat. sol.	Solid Phase
- 0.262		1.007	1.02	Ice
- 0.50		1.015	2.02	"
- 0.97		1.029	3.99	"
- 2.375		1.075	9.54	"
- 5.03		1.148	17.87	"
-13.0		1.282	32.01	"
-23.6		1.452	45.13	"
-43.5	(Eutec.)	—	58.00	" + $K_2SeO_3 \cdot 4H_2O$
-20.5		—	59.98	$K_2SeO_3 \cdot 4H_2O$
- 9.7		—	61.14	"
- 0.2		—	62.76	"
+10.5		—	65.11	"
13.5		—	65.83	"
19.5		—	67.00	"
24.3	(tr.pt.)	—	68.5	" + K_2SeO_3
0		—	68.45*	K_2SeO_3
20.3		—	68.48*	"
43.1		—	68.52	"
60.1		—	68.70	"
100.6		—	68.53	"

SeO

* Metastable

POTASSIUM BiSELENITE $KHSeO_3$
POTASSIUM PyroSELENITE $K_2Se_2O_5$

SOLUBILITY OF POTASSIUM BiSELENITE AND PyroSELENITE, IN WATER.

(Janickis, 1937; Janickis and Gutmanaite, 1936.)

t°	d. of sat. sol.	Gms. $K_2Se_2O_5$ per 100 gms. sat. sol.	Solid Phase
- 0.166	1.003	0.63	Ice
- 0.365	1.010	1.565	"
- 0.694	1.023	3.09	"
- 1.342	1.047	6.04	"
- 3.17	1.119	14.12	"
- 6.285	1.237	25.55	"
-14.3	1.466	43.13	"
-22.7	1.6055	52.55	"
-57.0(?)	—	70.0(?)	" + $KHSeO_3$
-20.6	—	73.52	$KHSeO_3$
-10.5	—	74.29	"
+ 0.2	—	75.87	"
12.8		77.21	$KHSeO_3$
18.9		78.18	"
23.0		78.70	"
25.2		79.31*	"
30.6		80.04*	"
24.		79.0(?)	"+$K_2Se_2O_5$
27.2		79.21	$K_2Se_2O_5$
31.7		79.41	"
50.4		80.39	"
69.6		82.45	"
90.8		83.72	"
102.8		84.47	"

* Metastable

POTASSIUM Tetra SELENITE $KH_3(SeO_3)_2$.

SOLUBILITY OF POTASSIUM TETRA SELENITE IN WATER.

(Janickis, 1932; Janickis and Gutmanaite, 1936.)

t°	d. of sat. sol.	Gms. $KH_3(SeO_3)_2$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $KH_3(SeO_3)_2$ per 100 gms. sat. sol.	Solid Phase
-0.178	1.003	0.59	Ice	-6.9	46.52	$KH_3(SeO_3)_2$
-0.288	1.009	1.467	"	0.0	53.57	"
-0.544	1.019	2.905	"	+11.9	63.20	"
-1.027	1.040	5.69	"	20.3	68.65	"
-2.302	1.102	13.43	"	31.0	75.71	"
-4.10	1.202	24.62	"	40.2	80.30	"
-7.42	1.399	42.3	"	50.8	85.55	"
-8.0	—	46.0	" + $KH_3(SeO_3)_2$	59.4	89.65	"

POTASSIUM SELENATE K_2SeO_4.

SOLUBILITY IN WATER.

t°.	-20°.	-5°.	+5°.	18°.	97°.
SeO Gms. K_2SeO_4 per 100 gms. solution	51.5	51.7	52	52.6	54.9

(Etard, 1894.)

100 gms. H_2O dissolve 115 gms. K_2SeO_4 at 12°. (Tutton, 1907.)

More recent determinations by Meyer and Aulich, 1928 and Friend, 1929, fail to agree and a satisfactory explanation of the difference is not apparent. Although Friend employed a period of shaking of only 2 hours and Meyer and Aulich, 4 to 6 hours his results are the higher. The following values were taken from average curves drawn from the original results in the two cases.

t°	Gms. K_2SeO_4 per 100 gms. sat. sol. (Meyer & Aulich)	Gms. K_2SeO_4 per 100 gms. sat. sol. (Friend)	t°	Gms. K_2SeO_4 per 100 gms. sat. sol. (Meyer & Aulich)	Gms. K_2SeO_4 per 100 gms. sat. sol. (Friend)
-20	51.5	—	40	53.55	54.15
0	51.8	53.55	50	53.95	54.4
10	52.2	53.55	60	54.3	54.7
20	52.6	53.7	70	54.55	55.0
25	52.85	53.8	85	54.85	55.6
30	53.1	53.95	100	55.0	56.2

EQUILIBRIUM IN THE SYSTEM POTASSIUM SELENATE, MAGNESIUM SELENATE AND WATER AT 25°.

(Meyer and Aulich, 1928.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
K_2SeO_4	$MgSeO_4$		K_2SeO_4	$MgSeO_4$	
53.3	0.0	K_2SeO_4	21.83	11.40	1.1.6
51.13	0.56	"	21.40	11.48	" + $MgSeO_4.6H_2O$
50.58	0.63	"	19.95	12.90	$MgSeO_4.6H_2O$
47.31	0.89	" + 1.1.6	19.59	13.37	"
38.50	2.12	1.1.6	5.82	24.36	"
30.24	5.44	"	0.0	27.5	"

1.1.6 = $K_2SeO_4.MgSeO_4.6H_2O$.

EQUILIBRIUM IN THE SYSTEM POTASSIUM SELENATE, SODIUM SELENATE AND WATER AT 25°.

(Meyer and Aulich, 1928.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
K_2SeO_4	Na_2SeO_4		K_2SeO_4	Na_2SeO_4	
53.3	0.0	K_2SeO_4	23.24	28.52	K_2SeO_4 + Na_2SeO_4
45.20	7.21	"	21.86	31.29	"
37.72	12.76	"	19.87	31.78	Na_2SeO_4
30.02	19.90	"	17.42	32.34	"
26.80	25.36	"	0.0	36.40	"

POTASSIUM Neodymium **SELENATE** $KNd(SeO_4)_2.4H_2O$.

100 gms. H_2O sat. with $KNd(SeO_4)_2.4H_2O$ contain 15.0 gms. $KNd(SeO_4)_2$ at 0° and 25.0 gms. at 20°. (Meyer and Kittlemann, 1931.)

SiO

POTASSIUM SILICATE K_2SiO_3.

Data for equilibrium in the systems $K_2SiO_3 + H_2O$, $K_2Si_2O_5 + H_2O$, $K_2SiO_3 + SiO_2$, $SiO_2 + H_2O$ and $K_2SiO_3 + SiO_2 + H_2O$, at temperatures between 200° and 1000° +, determined by the "hydrotherma' quenching method," are given by Morey (1917).

POTASSIUM STANNATE $K_2SnO_3.3H_2O$.

100 gms. H_2O dissolve 106.6 gms. at 10°, and 110.5 gms. at 20°. Sp. Gr. at 10° = 1.618 at 20° = 1.627. (Ordway, 1865.)

POTASSIUM STANNATE $K_2Sn(OH)_6$ and $K_2Sn(OH)_6.2H_2O$.

SOLUBILITY OF THE ANHYDROUS AND THE HYDRATED SALT, EACH SEPARATELY, IN WATER. (Zocher, 1920.)

t°.	Gms. $K_2Sn(OH)_6$ per 100 gms. sat. sol.	Solid Phase.
28	50.7	$K_2Sn(OH)_6$
28	52.4	$K_2Sn(OH)_6.2H_2O$

TeO

POTASSIUM TELLURATE K_2TeO_4.

100 gms. H_2O dissolve 8.82 gms. K_2TeO_4 at 0°, 27.53 gms. at 20° and 50.42 gms. at 30°. (Rosenheim and Weinheber, 1910–11.)

POTASSIUM VANADATE $K_3V_5O_{14}.5H_2O$.

100 gms. H_2O dissolve 19.2 gms. at 17.5°. (Radan, 1889.)

POTASSIUM ZINC VANADATE $KZnV_5O_{14}.8H_2O$.

100 gms. H_2O dissolve 0.41 gm. of the salt (Radan).

POTASSIUM TUNGSTATE K_2WO_4

WO

Fusion-point data are given for the following mixtures.

K_2WO_4 + Na_2WO_4 (Van Liempt, 1922.)
" + WO_3 (Van Liempt, 1922; Hoermann, 1929.)

KRYPTON Kr.

SOLUBILITY OF KRYPTON IN WATER. (von Antropoff, 1919.)

The following new determinations were made in a refined apparatus arranged so that the solvent and its vapor touched no cock. The previous determinations were found to be in error in the region of the minimum. The results are expressed in terms of the Bunsen coefficient as modified by Kuenen, that is the volume of gas in cc. (reduced to normal conditions) dissolved by 1.0 gm. of H_2O.

t°.	Absorp. coef. β	t°.	Absorp. coef. β.	t°.	Absorp. coef. β.	t°.	Absorp. coef. β.
0.....	0.1105	20.....	0.0696	40.....	0.0433	60.....	0.0357
10.....	0.0810	30.....	0.0511	50.....	0.0383		

The above determinations have been recalculated by Valentiner, 1927, and expressed in terms of the Ostwald Solubility α' which is the relation of the concentration of the gas in the liquid to the gas phase and, according to the Henry-Dalton law, is independent of the partial pressure of the gases at a given temperature.

t°	α'	t°	α'	t°	α'
0	0.1105	30	0.0565	60	0.0418
10	0.0840	40	0.0494	70	0.0403
20	0.0673	50	0.0447	80	0.0398

KRYPTON Kr

Kr

SOLUBILITY OF KRYPTON IN SEVERAL LIQUIDS, DETERMINED BY SIMPLE METHODS TO AN ACCURACY OF ABOUT 5 PERCENT.

Results of Körösy, 1937

Solvent	t°	(Ostwald Exp.) α
Ethyl Alcohol (95%)	21	0.62
" " (97.5%)	21	0.67
Cyclohexanol	22	0.40
Acetone (technical)	19	0.83
" (dried)	20	1.05
Benzene	22	0.97
Tetraline	24	0.49
Butyl acetate (techn.)	20	0.85
Butyl phthalate "	20	0.47
Tricresyl phosphate "	22	0.23
Acetic acid (glacial)	22	0.47
Glycerol	20	0.06
Chloroform	0	0.97
"	21	1.01
Bromoform	22	0.46
Carbon tetrachloride	0	1.20
" "	21	1.31
Aq. 20% $CaCl_2$ Solution	22	0.04
Ar in Chloroform	22	0.178

Results of Van Liempt and Van Wijk, 1937

Solvent	t°	S
Water	0.5	0.12
"	20	0.06
Gasoline (Benzine)	19	0.89
Petroleum	20	1.00
Paraffine oil	18.5	0.60
Benzene	19	0.67
Toluene	18	0.84
Methyl alcohol	18	0.52
Ethyl " (96%)	19	0.51
Amyl "	23	0.66
Glycerol (100%)	22	0.01

S = cc. Kr (at 0 and 760mm.) dissolved by 1.0cc solvent under 1 atmosphere pressure of Kr and vapor of solvent.

The Krypton used in both cases contained about 5 percent of xenon.

Data for the solubility of Krypton in liquid Oxygen are given by v. Stackelberg, 1934.

SOLUBILITY OF LANTHANUM IN MERCURY.

(Parks and Campanella, 1936.)

Amalgams of lanthanum and mercury were prepared by heating the mixed constituents in fused quartz flasks to 200° or by electrolysis of Lanthanum Salts dissolved in absolute ethyl alcohol with Hg as the cathode. Such amalgams were kept in evacuated fused quartz flasks at the selected temperatures, approaching equilibrium from above and below. A filtered portion of the saturated solution was allowed to stand in contact with the air until the lanthanum had separated as the hydroxide and this was then determined by titration.

t°	Gms. La per 100 gms. La + Hg	t°	Gms. La per 100 gms. La + Hg
0	0.00552	37.5	0.0134
12.5	0.00907	50.0	0.0184
25.0	0.00960		

LANTHANUM BROMATE $La(BrO_3)_3.9H_2O$.

BrO

SOLUBILITY OF LANTHANUM BROMATE IN WATER.

(James, Fogg, McIntire, Evans and Donovan, 1927.)

t°	Gms. per 100 gms. sat. sol.		t°	Gms. per 100 gms. sat. sol.	
	$La(BrO_3)_3$	$La(BrO_3)_3.9H_2O$		$La(BrO_3)_3$	$La(BrO_3)_3.9H_2O$
0	49.48	64.83	20	59.83	78.40
5	52.06	68.22	25	62.74	82.21
10	54.59	71.53	30	66.63	87.31
15	57.02	74.89	35	69.74	91.38

LANTHANUM ACETATE $La(CH_3COO)_3.1\frac{1}{2}H_2O$.

100 gms. H_2O dissolve 20.43 gms. $La(CH_3COO)_3$ at 18°. (Vesterberg, 1916, 1917.)
» » » 16.88 » » » 25°. (Meyer and Muller, 1920.)

100 gms. Methyl Alcohol dissolve 0.64 gm. $La(CH_3COO)_3$ at 15° and 0.77 gms. at 66° (b.pt.). (Henstock, 1934.)

LANTHANUM CITRATE $2(LaC_2H_5O_7).7H_2O$.

100 gms. aq. citric solution containing 10 gms. citric acid per 100 cc., dissolve 0.8 gm. $La(C_6H_5O_7)$ at 20°. (Holmberg, 1907.)

CH

LANTHANUM GLYCOLATE $La(C_2H_3O_3)_3$.

One liter H_2O dissolves 3.328 gms. $La(C_2H_3O_3)_3$ at 20°. (Jantsch and Grunkraut, 1912–13.)

LANTHANUM MALONATE $La_2(C_3H_2O_4)_3.5H_2O$.

100 gms. aq. Am. malonate sol. (10 gms. per 100 cc.) dissolve 0.2 gm.
100 gms. aq. malonic acid sol. (20 gms. per 100 cc.) dissolve 0.6 gm.
$\Big\}$ $La_2(C_3H_2O_4)_3$ at 20°.
(Holmberg, 1907.)

LANTHANUM LACTATE $La(C_3H_5O_3)_3.3H_2O$.

100 cc. sat. solution of lanthanum lactate in water contain 1.44 gms. La_2O [= 4.06 gms. $La(C_3H_5O_3)_3.3H_2O$] at 20°. (Jantsch, 1926.)

LANTHANUM TARTRATE $La_2(C_4H_4O_6)_3.9H_2O$.

One liter H_2O dissolves 0.059 gm. $La_2(C_4O_4O_6)_3$ at 25° (solid phase $La_2(C_4H_4O_6)_3.3H_2O$). Determined by electrolytic method. (Rimbach and Schubert, 1909.)

SOLUBILITY OF LANTHANUM TARTRATE IN AQ. TARTARIC ACID AND AMMONIUM TARTRATE SOLUTIONS AT 20°.

(Holmberg, 1907.)

In Aq. Tartaric Acid.		In Aq. Ammonium Tartrate.	
Gms. Tartaric Acid per 100 cc. Solvent.	Gms. $La_2(C_4O_4O_6)_3$ per 100 Gms. Sat. Sol.	Gms. Am. Tartrate per 100 cc. Solvent.	Gms. $La_2(C_4H_4O_6)_3$ per 100 Gms. Sat. Sol.
20	0.6	10	0.2
40	1.2	20	0.6

LANTHANUM SULFONATES.

SOLUBILITY OF EACH IN WATER.

CH

Sulfonate.	Formula.	Gms. Anhydrous Sulfonate per 100 Gms. H_2O.	Authority.
Lanthanum Benzene Sulfonate	$La[C_6H_5SO_3]_3.9H_2O$	63.1	(Holmberg, 1907.)
" *m* Nitrobenzene Sulfonate	$La[C_6H_4NO_2SO_3]_3.6H_2O$	16	"
" *m* Chlorbenzene Sulfonate	$La[C_6H_4Cl.SO_3]_3.9H_2O$	13.1	"
" *m* Brombenzene "	$La[C_6H_4Br.SO_3]_3.9H_2O$	12.0	"
" (6) Chloro (3) Nitrobenzene (1) Sulfonate	$La[C_6H_3Cl(NO_2)SO_3]_3.8H_2O$	24.5	"
" (1) Bromo (4) Nitrobenzene (2) Sulfonate	$La[C_6H_3BrNO_2SO_3]_3.8H_2O$	5	(Katz & James, '13.)
" *α* Naphthalene Sulfonate	$La[C_{10}H_7SO_3]_3.6H_2O$	5.2	(Holmberg, 1907.)
" 1.5 Nitronaphthalene Sulfonate	$La[C_{10}H_6(NO_2)SO_3]_3.6H_2O$	0.55	"
" 1.6 " "	" $.9H_2O$	0.21	"
" 1.7 " "	" $.9H_2O$	1.1	"

LANTHANUM Cobalti**CYANIDE** $La_2(CoC_6N_6)_2.9H_2O$.

100 gms. aq. 10% HCl (d_{15} = 1.05) dissolve 10.41 gms. salt at 25°. (James and Willand, 1916.)

LANTHANUM OXALATE $La_2(C_2O_4)_3.9H_2O$.

SOLUBILITY OF LANTHANUM OXALATE IN WATER AT 25°.

COO

Gms. $La_2(C_2O_4)_3$ per liter sat. solution. Determined by:				Authority
Conductivity Method	Gravimetric Method	Volumetric Method	Colorimetric Method	
0.00062	—	—	—	(Rimback and Schubert, 1909.)
0.00070	0.00096	0.00121	—	(Hauser and Herzfeld, 1912.)
0.00206	0.00214	—	—	(Sarver and Brinton, 1927.)
0.00060	—	0.00208	0.00195	(Kolthoff and Elmquist, 1931.)

Solid Phase $La_2(C_2O_4)_3.9H_2O$ in all cases.

100 gms. aq. 10.2% HNO_3 (d = 1.063) dissolve 0.80 gm. $La_2(C_2O_4)_3$ at 15°. (v. Scheele, 1899.)

100 gms. aq. 19.4% HNO_3 (d = 1.116) dissolve 2.69 gms. $La_2(C_2O_4)_3$ at 15°. (v. Scheele, 1899.)

SOLUBILITY OF LANTHANUM OXALATE IN AQ. SOLUTIONS OF SULFURIC ACID AT 25°.

(Hauser and Wirth, 1908; Wirth, 1908; Wirth, 1912.)

Normality of H_2SO_4.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Normality of H_2SO_4.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
	La_2O_3	= $La_2(C_2O_4)_3$.			La_2O_3	= $La_2(C_2O_4)_3$.	
0.1	0.0208	0.0346	$La_2(C_2O_4)_3.9H_2O$	2	0.4417	0.7344	$La_2(C_2O_4)_3.9H_2O$
0.5	0.0979	0.1629	"	3.09	0.680	1.1306	"
1	0.2383	0.3962	"	4.32	0.880	1.4630	"
1.5	0.319	0.5304	"	5.6	1.092	1.8155	"

SOLUBILITY OF LANTHANUM OXALATE IN AQ. SOLUTIONS OF OXALIC ACID AT 25°. (Hauser and Wirth, 1908.)

Normality of Aq. Oxalic Acid.	Gms. per 100 Gms. Sat. Sol. La_2O_3	= $La_2(C_2O_4)_3$.	Solid Phase.
0.1	unweighable		$La_2(C_2O_4)_3.9H_2O$
1.0	0.00032	0.00053	"
3.2 (sat.)	0.00045	0.00075	"

Results are also given for the solubility in mixtures of sulfuric and oxalic acids.

100 cc. aq. 20% triethylamineoxalate dissolve approx. 0.032 gm. $La_2(C_2O_4)_3$. (Grant and James, 1917.)

SOLUBILITY OF LANTHANUM OXALATE IN AQUEOUS SOLUTIONS OF ACIDS AT 25°.

(Sarver and Brinton. 1927.)

From 50 to 1000 gms. of the saturated solutions were evaporated to dryness in small porcelain dishes and the residue converted to oxide and weighed.

Normality of Acid in Aqueous Solvent	Gms. $La_2(C_2O_4)_3$ per 100 gms. sat. sol.	Normality of Acid in Aqueous Solvent	Gms. $La_2(C_2O_4)_3$ per 100 gms. sat. sol.
0.1008 HCl	0.0208	0.2482 HNO_3	0.0354
0.2576 "	0.0567	1.992 "	0.9256
0.5004 "	0.1384	4.054 "	2.660
0.978 "	0.3074	2.00 " + 0.1 $(COOH)_2$	0.3908
1.484 "	0.4937	3.03 " + 0.1 "	1.227
2.000 "	0.6770	4.00 " + 0.1 "	1.568
2.865 "	1.082	2.00 " + 0.5 "	0.1292
4.000 "	1.327	3.03 " + 0.5 "	0.3576
5.200 "	1.285	4.00 " + 0.5 "	0.7200
0.978 " + 0.1 $(COOH)_2$	0.0532	4.00 " + sat. "	0.7664
2.000 " + 0.1 "	0.2998	6.00 " + sat. "	1.304
2.865 " + 0.1 "	0.6330	0.086 H_2SO_4	0.0222
3.965 " + 0.1 "	1.026	0.419 "	0.1078
0.978 " + 0.5 "	0.0062	0.958 "	0.2523
2.865 " + 0.5 "	0.1098	1.846 "	0.5128
3.965 " + 0.5 "	0.3127	2.612 "	0.6840
1.484 " + sat. "			
4.00 " + sat. "			

COO

SOLUBILITY OF LANTHANUM OXALATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AND IN AQUEOUS OXALIC ACID SOLUTIONS OF NITRIC ACID AT 90°.

(Neckers and Kremers, 1928.)

The mixtures were frequently shaken during 36 hours. For analysis 50cc of the filtered saturated solutions were evaporated to dryness in porcelain dishes and the residues ignited and weighed as oxide.

Normality of Acid in Aqueous Solvent	Gms. La_2O_3 per 100cc sat. sol.	Normality of Acid in Aqueous 5% $(COOH)_2$ Solution	Gms. La_2O_3 per 100cc sat. sol.
0.779 HNO_3	0.4421	0.779 HNO_3	0.0302
1.558 "	1.2377	1.558 "	0.3083
3.75 "	4.6670	2.337 "	0.7517
5.00 "	10.4160	3.75 "	3.5260
		5.00 "	9.3907

LANTHANUM CHLORIDE $LaCl_3$.

SOLUBILITY OF LANTHANUM CHLORIDE AND OF LANTHANUM OXIDE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE AT 15°, 30°, 50° AND 100°.

(Prandtl and Rauchenberger, 1920.)

The results are given only in the form of small scale diagrams and it is stated that the numerical data will be published in full in the dissertation of Johanna Rauchenberger, University of München, 1920. The equilibrium

$$La(OH)_3 + 3NH_4Cl \rightleftharpoons LaCl_3 + 3NH_3 + 3H_2O$$

Cl

was approached by the authors from both sides. The composition of the basic chlorides obtained by shaking the oxide with 1.0 *n* NH_4Cl at different temperatures, and drying over soda lime, was approximately as follows:

At 15°, $La_4Cl_2O_5.9H_2O$; at 30°, $La_3ClO_4.6H_2O$; at 50°, $La_8Cl_2O_{11}.16H_2O$.

LANTHANUM Hexa Antipyrine Per **CHLORATE** $[La(COC_{10}H_{12}N_2)_6](ClO_4)_3$

100cc sat. solution of Lanthanum Hexa Antipyrine Perchlorate in Water contain 1.48 gm. $[La(COC_{10}H_{12}N_2)_6](ClO_4)_3$ at 20°. (Wilke-Dörfurt and Schliephake, 1928.)

LANTHANUM CHROMATE $La_2(CrO_4)_3.8H_2O$.

100 gms. sat. solution of Lanthanum Chromate in Water contain 0.020 gm. $La_2(Cr_2O_4)_3$ at 25°. (Britton, 1924.)

LANTHANUM Potassium CHROMATE.

CrO

The system $La_2(CrO_4)_3 + K_2CrO_4 + H_2O$ at 25° was studied by Carobbi, 1924, but the table of results does not show the quantity of $La_2(CrO_4)_3$ present in the solutions. The results show the several double compounds formed.

LANTHANUM Hexa Antipyrine **IODIDE** $[La(COC_{10}H_{12}N_2)_6]I_3$

100cc sat. solution of Lanthanum Hexa Antipyrine Iodide in Water contain 29.50 gm. $[La(COC_{10}H_{12}N_2)_6]I_3$ at 20°. (Wilke-Dörfurt and Schliephake, 1928.)

LANTHANUM IODATE $La(IO_3)_3$.

SOLUBILITY IN WATER AND IN AQ. SALT SOLUTIONS AT 25°.

(Harkins and Pearce, 1916.)

1000 gms. H_2O dissolve 0.6842 gm. $La(IO_3)_3$ at 25°, d_{25} sat. sol. = 0.99825.

IO

Salt.	Conc. of Salt, Milli-Normal.	Gms. $Li(IO_3)_3$ per Liter.	d_{25} of Sat. Sol.	Salt.	Conc. of Salt, Milli-Normal.	Gms. $Li(IO_3)_3$ per Liter.	d_{25} of Sat. Sol.
$La(NO_3)_3$	2	0.5595	0.99732	$NaNO_3$	25	0.86901	1.00250
"	5	0.5288	0.99807	"	50	0.99040	1.00385
"	10	0.5194	0.99859	"	100	1.1603	1.00742
"	50	0.5522	1.00212	"	200	1.385	1.01290
"	100	0.6214	1.00661	"	400	1.636	1.02422
"	200.52	0.7431	1.01533	"	800	2.156	1.04677
KIO_3	0.0990	0.6290	1.00030	"	1600	2.859	1.09005
"	0.4957	0.5633	1.00027	"	3200	3.030	1.17243
"	0.9914	0.4970	1.00030	$La(NO_3)_3$.- $2NH_4NO_3$	26.34	0.631	1.00112
"	1.9828	0.3738	1.00031				
$NaIO_3$	0.0913	0.63538	1.00060	"	52.68	0.674	1.00355
"	0.4560	0.56466	1.00059	"	105.36	0.754	1.00971
"	0.9130	0.50835	1.00065	"	158.04	0.816	1.01608
"	1.8260	0.39938	1.00065	"	196.83	0.867	1.02183
"	3.6530	0.19736	1.00069	"	393.67	1.063	1.04343
"	4.5326	0.13393	1.00083	"	787.35	1.364	1.08286
"	6.7989	0.09733	1.00130	"	1574.70	1.923	1.16652

According to Rimbach and Schubert (1909), one liter H_2O dissolves 1.681 gms. $Li(IO_3)_3$ at 25°, determined chemically, and 1.871 gms. determined electrolytically; solid phase, $2La(IO_3)_3.3H_2O$.

SOLUBILITY OF LANTHANUM IODATE IN WATER AND IN AQUEOUS SALT SOLUTIONS AT 25°.

(LaMer and Goldman, 1929; Friedman and La Mer, 1931.)

The solubility of lanthanum iodate in water varied with different samples from 0.00089 to 0.00094 gm. mols. per liter (= 0.5907 to 0.6233 gms. $La(IO_3)_3$ per liter).

IO

Mols. salt per liter of Aq. Solvent		Mols. La $(IO_3)_3$ per liter sat. solution	Mols. salt per liter of Aq. Solvent		Mols. La $(IO_3)_3$ per liter sat. solution
0.0002	K_2SO_4	0.0009167	0.001	KCl	0.0009113
0.0005	"	0.0009746	0.005	"	0.0009749
0.0010	"	0.0010564	0.010	"	0.0010322
0.0020	"	0.0012153	0.05	"	0.0013331
0.0070	"	0.0016852	0.10	"	0.0015713
0.0125	"	0.0020272	0.10	"	0.0016480
0.02	"	0.0023675	0.20	"	0.0018776
0.05	"	0.0031871	0.50	"	0.0025641
0.05	"	0.003370	1.0027	"	0.0030547
0.10	KNO_3	0.001679	2.00	"	0.0037828
0.10	$NaNO_3$	0.001654	0.05	Na_2SO_4	0.003326
0.10	NaCl	0.001627	0.0333	$La_2(SO_4)_3$	0.001830
0.033	$LaCl_3$	0.0009233	0.0166	"	0.001532

Mols. salt per liter of Aq. Solvent		Mols. $La(IO_3)_3$ per liter sat. solution
0.00166	$La(NO_3)_3$	0.0008347
0.00333	"	0.0008101
0.0166	""	0.0008696
0.0333	"	0.0009398
0.050	$Mg(NO_3)_2$	0.001766
0.05	$MgCl_2$	0.001768
0.05	"	0.001739
0.05	$MgSO_4$	0.003010
0.05	"	0.002997
0.05	$CdCl_2$	0.001689
0.05	$CdSO_4$	0.003205

LANTHANUM MOLYBDATE $La_2(MoO_4)_3$.

One liter H_2O dissolves 0.0179 gm. $La_2(MoO_4)_3$ at 25° and 0.0332 gm. at 85°. (Hitchcock, 1895.) MoO

EQUILIBRIUM IN THE SYSTEM LANTHANUM MOLYBDATE, SODIUM MOLYBDATE AND WATER AT 25°.

(Carobbi, 1928.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
Na_2MoO_4	$La_2(MoO_4)_3$		Na_2MoO_4	$La_2(MoO_4)_3$	
0.77	0.01	$La_2(MoO_4)_3$.aq.+1.1.2	15.50	0.18	1.2.3
2.44	0.02	1.1.2	16.19	0.19	"
2.92	0.03	"	20.02	0.25	"
7.56	0.08	"	22.35	0.28	"
11.50	0.13	"	25.26	0.34	"
11.54	0.13	" + 1.2.3	25.27	0.34	"+$Na_2MoO_4.2H_2O$
11.52	0.13	1.2.3	25.30	9.34	" "

1.1.2 = $La_2(MoO_4)_3.Na_2MoO_4.2H_2O$; 1.2.3 = $La_2(MoO_4)_3.2Na_2MoO_4.3H_2O$

LANTHANUM NITRATES α and β $La(NO_3)_3.6H_2O$.

SOLUBILITY OF LANTHANUM NITRATES IN WATER.

(Friend, 1935.)

t°	Gms. $La(NO_3)_3$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $La(NO_3)_3$ per 100 gms. sat. sol.	Solid Phase
0	50.03	α $La(NO_3)_3.6H_2O$	16.0	56.74	β $La(NO_3)_3.6H_2O$
18.4	54.16	"	23.2	58.7	"
21.2	55.03	"	29.6	60.08	"
35.4	59.12	"	32.2	61.34	"
42.4	63.84	"	40.0	62.71	"
44.2	65.13	"	46.4	65.55	"
43.0 tr.pt.	—	" + β $La(NO_3)_3.6H_2O$	49.4	65.17	"
14.4	56.27	β $La(NO_3)_3.6H_2O$	56.0	68.30	"
15.2	56.94	"	65.4 m.pt.	75.04	"

SOLUBILITY OF LANTHANUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID.

(Quill and Robey, 1937.)

NO

Results at 25°

d. of sat. sol.	Gms. per 100 gms. sat. sol. $La(NO_3)_3$	HNO_3	Solid Phase
—	59.0	0.0	$La(NO_3)_3.6H_2O$
1.771	56.42	3.06	"
—	46.42	11.95	"
—	29.10	34.69	"
—	29.62	40.17	$La(NO_3)_3.4H_2O$
—	28.73	41.14	"
—	25.18	54.41	"
—	21.61	58.36	"
1.489	2.79	70.70	$La(NO_3)_3.3H_2O$
—	0.56	87.85	$La(NO_3)_3$
1.483	0.0	90.0	None

Results at 50°

d. of sat. sol.	Gms. per 100 gms. sat. sol. $La(NO_3)_3$	HNO_3	Solid Phase
1.929	66.65	0.0	$La(NO_3)_3.6H_2O$
1.912	61.21	2.59	"
1.892	61.85	5.29	"
1.852	56.70	12.05	"
1.880	56.34	14.93	" + $La(NO_3)_3.4H_2O$
1.755	44.23	27.73	$La(NO_3)_3.4H_2O$
1.645	30.31	44.48	"
—	29.58	50.53	"
—	5.48	78.31	$La(NO_3)_3$(?)
—	1.38	85.51	"
1.419	0.41	91.15	"
1.440	0.0	90.0	None

LANTHANUM NITRATE $La(NO_3)_3$.

SOLUBILITY OF LANTHANUM NITRATE IN AQUEOUS SOLUTIONS OF LANTHANUM OXALATE AT 25° AND VICE VERSA. (James and Whittemore, 1912.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
$La_2(C_2O_4)_3$.	$La(NO_3)_3$.		$La_2(C_2O_4)_3$.	$La(NO_3)_3$.	
0	60.17	$La(NO_3)_3$	not det.	not det.	$La_2(C_2O_4)_3.5H_2O$
0.67	59.91	"	3.32	42.27	$La_2(C_2O_4)_3.8H_2O$
2.10	59.03	"	2.80	38.50	"
2.23	59.03	" $+La_2(C_2O_4)_3.3H_2O$	2.51	35.57	"
2.26	58.22	$La_2(C_2O_4)_3.3H_2O$	2.21	31.53	"
2.34	55.20	"	2.01	28.63	"
2.47	52.74	"	1.46	22.15	"
2.59	49.84	"	1.18	17.99	"
2.68	45.26	"	0.50	9.89	"
not det.	not det.	$La_2(C_2O_4)_3.5H_2O$	0.28	5.06	"

SOLUBILITY OF LANTHANUM NITRATE IN AQUEOUS SOLUTIONS OF MAGNESIUM NITRATE AND VICE VERSA AT 20°.

(Di Capua, 1929.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$La(NO_3)_3$	$Mg(NO_3)_2$		$La(NO_3)_3$	$Mg(NO_3)_2$	
60.13	0	$La(NO_3)_3.6H_2O$	26.0	24.0	$La(NO_3)_3.6H_2O$
58.91	2.20	"	22.90	25.48	$Mg(NO_3)_3.6H_2O$
55.06	6.21	"	15.35	30.93	"
50.11	9.83	"	6.89	36.30	"
42.98	17.40	"	3.20	39.25	"
37.02	19.25	"	0.0	43.68	"

NO

SOLUBILITY OF LANTHANUM NITRATE IN AQUEOUS SOLUTIONS OF MANGANESE NITRATE AND VICE VERSA AT 20°.

(Di Capua, 1929.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$La(NO_3)_3$	$Mn(NO_3)_2$		$La(NO_3)_3$	$Mn(NO_3)_2$	
60.13	0.0	$La(NO_3)_3.6H_2O$	24.70	26.80	$Mn(NO_3)_2.6H_2O$
53.90	5.08	"	22.95	27.50	"
49.20	8.91	"	21.25	29.18	"
41.45	13.22	"	14.15	41.10	"
36.82	16.19	"	10.00	45.00	"
29.81	21,00	"	6.22	49.20	"
27.45	21.95	"	0.0	58.81	"

LANTHANUM Magnesium NITRATE $2La(NO_3)_3.3Mg(NO_3)_2.24H_2O$.

SOLUBILITY OF LANTHANUM MAGNESIUM NITRATE IN WATER.

(Friend and Wheat, 1935.)

t°	Gms. $2La(NO_3)_3.3Mg(NO_3)_2.24H_2O$ per 100 gms. sat. solution	t°	Gms. $2La(NO_3)_3.3Mg(NO_3)_2.24H_2O$ per 100 gms. sat. solution
18.6	62.19	61.4	73.05
31.6	63.96	74.8	77.43
46.8	68.57	113.5 (m.pt.)	100.00
50.8	70.17		

LANTHANUM Ammonium **NITRATE** $La(NO_3)_3.2NH_4NO_3$.

100 gms. H_2O dissolve 181.4 gms. $La(NO_3)_3.2NH_4NO_3$ at 15°. (Holmberg, 1907.)

LANTHANUM Double **NITRATES.**

SOLUBILITY OF LANTHANUM DOUBLE NITRATES IN CONC. $HNO_3(d_{15} = 1.325)$ AT 16°. (Jantsch, 1912.)

Salt.	Formula.	Gms. Hydrated Salt Dissolved per Liter Sat. Sol.
Lanthanum Magnesium Nitrate	$[La(NO_3)_6]_2Mg_3.24H_2O$	63.8
" Nickel "	" Ni_3 "	80.3
" Cobalt "	" Co_3 "	109.2
" Zinc "	" Zn_3 "	124.1
" Manganese "	" Mn_3 "	193.1

NO 100cc. of a saturated solution of $La(NO_3)_3.6H_2O$ in Ethyl Ether prepared by frequent agitation and allowing to stand over night at about 20° contain 0.002 gm. La_2O_3. A saturated ethereal solution prepared as above but using Lanthanum nitrate dehydrated at 150° contain only 0.001 gm. La_2O_3 per 100cc. (Wells, 1930.)

Fusion-point data for mixtures of $La(NO_3)_3$ + $Mg(NO_3)_2$ are given by Quill and Robey, 1937.

LANTHANUM OXIDE La_2O_3.

SOLUBILITY OF LANTHANUM OXIDE IN WATER.

t°	Milligrams La_2O_3 per liter sat. sol.	Method	Authority
18	0.405	Potentiometric	Sadolin, 1927.)
25	0.40	Volumetric	Bush, 1927.
25	0.73	Volumetric	Kolthoff and Elmquist,
25	0.3-0.67	Conductivity	" 1931.

LANTHANUM Dimethyl **PHOSPHATE** $La_2[(CH_3)_2PO_4]_6.4H_2O$.

100 gms. H_2O dissolve 103.7 gms. $La_2[(CH_3)_2PO_4]_6$ at 25°. (Morgan and James, 1914.)

LANTHANUM SULFATE $La_2(SO_4)_3.9H_2O$.

SOLUBILITY IN WATER. (Muthmann and Rölig, 1898.)

t°.	Gms. $La_2(SO_4)_3$ per 100 Gms. Solution.	Gms. $La_2(SO_4)_3$ per 100 Gms. Water.	t°.	Gms. $La_2(SO_4)_3$ per 100 Gms. Solution.	Gms. $La_2(SO_4)_3$ per 100 Gms. Water.
0	2.91	3	50	1.47	1.5
14	2.53	2.6	75	0.95	0.96
30	1.86	1.9	100	0.68	0.69

SO SOLUBILITY OF LANTHANUM SULFATE IN AQ. SOLUTIONS OF AMMONIUM SULFATE, POTASSIUM SULFATE AND SODIUM SULFATE. (Barre, 1910, 1911.)

In Aq. $(NH_4)_2SO_4$ at 18°.			In Aq. K_2SO_4 at 16.5°.			In Aq. Na_2SO_4 at 18°.		
Gms. per 100 Gms. H_2O.		Solid Phase.	Gms. per 100 Gms. H_2O.		Solid Phase.	Gms. per 100 Gms. H_2O.		Solid Phase.
$(NH_4)_2SO_4$.	$La_2(SO_4)_3$.		K_2SO_4.	$La_2(SO_4)_3$.		Na_2SO_4.	$La_2(SO_4)_3$.	
4.01	0.393	1.1.2	0	2.198	1.0.9	0	2.130	1.0.9
8.73	0.279	"	0.247	0.727	1.1.2	0.395	0.997	1.1.2
18.24	0.253	"	0.496	0.269	"	0.689	0.353	"
27.89	0.476*	"	0.846	0.185	"	0.774	0.299	"
36.11	0.277*	"	1.029	0.054	1.5	1.136	0.129	"
47.49	0.137	2.5	1.156	0.022	"	2.480	0.044	"
53.82	0.067	1.5				3.802	0.019	"
65.29	0.0117	"				5.548	0.016	"
73.78	0.0033	"						

* = unstable equilibrium.

1.0.9 = $La_2(SO_4)_3.9H_2O$, 1.1.2 = $La_2(SO_4)_3.X_2SO_4.2H_2O$ (where X = (NH_4), K or Na), 2.5 = $2La_2(SO_4)_3.5(NH_4)_2SO_4$, 1.5 = $La_2(SO_4)_3.5X_2SO_4$.

SOLUBILITY OF LANTHANUM SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°. (Wirth, 1912.)

Normality of Aq. H_2SO_4.	Gms. per 100 Gms. Sat. Sol. La_2O_3	= $La_2(SO_4)_3$.	Solid Phase.	Normality of Aq. H_2SO_4.	Gms. per 100 Gms. Sat. Sol. La_2O_3	= $La_2(SO_4)_3$.	Solid Phase.
Water	1.43	2.483	$La_2(SO_4)_3.9H_2O$	4.321	1.11	1.927	$La_2(SO_4)_3.9H_2O$
0.505	1.69	2.934	"	6.685	0.531	0.9217	"
1.10	1.796	3.118	"	9.68	0.266	0.4617	"
2.16	1.818	3.156	"	12.60	0.214	0.371	"
3.39	1.42	2.465	"	15.15	0.177	0.307	"

Data for the solubility of lanthanum sulfate in aq. H_2SO_4 in presence of solid oxalic acid at 25° are given by Wirth, 1908.

LANTHANUM Ammonium SULFATES.

EQUILIBRIUM IN THE SYSTEM LANTHANUM SULFATE, AMMONIUM SULFATE AND WATER AT 25°. (Zambonini and Stolfi, 1926.)

Gms. per 100 gms. sat. sol. $La_2(SO_4)_3$.	$(NH_4)_2SO_4$.	Solid Phase.	Gms. per 100 gms. sat. sol. $La_2(SO_4)_3$.	$(NH_4)_2SO_4$.	Solid Phase.
0.88	6.24	$La_2(SO_4)_3.9H_2O$+1.1.2	0.22	29.37	1.3
0.88	6.26	1.1.2	0.19	30.40	1.5
0.75	7.19	»	0.05	33.6	»
0.73	11.11	»	0.05	36.85	»
0.34	14.48	»	0.02	39.24	» +1.6
0.32	22.89	»	0.02	42.48	1.6
0.30	22.80	» +1.3	0.02	43.24	»
0.28	25.12	1.3	0.00	44.64	1.6+$(NH_4)_2SO_4$
0.26	27.97	»			

1.1.2 = $La_2(SO_4)_3.(NH_4)_2SO_4.2H_2O$; 1.5 = $La_2(SO_4)_3.5(NH_4)_2SO_4$;
1.3 = $La_2(SO_4)_3.3(NH_4)_2SO_4$; 1.6 = $La_2(SO_4)_3.6(NH_4)_2SO_4$.

LANTHANUM Potassium SULFATES.

EQUILIBRIUM IN THE SYSTEM LANTHANUM SULFATE, POTASSIUM SULFATE AND WATER AT 25°. (Zambonini and Carobbi, 1924.)

Gms. per 100 gms. sat. sol. $La_2(SO_4)_3$.	K_2SO_4.	Solid Phase.	Gms. per 100 gms. sat. sol. $La_2(SO_4)_3$.	K_2SO_4.	Solid Phase.
0.87	0.23	1.1.2	0.00	1.51	1.4.1
0.77	0.23	»	0.00	4.24	»
0.41	0.45	»	0.00	4.78	1.4½.2
0.28	0.79	2.3.8	0.00	10.16	»
0.26	0.74	» +1.3	0.00	11.11	1.5.2
0.24	0.87	1.3	0.00	11.02	» +K_2SO_4
0.00	1.62	» +1.4.1			

1.1.2 = $La_2(SO_4)_3.K_2SO_4.2H_2O$; 1.4.1 = $La_2(SO_4)_3.4K_2SO_4.H_2O$;
2.3.8 = $2La_2(SO_4)_3.3K_2SO_4.8H_2O$; 1.4½.2 = $La_2(SO_4)_3.4\frac{1}{2}K_2SO_4.2H_2O$;
1.3 = $La_2(SO_4)_3.3K_2SO_4$; 1.5.2 = $La_2(SO_4)_3.5K_2SO_4.2H_2O$.

LANTHANUM Sodium SULFATE.

EQUILIBRIUM IN THE SYSTEM LANTHANUM SULFATE, SODIUM SULFATE AND WATER AT 25°. (Zambonini and Carobbi, 1925 *a*.)

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
$La_2(SO_4)_3$.	Na_2SO_4.		$La_2(SO_4)_3$.	Na_2SO_4.	
0.19	0.54	$La_2(SO_4)_3.Na_2SO_4.2H_2O$	0.0	10.46	$La_2(SO_4)_3.Na_2SO_4.2H_2O$
0.09	0.75	»	0.0	13.86	»
trace	3.42	»	0.0	15.06	»
»	5.43	»	0.0	16.28	»
»	7.13	»	0.0	18.06	»+Na_2SO_4

LANTHANUM Thallium SULFATES.

EQUILIBRIUM IN THE SYSTEM LANTHANUM SULFATE, THALLIUM SULFATE AND WATER AT 25°. (Zambonini and Carobbi, 1925.)

SO

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
$La_2(SO_4)_3$.	Tl_2SO_4.		$La_2(SO_4)_3$.	Tl_2SO_4.	
1.86	0.19	$La_2(SO_4)_3.9H_2O$+1.1.2	0.15	1.89	1.3
1.19	0.14	1.1.2	0.16	2.01	» +1.4 1/2
0.29	0.49	»	0.17	2.05	1.4 1/2
0.19	0.84	»	0.12	2.37	»
0.15	1.27	»	—	3.19	»
0.11	1.75	» +1.3	—	4.07	»
0.27	1.71	» »	—	5.25	»
0.25	1.75	1.3	—	5.16	» + Tl_2SO_4
0.26	1.82	»	—	5.28	» »

1.1.2 = $La_2(SO_4)_3.Tl_2SO_4.2H_2O$; 1.3 = $La_2(SO_4)_3.3Tl_2SO_4$; 1.4 1/2 = $La_2(SO_4)_3.4\,1/2\,TlSO_4$.

LANTHANUM SELENATE

SOLUBILITY OF LANTHANUM SELENATE IN WATER.

(Friend, 1937.)

SeO

t°	Gms. $La_2(SeO_4)_3$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $La_2(SeO_4)_3$ per 100 gms. sat. sol.	Solid Phase
0.0	33.55	$La_2(SeO_4)_3.Aq.$	46.2	27.54	$La(SeO_4)_3.12H_2O$
9.6	30.90	"	51.4	23.37	"
15.0	30.84	"	59.4	15.92	"
21.8	31.31	"	69.4	8.51	"
25.4	30.54	"	78.2	5.02	"
33.6	31.29	"	81.2	3.78	"
40.6	31.15	"	92.4	1.93	"
36.4	34.00*	$La_2(SeO_4)_3.12H_2O$	93.4	1.97	"

* Metastable

SOLUBILITY OF LANTHANUM SELENATE IN AQUEOUS SOLUTIONS OF SELENIC ACID.

(Friend, 1937.)

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms. sat. sol.		Solid Phase
	H_2SeO_4	$La_2(SeO_4)_3$			H_2SeO_4	$La_2(SeO_4)_3$	
35	0	31.2	$La_2(SeO_4)_3.Aq.$	83.6	0	3.25	$La_2(SeO_4)_3.12H_2O$
"	2.08	28.96	"				
"	7.80	24.07	"	"	1.68	4.81	"

LANTHANUM TUNGSTATE $La_2(WO_4)_3$.

One liter H_2O dissolves 0.0117 gm. $La_2(WO_4)_3$ at 27° and 0.0236 at 65°. (Hitchcock, 1895.)

LITHIUM Li

SOLUBILITY OF LITHIUM IN LIQUID AMMONIA, DETERMINED BY VAPOR PRESSURE MEASUREMENTS.

(Johnson & Piskur, 1933.)

The vapor pressures of solutions of lithium in liquid ammonia at constant temperature give a curve which intersects the horizontal line representing the vapor pressure of the saturated solution. This point was determined at several temperatures with results showing that, contrary to the determinations of Ruff and Geisel, 1906, a slight increase in concentration of lithium in liquid ammonia occurs with increasing temperature.

t°	Vapor Pressure mm. Hg.	Mols. NH_3 per atom Li	Gms. Li per 100 gms. NH_3
-63.5	1.1	3.81	10.698
-33.2	3.4	3.75	10.866
-32.7	3.4	3.74	10.895
0.0	34.0	3.60	11.319

LITHIUM ALUMINATE $LiH(AlO_2)_2.5H_2O$.

One liter sat. solution of $LiH(AlO_2)_2.5H_2O$ in Water contains 0.00012 gm. equivalents at 25°, 0.00013 at 50° and 0.00033 at 80° as determined by electrical conductivity. (Prociv, 1929.)

AsO

LITHIUM ARSENITE $LiAsO_2$.

EQUILIBRIUM IN THE SYSTEM LITHIUM OXIDE, ARSENIC TRIOXIDE AND WATER AT 25°. (Schreinemakers and de Baat, 1920.)

Four to six weeks constant agitation were required for saturation.

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
Li_2O.	As_2O_3.		Li_2O.	As_2O_3.	
0.0	2.02	As_2O_3	5.36	6.32	$LiAsO_2$
0.45	6.45	»	6.45	6.98	»
0.84	10.26	$LiAsO_2$	7.35	7.47	»
0.89	3.74	»	7.64	7.50	»+$LiOH.H_2O$
2.26	4.19	»	7.81	3.81	$LiOH.H_2O$
4.24	5.65	»	7.15	0.0	»

LITHIUM BORATE (Meta) $LiBO_2.8H_2O$.

BO

SOLUBILITY OF LITHIUM META BORATE IN WATER.

(Rosenheim and Reglin, 1921; Mensel, 1927.)

t°	Gms. $LiBO_2$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $LiBO_2$ per 100 gms. sat. sol.	Solid Phase
-0.515	0.78	Ice + $LiBO_2.8H_2O$	25.6	3.42	$LiBO_2.8H_2O$
0.0	0.89	$LiBO_2.8H_2O$	38.8	9.42	"
18.0	2.203	"	44.8	14.7	"
25.0	3.344	"	47. m.pt.	—	"

EQUILIBRIUM IN THE SYSTEM LITHIUM OXIDE, BORIC OXIDE, WATER AT 30°.

(Dukelski, 1907.)

BO

Gms. per 100 Gms. Sat. Sol. Li_2O.	Gms. per 100 Gms. Sat. Sol. B_2O_3.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. Li_2O.	Gms. per 100 Gms. Sat. Sol. B_2O_3.	Solid Phase.
7.01	...	$LiOH.H_2O$	1.32	3.36	$Li_2O.2B_2O_3.xH_2O$
7.51	2.98	"	0.86	2.47	"
7.71	3.38	" $+Li_2O.B_2O_3.16H_2O$	0.53	2.47	"
7.68	3.56	$Li_2O.B_2O_3.16H_2O$	2.17	13.12	"
5.40	2.78	"	2.61	16.39	"
3.47	2.42	"	5.08	30.81	$Li_2O.5B_2O_3.10H_2O$
2.94	2.51	"	4.10	27.07	"
1.58	3.27	"	3.22	15.40	"
2.17	6.90	"	1.55	15.40	"
3.66	14.78	"	1.30	14.14	"
5.25	22	"	0.96	11.47	$B(OH)_3$
5.63	23.8	"	0.63	4.85	"
1.81	6.20	$Li_2O.2B_2O_3.xH_2O$	0	3.54	"

LITHIUM Per BORATE $Li_2B_2O_5.2\frac{1}{2}H_2O$.

100cc water dissolve 10.13 gm. lithium per borate at ordinary temperature. (Bezner-Löwy, 1923.)

Fusion-point data are given for:

$LiBO_2$ + LiF (Kitaigorodski, Popowa and Botwinkin, 1933.)
" + Li_2SiO_3 (Klooster, 1910-11.)
" + $NaBO_2$ " "

LITHIUM BROMIDE $LiBr.2H_2O$.

SOLUBILITY IN WATER.

(Kremers, 1858; Bogorodsky, 1894; Jones, 1907.)

Br

t°.	Gms. LiBr per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. LiBr per 100 Gms. H_2O.	Solid Phase.
− 0.46	1.058	Ice (J)	10	166	$LiBr.2H_2O$ (K)
− 1.94	4.274	"	20	177	"
− 4.27	8.678	"	30	191	"
−10.3	17.80	"	40	205	"
−30.5	37.64	"	44	209	" $+LiBr.H_2O$ (B)
−45	50	" $+LiBr.3H_2O$	50	214	$LiBr.H_2O$ (K)
−30	80	$LiBr.3H_2O$	60	224	"
−10	122	"	80	245	"
0	143	" (K)	100	266	"
+ 4	160	" $+LiBr.2H_2O$ (B)	159	...	$LiBr.H_2O+LiBr$ (B)

The more recent determinations of Hüttig and Renscher, 1924, and of Hüttig and Steudemann, 1927, (made by the freezing-point method) do not agree with the above older results, especially for the di and tri hydrate. The following values were taken from an average curve constructed from the results of Hüttig and co-workers.

t°	Gms. LiBr per 100 gms. sat. sol.	Solid Phase	t°	Gms. LiBr per 100 gms. sat. sol.	Solid Phase
-72	39.1	Ice + $LiBr.5H_2O$	25	63.0	$LiBr.2H_2O$
-53	47.9	$LiBr.5H_2O$ + $LiBr.3H_2O$	32	65.4(?)	" + $LiBr.H_2O$
-30	51.0	$LiBr.3H_2O$	33	67.6(?)	" "
-10	55.0	"	40	67.8	$LiBr.H_2O$
+ 4	59.2	" + $LiBr.2H_2O$	60	69.0	"
10	59.5	$LiBr.2H_2O$	80	71.0	"
20	61.6	"	100	72.7	"

SOLUBILITY OF LITHIUM BROMIDE IN AQUEOUS SOLUTIONS OF HYDROBROMIC ACID AT 25°.

(Scott and Durham, 1930.)

Gms. per 100 gms. sat. solution HBr	LiBr	Solid Phase
0.0	60.41	$LiBr.2H_2O$
5.44	55.29	"
23.93	38.09	"
29.90	34.45	"

SOLUBILITY OF LITHIUM BROMIDE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 25°.

(Simmons, Freimuth and Russell, 1936.)

Gms. per 100 gms. sat. sol. C_2H_5OH	LiBr	Solid Phase	Gms. per 100 gms. sat. sol. C_2H_5OH	LiBr	Solid Phase
0.0	65.31	$LiBr.2H_2O$	43.28	47.63	$LiBr.H_2O$
4.88	62.08	"	47.57	46.70	"
10.23	59.06	"	46.53	46.63	" + LiBr
14.44	56.68	"	47.86	46.51	LiBr
20.09	55.24	"	51.66	44.13	"
26.59	52.98	"	55.24	42.45	"
33.05	52.07	" + $LiBr.H_2O$	58.78	41.22	"
35.43	50.79	$LiBrH_2O$			

SOLUBILITY OF LITHIUM BROMIDE IN ABSOLUTE ETHYL ALCOHOL.

(Bonnell and Jones, 1926.)

t°.	Gms. LiBr per 100 gms. C_2H_5OH.	Solid Phase.
0	32.61	LiBr
10	36.02	»
25	72.10	»
30	72.51	»
40	73.03	»
50	77.52	»
60	82.84	»
70	89.13	»
75	91.12	»
80	99.10	»

Between 13°.2 and 23°.8 lithium bromide alcoholate is formed and different values are obtained depending upon the solid phase present.

t°.	Gms. LiBr per 100 gms. C_2H_5OH when the Solid Phase is LiBr	$LiBr.4C_2H_5OH$.
13.2	70.0	70.0
15	70.2	38.1 (68.7)
16	70.4	39.0 (67.5)
20	70.8	42.0 (60.6)
23	71.2	46.0 (53.0)
23.8	71.3	47.2

The results in parentheses were obtained by thermal analysis. The eutectic point for Li Bi + $LiBr.4C_2H_5OH$ is at 13°.2. The congruent m. pt. of $LiBr.4C_2OH$ is 23°.8.

SOLUBILITY OF LITHIUM BROMIDE IN ABSOLUTE ACETONE.

(Bell, Rowlands, Bamford, Thomas and Jones, 1930.)

t°	Gms. Li Br per 100 gms. $(CH_3)_2CO$	Solid Phase	t°	Gms. Li Br per 100 gms. $(CH_3)_2CO$	Solid Phase
10	13.4	$LiBr.2(CH_2)_2CO$	35.5	22.6	$LiBr.2(CH_3)_2CO$ + LiBr
20	18.2	"	37	23.7	LiBr
30	21.3	"	40	26.3	"
32	22.1	"	50	34.6	"
35	22.4	"	60	39.7	"

Determinations made by means of specific conductivity measurements by Lannung, 1932, gave 11.24 gms. LiBr per 100 gms. $(CH_3)_2CO$ at 18° and 19.8 gms. at 37°.

100 gms. Glycol dissolve 60.0 gms. LiBr at 14.7°. (deConnick, 1905.)

LITHIUM BROMIDE

100 gms. sat. solution of lithium bromide in Benzaldehyde (C_6H_5CHO) contain 11.527 gms. LiBr at 25°. (Müller, Raschka and Wittemann, 1927.)

Fusion-point data are given for:

LiBr + LiCl	(Botschwar, 1933.)
" + LiF	" "
" + LiOH	(Scarpa, 1915.)
" + AgBr	(Sandonnini and Scarpa, 1913.)
" + KBr	(Kellner, 1917.)
" + $MgBr_2$	(Kellner, 1917; Ferrari and Calla, 1931.)
" + NaBr	(Kellner, 1917.)
" + $SrBr_2$	(Kellner, 1917.)

LITHIUM BROMATE $LiBrO_3.H_2O$.

BrO

SOLUBILITY OF LITHIUM BROMATE IN WATER.

(Simmons and Waldeck, 1931.)

t°	Gms. $LiBrO_3$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $LiBrO_3$ per 100 gms. sat. sol.	Solid Phase
5	61.6	$LiBrO_3.H_2O$	53	72.4	$LiBrO_3$
15	63.3	"	56	72.6	"
25	65.4	"	70.5	74.3	"
35	67.5	"	85	76.2	"
50	71.5	"	100	78.0	"

The transition temperature for $LiBrO_3.H_2O \rightarrow LiBrO_3$ is between 50.8° and 52°.

The previous determination of Mylius and Funk, 1897, at 18° of 60.4 gms. $LiBrO_3$ per 100 gms. sat. solution of density = 1.833, is apparantly too low.

LITHIUM METHIONATE $Li_2[CH_2(SO_3)_2]$.

100 gms. H_2O sat. with Lithium Methionate contain 72.8 gms. $Li_2[CH_2(SO_3)_2]$ at 25°. (Baker and Terptra, 1929; Baker, 1930.)

LITHIUM FORMATE $LiHCOO.H_2O$.

CH

SOLUBILITY OF LITHIUM FORMATE IN WATER.

(Groschuff, 1903.)

t°.	Gms. HCOOLi per 100 Gms. Solution.	Mols. HCOOLi per 100 Mols. H_2O.	Solid Phase.	t°	Gms. HCOOLi per 100 Gms. H_2O.	Mols. HCOOLi per 100 Mols. H_2O.	Solid Phase.
−20	21.14	9.28	$HCOOLi.H_2O$	91	54.16	40.90	$HCOOLi.H_2O$
0	24.42	11.18	"	98	57.05	45.99	HCOOLi
18	27.85	13.36	"	104	57.64	47.11	"
49.5	35.60	19.14	"	120	59.63	51.13	"
74	44.91	28.22	"				

Sp. gr. sat. sol. at .18° = 1.142.

FREEZING-POINTS OF AQUEOUS LITHIUM FORMATE SOLUTIONS.

(Sidgwick and Gentle, 1922.)

t° of f. pt.	Gms. HCOOLi per 100 gms. sat. sol.	Solid Phase.
− 4.27	5.80	Ice
− 9.02	10.98	"
−16.42	17.84	"

FREEZING-POINTS OF MIXTURES OF LITHIUM FORMATE AND FORMIC ACID.

(Kendall and Adler, 1921.)

The previous results on this system by Groschuff, 1903 are considered to be largely in error.

t°	Gm. Mols. LiHCOO per 100 gm. mols. mixture	Solid Phase	t°	Gm. Mols. LiHCOO per 100 gm. mols. mixture	Solid Phase	t°	Gm. Mols. LiHCOO per 100 gm. mols. mixture	Solid Phase
8.4	0.0	HCOOH	-14.6	18.19	HCOOH	90.5	25.91	LiHCOO
7.0	1.58	"	-17.1	19.56	"	97.9	26.38	"
5.2	3.47	"	-19.8	21.25	"	113.1	27.71	"
3.2	5.23	"	-21.7	22.24	"	131.2	29.87	"
1.1	7.09	"	-23.5	23.49	"	145.1	31.98	"
-1.3	8.93	"	-25.0	24.33	"	150.4	33.04	"
-3.5	10.75	"	+18.0	23.49	LiHCOO	159.1	35.01	"
-5.6	12.23	"	34.0	23.98	"	163.5	36.13	"
-8.2	13.99	"	80.0	25.31	"			

LITHIUM ACETATE $CH_3COOLi.2H_2O$.

SOLUBILITY OF LITHIUM ACETATE IN WATER.

(Sidgwick and Gentle, 1922.)

t°.	Gms. CH_3COOLi per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. CH_3COOLi per 100 gms. sat. sol.	Solid Phase.
— 1.54....	2.63	Ice	53.3.....	52.23	$CH_3COOLi.2H_2O$
— 2.98....	4.83	»	55.4.....	56.60	»
— 6.62....	9.53	»	57.3.....	61.92	»
—16.12....	18.33	»	57.8(m. pt.).	64.25	»
± 0......	23.76	$CH_3COOLi.2H_2O$	57.0.....	64.88	CH_3COOLi
+25.8.....	31.28	»	102.8.....	66.73	»
36.7.....	38.25	»	157.5.....	71.33	»
50.5.....	49.55	»	286(m. pt.) ..	–	»

FREEZING-POINTS OF MIXTURES OF LITHIUM ACETATE AND ACETIC ACID.

(Davidson and McAllister, 1930.)

CH

t°	Gm. Mols. $LiC_2H_3O_2$ per 100 gm. mols. mixture	Solid Phase	t°	Gm. Mols. $LiC_2H_3O_2$ per 100 gm. mols. mixture	Solid Phase
16.50	0.0	$HC_2H_3O_2$	110.0	41.84*	1.1
14.85	3.56	"	112.0	45.74*	"
14.16	5.01	"	112.5	48.76*	"
13.15	6.86	"	112.5	50.06*	"
12.10	8.45	"	136.0	43.95	$LiC_2H_3O_2$
16.7	8.61	1.1	147.5	46.04	"
22.1	9.15	"	156.0	47.57	"
25.0	9.53	"	161.0	48.22	"
51.0	12.28	"	178.5	52.41	"
70.0	16.24	"	188.0	55.89	"
83.0	20.25	"	192.0	56.90	"
98.0	27.64	"	221.0	70.87	"
106.5	35.34	"	272.	100.00	"
109.0	39.83	"			

* Metastable; 1.1 = $LiC_2H_3O_2.HC_2H_3O_2$.

Previous determinations upon this this system are given by Vasilev, 1909.

100 gms. methyl alcohol (CH_3OH) sat. with dehydrated lithium acetate dissolve 30.37 gms. $LiC_2H_3O_2$ at 15° and 32.47 gms. at 67.2° (b.pt.) (Henstock, 1934.)

LITHIUM Phenyl ACETATE $LiC_7H_7CO_2$

Fusion-point data for mixtures of Lithium phenyl acetate ($LiC_7H_7CO_2$) and Phenyl acetic acid ($HC_7H_7CO_2$) and for Lithium phenyl acetate and Phenyl acetic anhydride, $(C_7H_7CO)_2O$, are given by Bakunin and Vitale, 1935.

LITHIUM CITRATE $C_3H_4(OH)(COOLi)_3.4H_2O$.

100 gms. H_2O dissolve 61.2 gms. Li citrate at 15°. d_{15} sat. sol. = 1.187.
(Greenish and Smith, 1902.)

SOLUBILITY IN AQUEOUS ALCOHOL AT 25°.
(Seidell, 1910.)

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $C_3H_4OH(COOLi)_3.4H_2O$ per 100 Gms. Solvent.	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $C_3H_4OH(COOLi)_3.4H_2O$ per 100 Gms. Solvent.
0	1.216	74.50	50	0.933	4.93
10	1.150	49.30	60	0.897	2.25
20	1.083	32.10	70	0.867	0.60
30	1.025	18.80	80	0.838	0.30
40	0.976	9.65	100	0.788	0.02

CH

LITHIUM TARTRATES.

SOLUBILITY IN WATER.

Salt.	Formula.	t°.	Gms. Salt per 100 Gms. Sat. Sol.	Authority.
Lithium Dihydroxytartrate	$Li_2C_4H_4O_8.2\frac{1}{2}H_2O$	0	0.079	(Fenton, 1898.)
Lithium Sodium Racemic Tartrate	$LiNaC_4H_4O_6.2H_2O$	20	19.97	(Schlossberg, 1900.)
" " Dextro "	"	20	22.55	"
" Potassium Racemic "	$LiKC_4H_4O_6.H_2O$	20	35.19	"
" " Dextro "	"	20	37.82	"

THE SYSTEM LITHIUM AMMONIUM d-TARTRATE, LITHIUM AMMONIUM l TARTRATE AND WATER.
(Campbell and Slotin, 1933.)

The saturated solutions and the solid phases were analyzed polarimetrically using as a scale the rotations of solutions of pure Lithium Ammonium d Tartrate of different concentrations, determined for the sodium D line at 30°. The isotherm at 0° was determined and the invariant points only at 30° and 60°.

t°	Gms. per 100 gms. H_2O		Solid Phase
	$d-LiNH_4C_4H_4O_6$	$r-LiNH_4C_4H_4O_6$	
0	0.0	2.806	Racemate form (= $Li_2(NH_4)_2(C_4H_4O_6)_2.H_2O$)
"	6.531	2.363	"
"	12.241	1.860	"
"	17.690	1.64	"
"	23.251	1.462	" + d form
"	24.810	0.98	d form
"	28.519	0	"
30	0.0	6.542	Racemate form
"	32.917	—	" + d form
"	37.910	0.0	d form
60	0.0	11.480	Racemate form
"	44.103	—	" + d form
"	52.743	0.0	d form

SOLUBILITY OF LITHIUM d-TARTRATE IN WATER.

(Campbell and Slotin, 1933.)

t°	Gms. $Li_2C_4O_4O_6$ per 100 gms. H_2O	Solid Phase	t°	Gms. $Li_2C_4O_4O_6$ per 100 gms. H_2O	Solid Phase
0	42.106	$Li_2C_4H_4O_6 \cdot 2H_2O$	25	26.711	$LiC_4H_4O_6$
8.0	33.451	"	30	26.663	"
10.55	31.495	"	45	27.510	"
20.0	27.052	"	60	29.522	"
21.67 tr. pt.	—	" + $Li_2C_4H_4O_6$			

EQUILIBRIUM IN THE SYSTEM LITHIUM d-TARTRATE, AMMONIUM d-TARTRATE AND WATER.

(Campbell and Slotin, 1933.)

Gms. per 100 gms. H_2O $(NH_4)_2C_4O_4O_6$	Gms. per 100 gms. H_2O $Li_2C_4O_4O_6$	Solid Phase
Results at 0°		
0.0	42.106	$Li_2C_4H_4O_6 \cdot 2H_2O$
2.510	36.857	"
3.473	32.561	"
6.013	30.160	" + DS
8.022	22.125	DS
14.491	14.092	"
23.081	8.846	"
36.610	7.011	"
45.930	6.026	" + $(NH_4)_2C_4H_4O_6$
45.125	3.952	$(NH_4)_2C_4O_4O_6$
44.251	1.973	"
43.916	0.0	"
Results at 30°		
0.0	26.661	$Li_2C_4O_4O_6$
3.076	27.143	"
7.703	29.181	"
9.350	30.661	"
11.980	32.731	" + DS
14.672	26.071	DS
16.744	22.603	"

Gms. per 100 gms. H_2O $(NH_4)_2C_4H_4O_6$	Gms. per 100 gms. H_2O $Li_2C_4H_4O_6$	Solid Phase
Results at 30° (con.)		
24.662	14.732	DS
29.651	11.603	"
39.671	8.182	"
63.600	6.916	"
66.205	6.771	" + $(NH_4)_2C_4H_4O_6$
66.310	3.326	$(NH_4)_2C_4H_4O_6$ CH
63.813	0.0	"
Results at 60°		
0.0	29.552	$Li_2C_4O_4O_6$
5.807	30.051	"
11.003	31.452	"
16.349	34.242	"
23.121	37.981	" + DS
24.431	27.609	DS
41.083	16.151	"
63.011	13.103	"
98.392	10.244	" + $(NH_4)_2C_4H_4O_6$
92.832	6.650	$(NH_4)_2C_4H_4O_6$
90.247	3.631	"
87.171	0.0	"

DS = $Li_2C_4H_4O_6 \cdot (NH_4)_2C_4H_4O_6$.

LITHIUM BENZOATE $C_6H_5COOLi.H_2O$.

SOLUBILITY OF LITHIUM BENZOATE IN WATER.

(Sidgwick and Ewbank, 1922.)

t°.	Gms. C_6H_5COOLi per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. C_6H_5COOLi per 100 gms. sat. sol.	Solid Phase.
− 1.69....	7.22	Ice	34.5....	33.20	$C_6H_5COOLi.H_2O$
− 3.94....	13.69	»	84.5....	34.61	C_6H_5COOLi
− 6.49....	19.85	»	111.0....	36.51	»
0.......	27.97	$C_6H_5COOLi.H_2O$	162.4....	45.14	»
+13.5.....	29.80	»	176.0....	49.12	»
28.5.....	32.12	»			

100 gms. Methyl Alcohol (CH_3OH) saturated with dehydrated lithium benzoate contain 20.52 gms. LiC_6H_5COO at 15° and 19.71 gms. at 67° (b.pt.). (Henstock, 1934.)

LITHIUM BENZOATE C_6H_5COOLi.

SOLUBILITY IN AQUEOUS ALCOHOL SOLUTIONS AT 25°.

(Seidell, 1910.)

Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. C_6H_5COOLi per 100 Gms. Sat. Sol.	Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. C_6H_5COOLi per 100 Gms. Sat. Sol.
0	1.103	27.64	60	0.970	19.80
10	1.088	28.60	70	0.932	15.40
20	1.072	28.50	80	0.890	10.70
30	1.052	27.80	90	0.847	6.40
40	1.030	26.20	95	0.823	4.50
50	1.003	23.60	100	0.799	2.60

100 gms. H_2O dissolve about 40 gms. C_6H_5COOLi at the b. pt. (U.S.P.)
100 gms. alcohol dissolve about 10 gms. C_6H_5COOLi at the b. pt. "

LITHIUM *o* Hydroxy BENZOATE (Lithium Salicylate) $C_6H_4.OH.COOLi.H_2O$.

SOLUBILITY OF LITHIUM ORTHO HYDROXYBENZOATE IN WATER.

(Sidgwick and Ewbank, 1922.)

t°.	Gms. *o* C_6H_4 OH.COOLi per 100 gms. sat. sol.	Solid Phase	t°.	Gms. *o* C_6H_4 OH.COOLi per 100 gms. sat. sol.	Solid Phase
— 2.26...	10.17	Ice	28.5...	56.50	*o* C_6H_4 OH.COOLi H_2O
— 5.56...	20.62	"	32.0...	57.50	"
—12.82..	35.83	"	38.5...	59.67	"
— 8 5...	45.20	*o* C_6H_4.OH.COOLi $6H_2O$	52.0...	64.18	" (unstable)
— 1.0....	49.04	"	60.0...	66.56	" "
+ 9.0....	52.45	*o* C_6H_4 OH COOLi H_2O	73.0...	66.56	*o* C_6H_4 OH COOLi
3.5....	52.96	*o* C_6H_4 OH.COOLi.$6H_2O$ (unstable)	113.0...	71.46	"
10.0....	59.96	*o* C_6H_4 OH COOLi.H_2O	138.0...	75.77	"

CH

SOLUBILITY OF LITHIUM META AND PARA HYDROXYBENZOATES IN WATER.

(Sidgwick and Ewbank, 1922.)

Results for Meta Hydroxybenzoate.			Results for Para Hydroxybenzoate.		
t°.	Gms. *m* C_6H_4.OH.COOLi per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. *p* C_6H_4.OH.COOLi per 100 gms. sat. sol.	Solid Phase.
— 4.41...	16.02	Ice	— 0.98...	5.04	Ice
— 10.78...	29.58	"	— 2.37...	9.81	"
— 17.67...	39.97	"	— 5.23...	17.88	"
+ 10 0....	52.53	*m* C_6H_4 OH COOLi	— 9.28...	25.96	"
74.5. ..	55.04	"	— 12.62...	31.54	" (unstable)
104.0....	58.47	"	+ 12.5....	30.84	*p* C_6H_4.OH COOLi
122.0....	61.86	"	± 0. ...	30.92	"
			85.0....	31.96	"
			113.0....	35.00	"

LITHIUM SALICYLATE $C_6H_4OHCOOLi.\frac{1}{2}H_2O$.

SOLUBILITY IN AQUEOUS ALCOHOL SOLUTIONS AT 25°.

(Seidell, 1909, 1910.)

Gms. C_2H_5OH per 100 Gms. Solvent.	d_{25} of Sat. Sol.	Gms. $C_6H_4OHCOOH.\frac{1}{2}H_2O$ per 100 Gms. Sat. Sol.	Gms. C_2H_5OH per 100 Gms. Solvent.	d_{25} of Sat. Sol.	Gms. $C_6H_4OHCOOH.\frac{1}{2}H_2O$ per 100 Gms. Sat. Sol.
0	1.209	56	60	1.104	51.1
10	1.195	55.9	70	1.083	49.5
20	1.180	55.4	80	1.056	47.5
30	1.163	54.7	90	1.026	45.8
40	1.144	53.7	92.3	1.020	45.6
50	1.124	52.5	100	1.027	48.2

100 gms. propyl alcohol dissolve 18.7 gms. Li salicylate (temp.?). (Schlamp, 1894.)

LITHIUM HIPPURATE $C_6H_5CO.NHCH_2COOLi$.

100 gms. H_2O dissolve about 40 gms. of the salt at 15-20°.

LITHIUM PHTHALATE $2Li_2C_8H_4O_4 \cdot 3H_2O$.

(Squire and Caines, 1905.)

EQUILIBRIUM IN THE SYSTEM LITHIUM PHTHALATE, PHTHALIC ACID AND WATER.

(Smith, Sturm and Ely, 1935.)

Gms. per 100 gms. sat. sol.		Solid Phase
$H_2C_8H_4O_4$	$Li_2C_8H_4O_4$	
Results at 0°		
0.0	45.37	$2Li_2C_8H_4O_4 \cdot 3H_2O$
1.27	45.41	"
2.81	45.75	" + $LiHC_8H_4O_4 \cdot 2H_2O$
2.84	40.55	$LiHC_8H_4O_4 \cdot 2H_2O$
3.46	36.25	"
4.15	32.40	"
7.15	26.09	"
9.61	22.45	" + $H_2C_8H_4O_4$
8.67	20.39	$H_2C_8H_4O_4$
7.45	16.55	"
5.58	11.06	"
3.92	5.83	"
1.97	2.28	"
0.30	0.0	"
Results at 25°		
0.0	45.20	$2Li_2C_8H_4O_4 \cdot 3H_2O$
2.38	45.17	"
3.60	45.15	"
5.20	45.19	" + $LiHC_8H_4O_4 \cdot 2H_2O$
6.51	38.13	$LiHC_8H_4O_4 \cdot 2H_2O$
7.79	34.07	"
9.08	32.36	"
11.39	28.23	"
Results at 25 (con.)		
14.01	25.56	$LiHC_8H_4O_4 \cdot 2H_2O$
16.34	24.25	" + $H_2C_8H_4O_4$
13.32	19.39	$H_2C_8H_4O_4$
10.56	14.56	"
6.97	8.87	"
3.34	3.22	"
0.68	0.0	"
Results at 50°		
0.0	46.08	$2Li_2C_8H_4O_4 \cdot 3H_2O$
3.73	46.01	"
6.40	46.00	"
9.97	46.01	" + $LiHC_8H_4O_4 \cdot 2H_2O$
12.42	39.32	$LiHC_8H_4O_4 \cdot 2H_2O$
15.07	34.77	"
18.92	30.05	"
21.78	28.29	"
24.00	26.69	" + $H_2C_8H_4O_4$
20.21	21.36	$H_2C_8H_4O_4$
15.29	15.28	"
11.48	10.80	"
6.81	5.30	"
4.75	3.28	"
1.75	0.0	"

CH

EQUILIBRIUM IN THE SYSTEM LITHIUM PHTHALATE, MAGNESIUM PHTHALATE AND WATER.

(Smith and Ely, 1938.)

Gms. per 100 gms. sat. sol.		Solid Phase
$MgC_8H_4O_4$	$Li_2C_8H_4O_8$	
Results at 25°		
0.0	45.24	$2Li_2C_8H_4O_4 \cdot 3H_2O$
7.52	41.12	"
12.98	36.72	"
16.39	34.50	"
19.27	33.05	"
19.97	32.50	" + $2MgC_8H_4O_4 \cdot 11H_2O$
20.43	29.53	$2MgC_8H_4O_4 \cdot 11H_2O$
20.96	26.88	"
22.40	21.78	"
23.06	19.63	"
25.31	14.86	"
Results at 25° (con.)		
31.09	4.55	$2MgC_8H_4O_4 \cdot 11H_2O$
34.14	0.0	"
Results at 50°		
0.0	46.01	$2LiC_8H_4O_4 \cdot 3H_2O$
6.97	41.76	"
18.32	35.22	"
26.06	31.05	"
34.75	17.49	$2MgC_8H_4O_4 \cdot 11H_2O$
36.10	11.74	"
40.31	3.18	"
42.28	0.0	"

LITHIUM Racemic and Laevo **MANDELATES** $LiC_8H_7O_3$.

EQUILIBRIUM IN THE SYSTEM LITHIUM (±) RACEMIC MANDELATE, RACEMIC MANDELIC ACID AND WATER AT 25°.

(Ross and Morrison, 1933.)

Gms. per 100 gms. sat. sol. $HC_8H_7O_3$	Gms. per 100 gms. sat. sol. $LiC_8H_7O_3$	Solid Phase	Gms. per 100 gms. sat. sol. $HC_8H_7O_3$	Gms. per 100 gms. sat. sol. $LiC_8H_7O_3$	Solid Phase
0.0	4.9	$LiC_8H_7O_3$	13.7	3.3	1.1
0.9	4.7	"	14.6	3.2	"
4.0	4.7	"	15.3	3.2	"
4.7	5.0	" + 1.1	16.2	3.1	"
6.6	4.2	1.1	18.2	3.1	"
8.3	3.9	"	19.0	3.0	"
9.9	3.6	"	20.1	3.0	" + $HC_8H_7O_3$
11.1	3.6	"	18.8	1.6	$HC_8H_7O_3$
13.0	3.3	"	16.9	0.0	"

1.1 = $LiC_8H_7O_3.HC_8H_7O_3$.

EQUILIBRIUM IN THE SYSTEM LITHIUM (-) LAEVO MANDELATE, LAEVO MANDELIC ACID AND WATER AT 25°.

(Ross, Morrison and Johnstone, 1937.)

H

Gms. per 100 gms. sat. sol. (-)$HC_8H_7O_3$	Gms. per 100 gms. sat. sol. (-)$LiC_8H_7O_3$	Solid Phase	Gms. per 100 gms. sat. sol. (-)$HC_8H_7O_3$	Gms. per 100 gms. sat. sol. (-)$LiC_8H_7O_3$	Solid Phase
0.0	8.6	(-)$LiC_8H_7O_3$	10.6	3.5	1.1
1.0	8.5	"	11.9	3.4	"
1.3	8.6	"	10.3	3.4	(-)$HC_8H_7O_3$
2.6	5.6	1.1	10.2	2.6	"
5.6	4.0	"	10.0	1.7	"
6.9	4.0	"	9.9	0.8	"
9.2	3.7	"	10.1	0.0	"

1.1 = (-) $LiC_8H_7O_3.HC_8H_7O_3$

DiLITHIUM *d* CAMPHORATE $C_{10}H_{14}O_4Li_2$.

SOLUBILITY IN AQUEOUS SOLUTIONS OF CAMPHORIC ACID AT 13.5°-16° AND VICE VERSA.

(Jungfleisch and Landrieu, 1914.)

Gms per 100 Gms Sat. Sol. $C_8H_{14}(COOH)_2$.	Gms per 100 Gms Sat. Sol. $C_{10}H_{14}O_4Li_2$.	Solid Phase.	
0.621	0	Camphoric Acid	$C_8H_{14}(COOH)_2$
2.02	3.77	" "	"
3.25	10.63	Monolithium Tetracamphorate	$C_{10}H_{15}O_4Li.3C_{10}H_{16}O_4$
3.51	12.61	" "	"
3.99	20.56	" Dicamphorate	$C_{10}H_{15}O_4.Li.C_{10}H_{16}O_4$
3.43	24.69	" "	"
2.87	37.16	" Camphorate	$C_{10}H_{15}O_4Li$
0	40.80	Dilithium Camphorate	$C_{10}H_{14}O_4Li_2$

The mixtures were kept in a cellar at nearly constant temperature and shaken from time to time until equilibrium was reached. Additional results at 17°-23° are also given.

LITHIUM LAURATE, MYRISTATE, PALMITATE and STEARATE.

SOLUBILITY OF EACH OF THESE SALTS, DETERMINED SEPARATELY, IN SEVERAL SOLVENTS.

(Jacobson and Holmes, 1916.)

Li laurate = $C_{11}H_{23}COOLi$. Li myristate = $C_{13}H_{27}COOLi$, Li palmitate = $CH_3(CH_2)_{14}COOLi$ and Li stearate = $CH_3(CH_2)_{16}COOLi$.

Excess of salt shaken with solvent for 2 hrs. in all cases. The sat. sol. was analyzed by evaporating to dryness and weighing residue.

Solvent.	t°.	Gms. of Each Salt (determined separately) per 100 Gms. Solvent.			
		Li Laurate.	Li Myristate.	Li Palmitate.	Li Stearate.
Abs. Ethyl Alcohol	20	0.403	0.194	0.096	0.072
" "	25.4	0.447	0.224	0.118	0.089
" "	35	0.546	0.278	0.142	0.106
" "	50	0.782	0.435	0.248	0.200
" "	65	1.149	0.669	0.391	0.333
Methyl Alcohol	15.2	3.159	1.346	0.616	0.349
" "	25	3.773	1.680	0.771	0.439
" "	34.6	4.597	2.193	1.086	0.658
" "	50	6.088	3.281	1.652	1.057
Water	16.3	0.154	0.027	0.010	0.009
"	25	0.187	0.036	0.015	0.010
"	35	0.207	0.042	0.015	0.010
"	50	0.280	0.062	...	...
Ether	15.8	0.011	0.013	0.007	0.011
"	25	0.006	0.004	0.007	0.011
Amyl Alcohol	16	0.073	0.029	0.019	0.011
" "	25.7	0.111	0.046	0.032	0.028
" "	35	0.126	0.062	0.033	0.031
" "	49.2	0.203	0.109	0.069	0.060
Chloroform	15.2	0.006	0.004	0.004	0.004
Amyl Acetate	14.5	0.068	0.037	0.038	0.034
" "	25	0.064	0.034	0.024	0.029
" "	35	0.061	0.044	0.037	0.031
" "	50	0.061	0.045	0.036	0.044
Methyl Acetate	24.5	0.026	0.013	0.015	0.012
Acetone	15	0.300	0.413	0.434	0.571
"	25	0.376	0.447	0.508	0.706
"	35	0.430	0.502	0.537	0.663

The above lithium salts were prepared by adding the calculated amount of lithium acetate to the alcoholic solutions of the respective fatty acids. The resulting precipitates were dissolved in boiling alcohol and the solutions allowed to stand over night in a cool place. The salts so obtained were washed and dried.

LITHIUM LAURATE, MYRISTATE, etc.

SOLUBILITY IN WATER AND IN ALCOHOL OF $d = 0.797$, AT 18° AND AT 25°.

(Partheil and Ferie, 1903.)

Salt.	Formula.	Gms. Salt per 100 cc. Sat. Solution in: Water at 18°.	Water at 25°.	Alcohol at 18°.	Alcohol at 25°.
Stearate	$C_{17}H_{35}COOLi$	0.010	0.011	0.041	0.0532
Palmitate	$C_{15}H_{31}COOLi$	0.011	0.018	0.0796	0.0956
Myristate	$C_{13}H_{27}COOLi$	0.0232	0.0234	0.184	0.2100
Laurate	$C_{11}H_{23}COOLi$	0.158	0.1726	0.418	0.4424
Oleate	$C_{17}H_{33}COOLi$	0.0674	0.1320	0.9084	1.010

CN

LITHIUM Platino CYANIDE $Li_2Pt(CN)_4.?H_2O$.

SOLUBILITY OF LITHIUM PLATINOCYANIDE IN WATER.

(Terry and Jolly, 1923.)

t°.	Gms. $Li_2Pt(CN)_4$ per 100 gms. H_2O.	t°.	Gms. $Li_2Pt(CN)_4$ per 100 gms. H_2O.	t°.	Gms. $Li_2Pt(CN)_4$ per 100 gms. H_2O.	t°.	Gms. $Li_2Pt(CN)_4$ per 100 gms. H_2O.
0.0...	105.0	30.1...	152.3	40.0...	160.3	50.1...	175.0
16.3...	139.5	30.5...	156.1	42.5...	160.5	53.0...	182.0
22.2...	141.5	31.5...	152.0	42.7...	181.2	55.2...	173.8
23.0...	153.5	32.2...	152.4	43.1..	188.2	60.7...	178.0
24.1...	144.8	34.9...	166.6	43.2...	162.3	64.8...	185.7
25.0...	144.7	35.0...	154.6	45.0...	196.0	66.0...	205.2
25.7...	153.0	35.8..	155.6	45.7...	165.0	71.0...	204.0
25.8...	146.3	37.3...	173.0	46.6...	176.1	72 (tr. pt.)	
26.5...	147.5	38.0...	155.3	47.2...	186.0	78.2...	213.7
26.8...	151.2	38.8...	158.2	48.0...	173.0	88.2...	229.0
28.5...	148.5	39.2...	154.4	49.0 (tr. pt.)		89.8...	238.7
29.5 (tr. pt.)		39.5 (tr. pt.)		49.2...	173.1		

EQUILIBRIUM IN THE SYSTEM LITHIUM PLATINOCYANIDE, POTASSIUM PLATINOCYANIDE AND WATER AT 24°.1.

(Terry and Jolly, 1923.)

Gms. per 100 gms. sat. sol. $Li_2Pt(CN)_4$.	$K_2Pt(CN)_4$.	Solid Phase.	Gms. per 100 gms. sat. sol. $Li_2Pt(CN)_4$.	$K_2Pt(CN)_4$.	Solid Phase.
59.2	0.0	$Li_2Pt(CN)_4.?H_2O$	29.3	18.7	$LiKPt(CN)_4.2H_2O$
54.2	1.7	$LiKPt(CN)_4.2H_2O$	28.7	18.2	$K_2Pt(CN)_4.3H_2O$
54.1	2.2	»	27.3	16.1	»
52.1	2.7	»	23.0	19.8	»
45.9	4.4	»	22.0	19.4	»
38.9	9.2	»	19.3	20.2	»
36.5	11.2	»	10.2	23.6	»
34.0	12.3	»	6.1	26.5	»
30.5	13.9	»	4.6	26.9	»
28.5	16.1	»	0.0	28.6	»

CNS

LITHIUM Thio CYANATE $LiSCN.2H_2O$

SOLUBILITY OF LITHIUM THIOCYANATE IN WATER.

(Iwase, 1930.)

t°	Gms. LiSCN per 100 gms. sat. sol.	Solid Phase	t°	Gms. LiSCN per 100 gms. sat. sol.	Solid Phase
20	53.2	$LiSCN.2H_2O$	34	—	$LiSCN.2H_2O + LiSCN$
25	54.5	"	35	58.8	LiSCN
30	56.7	"	40	60.4	"

LITHIUM CARBONATE Li_2CO_3.

SOLUBILITY IN WATER.

(Bevade, 1885; Flückiger, 1887; Draper, 1887.)

An average curve was constructed from the available results and the following table read from it.

t°.	Gms. Li_2CO_3 per 100 Gms. Water.	Gms. Li_2CO_3 per 100 Gms. Solution.	t°.	Gms. Li_2CO_3 per 100 Gms. Water.	Gms. Li_2CO_3 per 100 Gms. Solution.
0	1.54	1.52	40	1.17	1.16
10	1.43	1.41	50	1.08	1.07
20	1.33	1.31	60	1.01	1.00
25	1.29	1.28	80	0.85	0.84
30	1.25	1.24	100	0.72	0.71

Density of saturated solution at 0° = 1.017; at 15° = 1.014.

More recent results at 0° agreeing with the above are given by Rosenheim and Reglin, 1921; and at 0° and 100°, by Kraus and Burgess, 1927.

Determinations of the equilibrium in aqueous solutions of lithium carbonate and bicarbonate in relation to the partial pressure of the carbon dioxide in the gas phase in contact with the solution are given by Walker, Bray and Johnston, 1927.

SOLUBILITY OF LITHIUM CARBONATE IN WATER UNDER HIGH PRESSURES OF CARBON DIOXIDE.

(Haehnel, 1927.)

A platinum lined autoclave was used and the mixtures shaken 1 hour and allowed to stand 1/2 hour before removing a sample for analysis. Lithium carbonate goes into solution in water in presence of CO_2 as bicarbonate. Such aqueous bicarbonate solutions are stable above -12° only under a CO_2 pressure of more than 1 atmosphere. The results are presented both in terms of gms. of Li_2CO_3 (shown in parentheses in the following table) and of $LiHCO_3$ per 100 gms. sat. solution.

Pressure of CO_2 in Atmospheres	Gms. $LiHCO_3$ per 100 gms. saturated solution at: -12°	-10°	-5°
1	22.71 (12.36)	21.25 (11.36)	16.12 (8.77)
3	22.71 (12.36)	22.43 (12.20)	— —
5	—	22.43 (12.20)	21.36 (11.62)
8	—	—	21.36 (11.62)
10	—	—	—
13	—	—	—
16	—	—	—
20	—	—	—
30	—	—	—
34	—	—	—
50	—	—	—

Pressure of CO_2 in Atmospheres	Gms. LiHCO per 100 gms. saturated solution at: 0°	+18°	+40°	+60°
1	14.13 (7.69)	10.56 (5.75)	8.55 (4.65)	7.33 (3.99)
3	— —	— —	— —	— —
5	16.96 (9.23)	12.52 (6.82)	8.62 (4.69)	— —
8	19.91 (10.83)	—	—	—
10	19.91 (10.83)	14.90 (8.11)	8.68 (4.72)	—
13	—	16.19 (8.81)	—	—
16	—	17.29 (9.41)	—	—
20	—	17.29 (9.41)	11.48 (6.25)	7.53 (4.10)
30	—	—	12.23 (6.66)	—
34	—	—	12.23 (6.65)	—
50	—	—	—	9.61 (5.23)

100 gms. H_2O dissolve 5.501 gms. $LiHCO_3$ at 13°. (Bevade, 1884.)

SOLUBILITY OF LITHIUM CARBONATE IN AQUEOUS SOLUTIONS OF ALKALI SALTS AT 25°.

(Geffcken — Z. anorg. Chem. 43, 197, '05.)

The original results were calculated to gram quantities and plotted on cross-section paper. The figures in the following table were read from the curves.

Gms. Salt per Liter.	Grams Li_2CO_3 per Liter in Aqueous Solutions of:							
	$KClO_3$.	KNO_3.	KCl.	NaCl.	K_2SO_4.	Na_2SO_4.	NH_4Cl.	$(NH_4)_2SO_4$.
0	12.63	12.63	12.63	12.63	12.63	12.63	12.63	12.63
10	12.95	13.05	13.10	13.4	13.9	14.0	16.0	20.7
20	13.10	13.3	13.5	13.9	14.7	15.0	19.2	25.0
30	13.25	13.6	13.8	14.3	15.4	16.0	21.5	28.2
40	13.40	13.8	14.0	14.6	16.0	16.6	23.3	30.8
60	...	13.8	14.2	14.5	16.9	17.8	26.0	35.2
80	...	13.6	14.0	14.4	17.7	18.6	27.6	38.5
100	...	13.5	13.9	14.2	18.2	19.4	28.4	41.0
120	...	13.3	13.7	14.0	...	19.9	28.7	42.6
140	...	13.0	13.3	...	...	20.4	28.8	43.5
170	...	12.6	...	...	...	...	28.9	...
200	...	12.2	...	...	...	...	29.0	...

CO 100 gms. aq. alcohol of 0.941 Sp. Gr. dissolve 0.056 gm. Li_2CO_3 at 15.5°.

One liter sat. sol. in water contains 0.1722 gm. mols. = 12.73 gms. Li_2CO_3 at 25°. (Ageno and Valla, 1911.)

SOLUBILITY OF LITHIUM CARBONATE IN AQUEOUS SOLUTIONS OF ORGANIC COMPOUNDS AT 25°.

(Rothmund, 1908, 1910; see also Traube, 1909.)

The solubility in H_2O = 0.1687 mols. Li_2CO_3 per liter = 12.47 gms. at 25°.

Aqueous Solution of:	Gm. Mols. Li_2CO_3 per Liter in Aq. Solution of:			
	0.125 Normality.	0.25 Normality.	0.5 Normality.	1 Normality.
Methyl Alcohol	...	0.1604	0.1529	0.1394
Ethyl Alcohol	0.1614	0.1555	0.1417	0.1203
Propyl Alcohol	0.1604	0.1524	0.1380	0.1097
Amyl Alcohol (tertiary)	0.1564	0.1442	0.1224	0.0899
Acetone	0.1600	0.1515	0.1366	0.1104
Ether	0.1580	0.1476	0.1300	...
Formaldehyde	0.1668	0.1653	0.1606	0.1531
Glycol	0.1660	0.1629	0.1565	0.1472
Glycerol	0.1670	0.1647	0.1613	0.1532
Mannite	0.1705	0.1737	0.1778	...
Grape Sugar	0.1702	0.1728	0.1752	0.1778
Cane Sugar	0.1693	0.1689	0.1661	0.1557
Urea	0.1686	0.1673	0.1643	0.1605
Thiourea	0.1667	0.1643	0.1600	0.1523
Dimethylpyrone	0.1562	0.1460	0.1280	0.0992
Ammonia	0.1653	0.1630	0.1577	0.1466
Diethylamine	0.1589	0.1481	0.1283	0.0937
Pyridine	0.1592	0.1503	0.1347	0.1091
Urethan	0.1604	0.1525	0.1377	0.1113
Acetamide	...	0.1614	0.1520	0.1358
Acetonitrile	0.1618	0.1556	0.1429	0.1178
Mercuricyanide	0.1697	0.1704	...	...

Freezing-point data for mixtures of Li_2CO_3 + Li_2SO_4 (Amadori, 1912.)

Li_2CO_3 + K_2CO_3. (Le Chatelier, 1894.)

SOLUBILITY OF LITHIUM CARBONATE IN AQUEOUS SOLUTIONS OF ACETONE AT 17.6°.

(Hartley, 1931.)

Mols. $(CH_3)_2CO$ per 1.0 Mol. $(CH_3)_2CO + H_2O$	Mols. Li_2CO_3 per 1.0 Mol. $Li_2CO_3 + (CH_3)_2CO + H_2O$
0.0	0.00331
0.0326	0.00211
0.0668	0.00105

CO

SOLUBILITY OF LITHIUM CARBONATE IN AQUEOUS SOLUTIONS OF SEVERAL ORGANIC COMPOUNDS.

(Weber, 1929.)

The solubility in water alone is 0.1691 gm. mols. Li_2CO_3 per liter.

Aqueous Solution of:	Gm. Mols. Li_2CO_3 per liter in Aq. Solution of:					
	0.008 Normality	0.0208 Normality	0.0417 Normality	0.0625 Normality	0.125 Normality	0.25 Normality
Paraldehyde	—	—	—	0.1629	0.1573	0.1467
Iso amyl alcohol	—	—	—	0.1621	0.1559	—
Hexyl alcohol	—	0.1666	0.1640	—	—	—
Octyl alcohol	0.1683	—	—	—	—	—

Fusion-point data for mixtures of $Li_2CO_3 + Na_2CO_3$ are given by Skaliks, 1928.)

COO

LITHIUM OXALATE $Li_2C_2O_4$.

SOLUBILITY OF MIXTURES OF LITHIUM OXALATE AND OXALIC ACID IN WATER AT 25°. (Foote and Andrew, 1905.)

Mixtures of the two substances were dissolved in water, and the solutions cooled in a thermostat to 25°.

Gms. per 100 Gms. Solution.		Mols. per 100 Mols. H_2O.		Solid Phase.
$H_2C_2O_4$.	$Li_2C_2O_4$.	$H_2C_2O_4$.	$Li_2C_2O_4$.	
10.20	...	2.274	...	$H_2C_2O_4.2H_2O$
10.66 10.55	2.96 3.11	2.457	0.622	$H_2C_2O_4.H_2O$ and $HLiC_2O_4.H_2O$
8.08 2.60	3.18 5.03	1.823 0.563	0.633 0.962	Double Salt $HLiC_2O_4.4H_2O$ $= 39.2H_2C_2O_4$ and $44.7Li_2C_2O_4$
2.16 2.12	6.54 1.61	0.469	1.273	$HLiC_2O_4.H_2O$ and $Li_2C_2O_4$
	5.87	...	1.901	$Li_2C_2O_4$

100 gms. aqueous solution, simultaneously saturated with lithium oxalate and ammonium oxalate at 25°, contain 5.75 gms. $Li_2C_2O_4$ + 4.8 gms. $(NH_4)_2C_2O_4$.

(Foote and Andrew, 1905.)

LITHIUM OXALATE $Li_2C_2O_4$.

EQUILIBRIUM IN THE SYSTEM LITHIUM OXALATE, ZIRCONIUM OXALATE AND WATER AT 19°.

(Boulanger, 1938a.)

The solid phases were of uncertain composition since the zirconyl oxalate apparantly hydrolyzed, yielding mixtures composed of the oxalates, oxalic acid and water.

COO

Gms. per 100 gms. sat. solution		Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.	
$Li_2(COO)_2$	$ZrO(COO)_2$	$Li_2(COO)_2$	$ZrO(COO)_2$	$Li_2(COO)_2$	$ZrO(COO)_2$
6.06	0.0	6.89	3.41	7.10	5.35
6.37	0.81	7.15	3.70	6.20	6.00
6.66	1.56	7.42	3.82	5.63	6.91
6.50	1.82	7.52	4.93	4.20	7.72
6.56	2.05	7.70	5.01	3.53	8.24

LITHIUM CHLORIDE $LiCl.H_2O$.

SOLUBILITY OF LITHIUM CHLORIDE AND WATER.

Cl

The results of Hüttig and Rensher, 1924; Benrath, 1927, 1932a; Deacon, 1927; Friend and Culley, 1931; Bassett and Sanderson, 1932; Appleby and Crawford, 1934; and Friend, Hale and Ryder, 1937 were plotted and from the average curve, the following values were taken.

t°	d. of sat. sol.	Gms. LiCl per 100 gms. sat. sol.	Solid Phase	t°	d. of sat. sol.	Gms. LiCl per 100 gms. sat. sol.	Solid Phase
0	1.268	40.9	$LiCl.2H_2O$	80	1.331	52.8	$LiCl.H_2O$
5	—	42.0	"	90	1.342	54.8	"
10	1.279	42.7	"	96(tr.pt.)	1.347	56.1	" + LiCl
15	—	43.8	"	97	—	56.8*	$LiCl.H_2O$
18.5(tr.pt.)	1.293	45.35	" + $LiCl.H_2O$	98	—	57.4*	"
25	1.296	45.85	$LiCl.H_2O$	100	1.347	56.2	LiCl
30	—	46.3	"	110	—	56.7	"
40	1.303	47.3	"	120	1.344	57.2	"
50	1.308	48.3	"	130	—	57.6	"
60	—	49.6	"	140	1.339	58.0	"
70	—	51.1	"	160	—	59.2	"

* metastable

Appleby and Crawford give the transition points as 19.1° and 93°.

LITHIUM CHLORIDE LiCl.

FREEZING-POINTS OF MIXTURES OF LITHIUM CHLORIDE AND WATER

Results of
Klein and Svanberg, 1920.

Normality of Aq. LiCl.	F. pt. of solution.
0.1	−0.360
0.25	−0.916
0.50	−1.807

Results of
Rodebush, 1918.

Gms. LiCl per 100 gms. H_2O.	F. pt. of solution.
5.48	− 5.11
10.68	−12.22
15.04	−18.75
18.58	−25.44

The following determinations of the transition points of Lithium Chloride in Water, made by the freezing-point method, are given by Hüttig and Steudemann, 1927.

t°	Gms. LiCl per 100 gms.		Solid Phase
	H_2O	sat. solution	
-80	33.9	25.3	Ice + $LiCl.5H_2O$
-68	40.3	28.7	$LiCl.5H_2O$ + $LiCl.3H_2O$
-20	58.4	36.9	$LiCl.3H_2O$ + $LiCl.2H_2O$
+12.5	68.0	40.5	$LiCl.2H_2O$ + $LiCl.H_2O$
100.5	130.0	56.5	$LiCl.H_2O$ + LiCl

SOLUBILITY OF LITHIUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID.

Results at 0°. (Engel, 1888.)

Gms. per 100 cc. Sat. Sol.		d_0 of Sat. Sol.
LiCl.	HCl.	
51	0	1.255
41.4	8.2	1.243
28.5	24.1	1.249
24.6	29.5	1.251

Results at 25°. (Herz, 1911–12.)

Gms. per 100 cc. Sat. Sol.	
LiCl.	HCl.
57.4	0
56.87	2.30
53.64	3.84
51.98	6.43

EQUILIBRIUM IN THE SYSTEM LITHIUM CHLORIDE, LITHIUM SULFATE AND WATER AT 30°. (Schreinemakers and Kayser, 1918.)

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
LiCl.	Li_2SO_4.		LiCl.	Li_2SO_4.	
46.10	0.0	$LiCl.H_2O$	8.07	12.20	$Li_2SO_4.H_2O$
45.97	0.0	» + $Li_2SO_4H_2O$	5.74	15.71	»
30.74	0.0	$Li_2SO_4.H_2O$	3.98	18.85	»
21.04	1.08	»	2.76	20.43	»
15.30	4.48	»	0.96	23.60	»
12.06	7.48	»	0.00	25.25	»

LITHIUM CHLORIDE LiCl.

EQUILIBRIUM IN THE SYSTEM LITHIUM CHLORIDE, MANGANESE CHLORIDE AND WATER.

(Benrath, 1934b.)

t°	Gms. per 100 gms. sat. sol.		Solid Phase
	MnCl$_2$	LiCl	
0	0.0	40.51	LiCl.2H$_2$O
"	0.54	40.33	" + 4.1.10
"	2.35	36.77	4.1.10
"	3.56	35.23	"
"	8.62	32.30	"
"	10.19	31.10	"
"	11.54	30.24	" + 1.1.5
"	11.63	30.18	1.1.5
"	13.43	28.53	"
"	13.45	28.60	" + MnCl$_4$.4H$_2$O
"	12.48	25.40	MnCl$_4$.4H$_2$O
"	14.15	22.12	"
"	27.91	8.84	"
"	38.86	0.0	"
20	0.0	45.28	LiCl.2H$_2$O + LiCl.H$_2$O
"	0.81	44.67	LiCl.H$_2$O + 4.1.10
"	0.86	44.53	4.1.10
"	3.73	39.26	"
"	9.09	34.82	"
"	14.39	31.45	"
"	16.47	30.41	"
"	17.25	29.65	" + 1.1.5
"	18.26	28.50	1.1.5
"	19.13	27.65	"
"	19.91	26.74	MnCl$_2$.2H$_2$O
"	22.25	23.82	" + MnCl$_2$.4H$_2$O
"	21.28	22.47	MnCl$_2$.4H$_2$O
"	28.75	11.51	"
"	42.36	0.0	"
35	2.55	45.14	LiCl.H$_2$O + 2.1.4
"	5.48	40.53	2.1.4
"	10.66	35.93	"
"	12.99	34.26	"
"	18.86	30.08	"
"	20.29	29.11	" + MnCl$_2$.2H$_2$O
"	21.57	26.40	MnCl.2H$_2$O
"	28.77	17.98	"
35	29.07	17.66	MnCl.2H$_2$O + MnCl4H$_2$O
"	31.00	13.76	MnCl$_4$.4H$_2$O
"	33.71	10.72	"
"	45.46	0.0	"
60	0.0	49.61	LiCl.H$_2$O
"	1.37	48.68	"
"	4.31	47.10	"
"	5.53	46.50	" + 2.1.4
"	9.68	41.07	2.1.4
"	13.61	37.74	"
"	17.93	33.89	"
"	19.15	33.13	1.1.2
"	23.71	29.09	MnCl$_2$.2H$_2$O
"	33.00	15.62	"
"	41.58	8.14	"
"	51.60	0.0	" + MnCl$_2$.4H$_2$O
80	0.0	52.88	LiCl.H$_2$O
"	5.25	49.47	"
"	7.78	48.33	" + 2.1.2
"	8.94	47.10	2.1.2
"	9.44	46.37	"
"	12.16	43.72	" + 1.1.2
"	17.82	36.79	1.1.2
"	21.62	33.28	"
"	27.52	28.23	" + MnCl$_2$.2H$_2$O
"	35.11	15.02	MnCl$_2$.2H$_2$O
"	52.03	0.0	"
99	0.0	55.84	LiCl
"	6.27	51.96	"
"	7.28	50.75	" + 2.1.2
"	8.81	49.47	2.1.2
"	13.23	44.26	"
"	17.83	39.77	"
"	20.63	37.25	" + 1.1.2
"	27.62	30.22	1.1.2
"	31.77	26.82	" + MnCl$_2$.2H$_2$O
"	36.15	15.89	MnCl$_2$.2H$_2$O
"	53.40	0.0	"

1.1.5 = $LiCl.MnCl_2.5H_2O$; 4.1.10 = $4LiCl.MnCl_2.10H_2O$; 2.1.2 = $2LiCl.MnCl_2.2H_2O$; 2.1.4 = $2LiCl.MnCl_2.4H_2O$; 1.1.2 = $LiCl.MnCl_2.2H_2O$.

Incomplete data are also given for the isotherms at 14°, 17.5°, 22°, 27°, 43°, 45°, 65°, 70°, 75°, 90° and 95°.

SOLUBILITY OF LITHIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AND VICE VERSA AT 25°.

(Smith, Elgersma and Hardenberg, 1924.)

The saturated solutions were analyzed by a viscometric method and also by a modified synthetic method.

Gms. per 100 gms. sat. sol. LiCl.	Gms. per 100 gms. sat. sol. NaCl.
45.8	0.0
45.5	0.5
41.3	0.4
40.1	0.2
36.8	0.3
35.7	0.3
33.5	0.4
33.5	0.3
31.6	0.8
24.9	2.3
17.4	7.3
16.9	8.4
6.5	19.0
0.0	26.4

EQUILIBRIUM IN THE SYSTEM LITHIUM CHLORIDE, NICKEL CHLORIDE AND WATER.

(Benrath, 1932a.)

t°	Gms. per 100 gms. sat. sol. NiCl$_2$	Gms. per 100 gms. sat. sol. LiCl	Solid Phase
0	0	40.51	$LiCl.2H_2O$
"	0.38	40.42	" + 4.1.10
"	2.45	36.24	4.1.10+$NiCl_2.4H_2O$
"	3.14	33.58	$NiCl_2.4H_2O$
"	4.83	30.57	"
"	9.08	22.64	$NiCl_2.6H_2O$
"	34.08	0.0	"
17.5	0.0	44.61	$LiCl_2.2H_2O$
"	0.28	42.61	4.1.10
"	0.40	43.97	"
"	2.33	38.78	"
"	3.84	36.83	$NiCl_2.2H_2O$+ $NiCl_2.4H_2O$
"	9.32	26.65	$NiCl_2.4H_2O$
"	13.64	22.04	"
"	18.49	17.65	"
"	15.99	19.73	$NiCl_2.6H_2O$
"	20.56	14.69	"
"	37.07	0.0	"
25	0	45.90	$LiCl.H_2O$
"	0.21	45.17	" + 2.1.4
"	0.50	42.92	2.1.4
"	2.46	38.93	"
"	3.11	38.17	" + $NiCl_2.2H_2O$
"	3.18	37.85	$NiCl_2.2H_2O$
"	3.46	37.56	"
"	4.43	35.95	"
25	6.98	30.96	$NiCl_2.4H_2O$
"	10.12	26.90	"
"	17.12	19.52	"
"	27.55	16.43	"
"	26.79	10.58	$NiCl_2.6H_2O$
"	33.56	4.94	"
"	39.58	0.0	"
50	0	48.18	$LiCl.H_2O$
"	0.26	48.11	" + 2.1.4
"	1.11	43.36	2.1.4
"	3.59	39.17	"
"	2.84	40.24	$NiCl_2.2H_2O$
"	3.87	37.72	"
"	10.97	28.39	"
"	15.12	24.60	"
"	29.44	12.78*	"
"	18.25	21.61	$NiCl_2.4H_2O$
"	22.43	17.38	"
"	27.69	12.70	"
"	35.05	6.60	"
"	40.20	2.38	"
"	43.17	0.0	"
99.5	0.0	55.84	LiCl
"	0.55	55.50	" + 1.1.2
"	0.72	54.66	1.1.2
"	1.42	48.66	"
"	5.25	40.58	" + $NiCl_2.2H_2O$
"	8.49	34.24	$NiCl\ .2H_2O$
"	14.86	26.71	"
"	28.85	14.49	"
"	36.30	8.97	"
"	46.71	0.0	"

* Metastable

4.1.10 = $4LiCl.NiCl_2.10H_2O$

2.1.4 = $2LiCl\ NiCl_2.4H_2O$

1.1.2 = $LiCl.NiCl_2.2H_2O$

Incomplete results are also given for the isotherms at 20°, 30°, 35°, 40.5°, 60° and 75°.

Equilibrium in the System Lithium Chloride, Ammonia and Water at 23-25°.

(Collins and Cameron, 1928.)

Gms. per 100 gms. sat. sol. LiCl	Gms. per 100 gms. sat. sol. NH_3	Solid Phase	Gms. per 100 gms. sat. sol. LiCl	Gms. per 100 gms. sat. sol. NH_3	Solid Phase	Gms. per 100 gms. sat. sol. LiCl	Gms. per 100 gms. sat. sol. NH_3	Solid Phase
45.4	0.0	$LiCl.H_2O$	51.9	16.70	$LiCl.NH_3$	45.3	32.7	$LiCl.3NH_3$
46.7	3.1	"	54.7	20.0	"	41.52	35.7	"
48.1	7.9	"	57.0	21.64	"	39.3	35.8	"
50.84	13.88	"	52.57	27.31	"	39.11	38.6	"
50.73	14.86	"	46.1	32.0	$LiCl.3NH_3$	37.9	40.4	"
50.81	15.34	$LiCl.NH_3$				45.9	33.2	"

The authors also give vapor pressure measurements for the above system at 25° and for the system LiCl + NH_3 at the temperatures 0°, 33°, 45.2°, 54.5°, 58.3°, 66.4°, 74.6° and 86.9°.

100 gms. Liquid Ammonia dissolve 0.538 gm. LiCl at -33.9°. (Johnson and Krumboltz, 1933.)

100 gms. Liquid Ammonia dissolve 1.41 gm. LiCl at 0°. (Linhard and
Cl Stephan, 1933, 1934.)

Equilibrium in the System Lithium Chloride, Lead Chloride and Water at 25°.

(Deacon, 1927.)

Gms. per 1000 gms. H_2O LiCl	Gms. per 1000 gms. H_2O $PbCl_2$	Solid Phase	Gms. per 1000 gms. H_2O LiCl	Gms. per 1000 gms. H_2O $PbCl_2$	Solid Phase
830.5	0.0	$LiCl.H_2O$	221.6	5.61	$PbCl_2$
830.0	17.2	"	156.2	2.58	"
835.0	31.0	"	75.88	1.53	"
835.0	72.0	"	43.77	1.39	"
834.9	101.6	" + $PbCl_2$	21.64	1.58	"
794.1	103.4	$PbCl_2$	7.16	2.58	"
621.8	94.43	"	6.67	2.68	"
453.9	48.71	"	3.88	4.74	"
329.2	16.36	"	0.0	10.87	"

Solubility of Lithium Chloride in Aqueous Solutions of Ethyl Alcohol at 25°.

(Simmons and Freimuth, 1930.)

Gms. per 100 gms. sat. sol. LiCl	Gms. per 100 gms. sat. sol. C_2H_5OH	Solid Phase	Gms. per 100 gms. sat. sol. LiCl	Gms. per 100 gms. sat. sol. C_2H_5OH	Solid Phase
45.94	0.0	$LiCl.H_2O$	27.19	56.42	$LiCl.H_2O$
44.90	4.45	"	25.43	60.24	"
41.88	12.92	"	23.09	66.77	"
40.65	14.49	"	22.41	68.96	" + LiCl
37.02	24.39	"	22.18	72.98	LiCl
34.17	34.24	"	22.13	74.24	"
30.02	47.43	"	20.18	79.82	"

SOLUBILITY OF LITHIUM CHLORIDE IN AQUEOUS SOLUTIONS OF ALCOHOL AT 25°.

(Pinar de Rubies, 1913–1914.)

The LiCl was determined by titration with $AgNO_3$. Solutions saturated by constant agitation for many hours. Solid phase, $LiCl.H_2O$ for all mixtures. The anhydride, LiCl, separates only from the most highly concentrated alcohol solutions.

Gms. per 100 Gms. Sat Sol.		Gms. per 100 Gms. Sat. Sol.	
C_2H_5OH.	LiCl.	C_2H_5OH.	LiCl.
0	44.9	50	25.75
10	40.9	60	21.6
20	37.25	70	21.1
30	33.3	75	20.8
40	29.4	80	20.75

SOLUBILITY OF LITHIUM CHLORIDE IN AQUEOUS SOLUTIONS OF URETHAN AT 25°.

(Palitzsch, 1928, 1929.)

Gm. Mols. per 1000 gms. H_2O		Solid Phase	Gm. Mols. per 1000 gms. H_2O		Solid Phase
LiCl	$NH_2COOC_2H_5$		LiCl	$NH_2COOC_2H_5$	
19.92	0.0	LiCl	22.40	9.2954	$LiCl + NH_2COOC_2H_5$
19.93	0.2463	"	14.73	48.336	$NH_2COOC_2H_5$
20.03	1.1528	"			

Cl

SOLUBILITY OF LITHIUM CHLORIDE IN ETHYL ALCOHOL AT DIFFERENT TEMPERATURES. (Turner and Bissett, 1913.)

t°.	Gms. LiCl per 100 Gms. C_2H_5OH.	Solid Phase.	t°.	Gms. LiCl per 100 Gms. C_2H_5OH.	Solid Phase.
0	14.42	$LiCl.4C_2H_5OH$	20	24.28	LiCl
5	15.04	"	30	25.10	"
10	16.77	"	40	25.38	"
15	18.79	"	50	24.40	"
17	20.31	"	60	23.46	"

SOLUBILITY OF LITHIUM CHLORIDE IN METHYL ALCOHOL.

(Lloyd, Brown, Olynwyn, Bonnel and Jones, 1928.)

t°	Gms. LiCl per 100 gms. CH_3OH	Solid Phase	t°	Gms. LiCl per 100 gms. CH_3OH	Solid Phase
0	45.2	$LiCl.3CH_3OH$	30	43.8	LiCl
10	44.2	LiCl	40	44.1	"
15	44.0	"	50	44.4	"
20	43.8	"	60	44.6	"

SOLUBILITY OF LITHIUM CHLORIDE IN ACETONE

(Bell, Rowlands, Bamford, Thomas and Jones, 1930.)

t°	Gms. LiCl per 100 gms. CH_3COCH_3	Solid Phase	t°	Gms. LiCl per 100 gms. CH_3COCH_3	Solid Phase
0	1.73	LiCl	30	0.87	LiCl
10	1.48	"	37	0.61	"
18	0.95	"	40	0.69	"
20	1.18	"	50	0.61	"

The values at 18° and at 37° were calculated from specific conductivity measurements by Lannung, 1932.

SOLUBILITY OF LITHIUM CHLORIDE IN SEVERAL SOLVENTS.

Solvent.		Gms. LiCl per 100 Gms. Solvent.	Authority.	Solvent.	t°.	Gms. LiCl per 100 Gms. Solvent.	Authority.
Alcohol:				Alcohol:			
Methyl	25	42.36	(Turner & Bissett, 1913.)	Amyl	25	9.03	(Turner & Bissett, 1913.)
Ethyl	25	2.54*	(Patten & Mott, 1904.)	"	?	7.2	(Andrews & Ende, 1895.)
Propyl	25	16.22	(Turner & Bissett, 1913.)	"	25	9*	(Patten & Mott, 1907.)
"	?	15.86	(Schlamp, 1894.)	Butyl	25	10.57*	" "
"	25	3.86*	(Patten & Mott, 1904.)	Glycerol	25	4.32*	" "
Allyl	25	4.38*	" "	Phenol	53	1.93*	" "

* Fused LiCl used for these determinations.

100 cc. anhydrous hydrazine dissolve 16 gms. LiCl at room temp.
(Welsh and Broderson, 1915.)

SOLUBILITY OF LITHIUM CHLORIDE IN SEVERAL SOLVENTS.

(Laszczynski, 1894; deConinck, 1905.)

In Acetone. (L.)

t°.	Gms. LiCl per 100 Gms. $(CH_3)_2CO$.	t°.	Gms. LiCl per 100 Gms. $(CH_3)_2CO$.
0	4.60	46	3.76
12	4.41	53	3.12
25	4.11	58	2.14

In Pyridine. (L.)

t°.	Gms. LiCl per 100 Gms C_5H_5N.
15	7.78
100	14.26

In Glycol. (de C.)

t°.	Gms. LiCl per 100 Gms. Sat. Sol.
15	11
	-

Cl

SOLUBILITY OF LITHIUM CHLORIDE AT 25° IN MIXTURES OF:

Acetone and Benzene.
(Marden and Dover, 1917.)

Gms Acetone per 100 Gms. Solvent.	Gms. LiCl per 100 Gms. Solvent.	Gms. Acetone per 100 Gms. Solvent.	Gms. LiCl per 100 Gms. Solvent.
100	2.30	40	0.088
90	1.69	20	0.019
80	0.966	10	0.009
60	0.234	0	0

Ethyl Acetate and Benzene.
(Marden and Dover, 1917.)

Gms. Ethyl Acetate per 100 Gms. Solvent.	Gms LiCl per 100 Gms. Solvent.
100	1.78
90	0.147
80	0.028
70	0.005

DISTRIBUTION OF LITHIUM CHLORIDE BETWEEN WATER AND AMYL ALCOHOL AT 30°.

(Dhar and Datta, 1913.)

Mols LiCl per Liter.		$\frac{c_1}{c_2}$.	Mols. LiCl per Liter.		$\frac{c_1}{c_2}$.
H_2O Layer c_1.	Alcohol Layer c_2.		H_2O Layer c_1.	Alcohol Layer c_2.	
3.24	0.0347	93.37	2.68	0.0240	111.66
3.06	0.0325	94.15	2.58	0.0275	113.40
2.93	0.0300	97.70	2.34	0.0200	117
2.82	0.0275	102.58	1.84	0.0125	147.2
2.76	0.0250	110.40	0.65	0.0030	216.66

SOLUBILITY OF LITHIUM CHLORIDE IN PYRIDINE.

(Kahlenberg and Krauskopf, 1908.)

In Anhydrous Pyridine.

t°.	Gms. LiCl per 100 Gms.		Solid Phase.
	Sat. Sol.	Solvent.	
8	11.31	12.71	$LiCl.2C_5H_5N$
28	11.87	13.47	"
40	11.60	13.10	$LiCl.C_5H_5N$
60	11.38	12.84	"
80	11.71	13.27	"
100	13.01	14.98	"

tr. temp. about 28°.

In 97% Pyridine + 3% H_2O by Volume.

t°.	Gms. LiCl per 100 Gms.	
	Sat. Sol.	Solvent.
22	12.50	14.31
32	13.79	15.98
45	15.58	18.46
58	16.72	20.08
72	17.12	20.66
97	18.35	22.48

SOLUBILITY OF LITHIUM CHLORIDE IN QUINOLINE.

(Walton and Wise, 1922.)

t°.	Gms. Li Cl per 100 gms. Quinoline.	Solid Phase.	t°.	Gms. Li Cl per 100 gms Quinoline.	Solid Phase.
0......	0.1515	$(C_9H_7N)_2LiCl$	56.4....	1.1734	$(C_9H_7N)_2LiCl$
25......	0.3538	»	67......	1.2353	»
40......	0.6175	»	75......	0.8180	»
45......	1.0328	»	96......	0.4588	»
50......	1.1107	»			

100 gms. sat. solution of lithium chloride in selenium oxychloride ($SeOCl_2$) contain 3.21 gms. Li Cl at 25°.
(Wise, 1923.)

DISTRIBUTION OF LITHIUM CHLORIDE BETWEEN WATER AND AMYL ALCOHOL AT 24°.9.

(Cavanagh, 1925.)

The mixtures were shaken in sealed tubes of about 600 cc. capacity. One of these was charged 10 times, precisely similarly, and provided a total of 2.5 liters of the amyl alcohol layer. These 10 successive samples of non aqueous equilibrium phase were shaken in turn with one and the same small aqueous phase (100 cc.) in a second tube, and this latter analyzed for Cl by a silver titration method. The procedure consisted essentially in the piece-meal concentration of a large amount of the phase to be analyzed, and the concentration of the Li Cl dissolved therein by a piece-meal extraction of it with water.

Approx. Normality of Li Cl in aq. Phase.	Gm. mols. Li Cl per 1000 gms.		Partition coefficient.
	Aq. phase.	Amyl alcohol phase	
0.05	0.051	0.000152	0.0030
0.10	0.0996	0.0003115	0.00313
0.20	0.198	0.000662	0.00335

DISTRIBUTION OF LITHIUM CHLORIDE BETWEEN WATER AND AMYL ALCOHOL AT 30°.

(Dhar, 1926 a.)

Normality conc. of Li Cl in		$\frac{C_1}{C_2}$.	Normality conc. of Li Cl in		$\frac{C_1}{C_2}$
Aq. layer (C_1).	Alcoholic layer (C_2).		Aq. layer (C_1).	Alcoholic layer (C_2).	
0.65	0.0030	216.7	2.76	0.0250	110.4
1.86	0.0125	147.2	2.82	0.0275	102.6
2.34	0.0220	117.0	2.93	0.0300	97.7
2.58	0.0225	113.4	3.06	0.0325	94.1
2.68	0.0240	111.7	3.24	0.0317	93.4

100 gms. sat. solution of Li Cl in normal butyl alcohol contain 11.49 gms. Li Cl at 25°, and the density of the sat. solution is $d_{\frac{25}{4}} = 0.8713$.
(Willard and Smith, 1922, 1923 a.)

Fusion-point data are given for the following systems:

LiCl + KCl	(Schaeffer, 1919.)
" + " + NaCl	(" "
" + NaCl	(Schaeffer; Zemcznzny and Rimbach, 1910.)
" + LiOH	(Scarpa, 1915.)
" + LiF	(Botschwar, 1933.)
" + $MgCl_2$	(Sandonnini, 1913, 1914.)
" + $MnCl_2$	(Sandonnini and Scarpa, 1913.)
" + NH_4NO_3	(Perman and Harrison, 1924a.)
" + $PbCl_2$	(Tries, 1914.)
" + RbCl	(Richards and Meldrum, 1917; Zemcznzny and Rimbach, 1910; Keitel, 1925.)
" + $SrCl_2$	(Sandonnini, 1911, 1911a, 1914.)
" + SnCl	(Rack, 1914.)
" + TlCl	(Sandonnini, 1911, 1914.)

LITHIUM Gold CHLORIDE $LiAuCl_4$

SOLUBILITY OF LITHIUM GOLD CHLORIDE IN WATER.

(Rosenbladt, 1886.)

t°	Gms. $LiAuCl_4$ per 100 Gms. Solution	t°	Gms. $LiAuCl_4$ per 100 Gms. Solution	t°	Gms. $LiAuCl_4$ per 100 Gms. Solution
10	53.1	40	67.3	60	76.4
20	57.7	50	72	70	81
30	62.5			80	85.7

LITHIUM CHLORATE $LiClO_3$.

SOLUBILITY OF LITHIUM CHLORATE IN WATER.

(Kraus and Burgess, 1927.)

The determinations were made by observing the temperature at which the last crystal of solid phase disappeared in the melt. Careful control of the temperature and vigerous stirring were necessary. The mixtures were kept under a slight excess pressure of dry nitrogen. The temperatures were read by means of a copper-constantan thermocouple.

ClO

t°	Gms. $LiClO_3$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $LiClO_3$ per 100 gms. sat. sol.	Solid Phase
-8.7	15.76	Ice	3.8	71.89	$LiClO_3.H_2O$
-13.2	20.73	"	6.0	72.60	"
-17.4	24.44	"	9.1	73.74	"
-23.3	28.68	"	14.0	76.08	"
-30.5	32.71	"	18.9	78.54	"
-36.6	35.38	"	21.0 tr.pt.	81.2	" + γ$LiClO_3$
-40.0	37.00	" + $LiClO_3.3H_2O$	-3.2	76.59*	$LiClO_3$
-37.1	38.10	$LiClO_3.3H_2O$	+2.9	77.59*	"
-33.9	39.05	"	8.4	78.33*	"
-15.7	45.35	"	12.8	79.26*	"
-8.8	47.94	"	16.4	79.68*	"
-4.8	50.49	"	22.1	81.68	"
-1.8	51.95	"	27.4	82.17	"
+2.2	54.57	"	32.3	83.43	"
4.8	56.66	"	36.5	84.94	"
6.1	58.16	"	41.5 tr.pt.	86.6	" + β$LiClO_3$
7.3	60.15	"	36.9	86.27*	β$LiClO_3$
8.0 m.pt.	62.60	"	43.9	87.17*	γ$LiClO_3$
7.9	63.44	"	48.7	87.0	β$LiClO_3$
7.4	64.88	"	64.4	88.81	"
6.0	67.18	"	71.9	90.35	"
3.4	69.74	"	86.3	92.45	"
+1.5 Eutec.	71.1	" + $LiClO_3.H_2O$	95.7	94.05	"
-1.7	72.59*	"	99.0 tr.pt.	94.9	" + α$LiClO_3$
-3.6	73.74*	"	103.0	95.08	α$LiClO_3$
-7.6	75.15*	"	107.5	96.01	"
-9.0 Eutec.	75.7*	" + γ$LiClO_3$	115.2	97.43	"
-13.6	77.25*	"	123.0	98.86	"
-25.0 Eutec.	81.0	" + β$LiClO_3$	127.3 m.pt.	100.00	"

The previous determination of Mylius and Funk, 1897 at 18° is much below, and that of Carlson, 1910, is considerably above the present results.

Additional results agreeing with the above are given by Berg, 1929. This author gives evidence that the γ modification of $LiClO_3$ is really the hydrate $3LiClO_3.H_2O$, the existance of which he reported in 1926.

LITHIUM Per CHLORATE $LiClO_4.3H_2O$.

SOLUBILITY OF LITHIUM PERCHLORATE IN WATER.

(Simmons and Ropp, 1928.)

t°	d. of sat. sol.	Gms. $LiClO_4$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $LiClO_4$ per 100 gms. sat. sol.	Solid Phase
0	1.215	29.90	$LiClO_4.3H_2O$	92.53	70.33	$LiClO_4.3H_2O + LiClO_4.H_2O$
10	1.236	32.88	"	93.2	70.5	$LiClO_4.H_2O$
20	1.258	35.95	"	97.3	71.0	"
25	1.269	37.48	"	108.9	72.8	"
30	1.277	38.87	"	120.7	75.0	"
40	1.300	41.97	"	136.9	80.0	"
64.6	—	50.0	"	144.0	82.5	"
77.9	—	55.0	"	148.5	85.0	"
89.2	—	60.0	"	149.0 m.pt.	86.5	"
92.3	—	62.5	"	149.3	87.5	"
94.3	—	65.0	"	144.2	90.0	"
95.1 m.pt.		66.32	"	145.75 tr.pt.	—	" + $LiClO_4$
94.8	—	66.67	"	167.5	91.04	$LiClO_4$
93.2	—	70.00	"	172.0	91.11	"
92.7	—	70.3	"	236.0 m.pt.	100.00	"

ClO

LITHIUM Per CHLORATE $LiClO_4.3H_2O$.

SOLUBILITY OF ANHYDROUS LITHIUM PERCHLORATE IN WATER AND IN OTHER SOLVENTS AT 25°. (Willard and Smith, 1923.)

Solvent.	d of solvent.	d of sat. sol.	Gms. $LiClO_4$ per 100 gms. sat. sol.
Water	–	1.2683	37.385
Methyl alcohol	0.78705	1.3849	64.57
Ethyl alcohol	0.78517	1.3173	60.28
n Propyl alcohol	0.7989	1.2006	51.22
n Butyl alcohol	0.8059	1.1326	44.23
iso Butyl alcohol	0.7981	1.0602	36.73
Acetone	0.7852	1.3233	57.72
Ethyl acetate	0.89457	1.3005	48.75
Ethyl ether	0.70817	1.2116	53.21

SOLUBILITY OF LITHIUM PERCHLORATE TRIHYDRATE IN SEVERAL SOLVENTS AT 25°.

(Willard and Smith, 1928.)

Solvent.	d of sat. sol.	Gms. $LiClO_4$ per 100 gms. sat. sol.	Solvent.	d of sat. sol.	Gms. $LiClO_4$ per 100 gms. sat. sol.
Methyl alcohol	1.1420	60.95	*iso* Butyl alcohol	0.8887	18.85
Ethyl alcohol	1.0241	42.16	Acetone	1.0965	49.04
n Propyl alcohol	0.9349	26.82	Ethyl acetate	1.0492	26.35
n Butyl alcohol	0.9082	21.40	Ethyl ether	0.7091	0.196

SOLUBILITY OF LITHIUM PERCHLORATE TRIHYDRATE IN MIXTURES OF ETHYL ALCOHOL AND ETHYL ACETATE AT 25°. (Smith, 1923.)

Vol. per cent C_2H_5OH in solvent.	Gms. $LiClO_4$ per 100 gms. sat. sol.	Vol. per cent C_2H_5OH in solvent.	Gms. $LiClO_4$ per 100 gms. sat. sol.
0.0 (= $CH_3COOC_2H_5$)	26.35	60.0	38.58
10.0	31.05	70.0	39.79
20.0	33.59	80.0	40.84
30.0	35.10	90.0	41.77
40.0	36.51	100.0	42.16
50.0	37.96		

LITHIUM BICHROMATE $Li_2Cr_2O_7.2H_2O$.

SOLUBILITY IN WATER AT 30°.

(Schreinemaker — Z. physik. Chem. 55, 79, '06; at 18°, Mylius and Funk — Ber. 30, 1718, '97.)

CrO

Composition in Weight per cent:				Solid Phase.
Of Solution.		Of Residue.		
% CrO_3.	% Li_2O.	% CrO_3.	% Li_2O.	
0.0	7.09	...	...	$LiOH.H_2O$
6.986	7.744	4.322	18.538	"
16.564	8.888	10.089	19.556	"
25.811	10.611	15.479	21.106	"
33.618	12.886	24.365	19.398	"
37.411	14.306	44.555	17.411	$LiOH.H_2O + Li_2CrO_4.2H_2O$
37.588	14.381	36.331	18.552	" "
37.495	13.311	51.075	16.384	$Li_2CrO_4.2H_2O$
40.280	10.858	...	...	"
43.404	11.809	53.793	14.070	$Li_2CrO_4.2H_2O + Li_2Cr_2O_7.2H_2O$
45.130	9.515	56.085	10.190	$Li_2Cr_2O_7.2H_2O$
47.945	7.951	58.029	9.238	"
57.031	6.432	65.560	8.733	"
67.731	5.713	71.687	8.513	$Li_2Cr_2O_7.2H_2O + CrO_3$
67.814	5.689	80.452	3.780	" "
65.200	4.661	...	...	CrO_3
63.257	2.141	85.914	0.758	"
62.28	...	...	...	"

A saturated aqueous solution contains:

49.985 per cent Li_2CrO_4, or 100 grams H_2O dissolve 99.94 grams Li_2CrO_4 at 30° (S.).

56.6 per cent $Li_2Cr_2O_7$, or 100 grams H_2O dissolve 130.4 grams $Li_2Cr_2O_7$ at 30° (S.).

52.6 per cent Li_2CrO_4, or 100 grams H_2O dissolve 110.9 grams $LiCrO_4$ at 18° (M. and F.).

Sp. Gr. of sat. solution at 18° = 1.574.

LITHIUM FLUORIDE LiF

SOLUBILITY OF LITHIUM FLUORIDE IN WATER.

F

t°	d. of sat. sol.	Gms. LiF per 100 gms. H_2O	Authority
0	—	0.120	(Payne, 1937.)
18	1.003	0.27	(Mylius and Funk, 1897
25	—	0.151	(Carter, 1928.)
25	—	0.132	(Meyer and Dunkel, 1931.)
25	0.9984	0.133	(Payne, 1937.)
35	0.9958	0.135	" "

Solubility of Lithium Fluoride in Liquid Hydrofluoric Acid. Determinations of the Solubility of LiF in liquid HF by Bond and Stowe, 1931, show that the reaction $LiF + HF = LiHF_2$ occurs and the molecular ratio LiF : HF in the saturated solution at temperatures between 0° and 40°, is approximately 0.043. This corresponds to 5.59 gms. LiF per 100 gms. HF. Fredenhagen and Cadenbach, 1930, 1931, 1933, found that 2.6 gms. LiF dissolve per 100cc sat. solution of LiF in liquid HF at 18°.

1000 gms. pure Acetone (CH_3COCH_3) dissolve 0.0000033 gm. LiF at 18° and 0.000004 gm. at 37°, as determined by conductivity measurements. (Lannung, 1932.)

Fusion-point data are given for LiF + LiOH and LiI + LiOH by Scarpa, 1915 and for LiF + MgF_2, by Tacchini, 1924.

LITHIUM Titanium FLUORIDE $Li_2TiF_6.2H_2O$.

SOLUBILITY IN WATER AND IN ETHYL ALCOHOL AT 20-22°.

(Ginsberg, 1932.)

F

Solvent	Gms. Li_2TiF_6 per 100cc Solvent	Solid Phase
Water	about 56	$Li_2TiF_6.2H_2O$
"	48	Li_2TiF_6
98% C_2H_5OH	0.035	$Li_2TiF_6.2H_2O$
"	0.030	Li_2TiF_6

LITHIUM GERMANATE $3LiGeO_3.H_2O$.

100 gms. sat. solution of Lithium Germanate in Water contain 0.84 gm. $LiGeO_3$ at 25°. (Pugh, 1926.)

LITHIUM IODIDE $LiI.3H_2O$.

SOLUBILITY IN WATER.

(Kremers, 1858, 1860; ice curve, Jones, 1907.)

I

t°.	Gms. per 100 Gms. Water.	Gms. per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. per 100 Gms. Water.	Gms. per 100 Gms. Sat. Sol.	Solid Phase.
−0.296	1.08	1.06	Ice	20	165	62 2	$LiI.3H_2O$
−1.218	4.36	4.19	"	25	167	62.6	"
−2.70	8.71	8.02	"	30	171	63.1	"
- 6.14	17.69	15.03	"	40	179	64.2	"
−16.2	38.31	27.70	"	50	187	65.2	"
−25	48.67	32.72	"	60	202	66.9	"
−59	85.13	46	"	70	230	69.7	"
−69 Eutec.	93	48.2	Ice+$LiI.3H_2O$	75	263	72.5	"
−60	100	50	$LiI.3H_2O$	75	m. pt.	...	"
−40	118	54.13	"	85	m. pt.	...	$LiI.2H_2O$
−20	134	57.27	"	80	435	81.3	$LiI.H_2O$
0	151	60.2	"	100	481	82.8	"
10	157	61.1	"	120	590	85 5	"

A more recent determination of the Eutectic point for Ice + $LiI.3H_2O$ by Hüttig and Steudemann, 1927, is −91° and 107 gms. LiI per 100 gms. H_2O.

SOLUBILITY OF LITHIUM IODIDE IN WATER.

(Hüttig and Pohle, 1924.)

t°.	Gms. LiI per 100 gms. H_2O.	Solid Phase.	t°.	Gms. LiI per 100 gms. H_2O.	Solid Phase.
0......	151	$LiI.3H_2O$	77.....	437	$LiI.2H_2O + LiI.H_2O$
19......	164	»	80.....	433	$LiI.1H_2O$
40......	179	»	88.....	437	"
59......	200	»	99.....	476	
75......	248	»	120.....	588	
75......	263	»	130.....	743	
71.5....	286	»	130.....	782	
70.5....	297	»+$LiI.2H_2O$	130.....	826	»+$LiI.{}^1/_2H_2O$
71.5....	306	$LiI.2H_2O$	130.....	835	$LiI.{}^1/_2H_2O$
79......	372	»			

The authors also give vapor pressures and thermo chemical data.

100 gms. sat. sol. of $LiI.3H_2O$ in Water contain 61.2 gms. LiI at 18°. (Lannung, 1934.)

100 gms. sat. sol. of $LiI.3H_2O$ in Water contain 61.6 gms. LiI at 25°. (Robertson, 1933.)

EQUILIBRIUM IN THE SYSTEM LITHIUM IODIDE, LEAD IODIDE AND WATER AT 25°.

(Demassieux and Roger, 1937.)

The results are given in the form of a diagram but the experimental determinations are not reported in the present paper. The following approximate values were estimated from the diagrams.

d. of sat. sol.	Gms. per 100 gms. sat. solution		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. solution		Solid Phase
	PbI_2	LiI			PbI_2	LiI	
1.815	0.0	62.2	$LiI.3H_2O$	2.160	28.0	40.5	1.1.4
1.885	5.0	55.8	"	2.195	31.91	38.53	" + PbI_2
1.970	10.0	55.2	"	2.140	30.0	38.0	PbI_2
2.080	16.0	52.5	"	1.840	22.5	37.0	"
2.160	21.5	50.0	" + 1.1.4	1.590	15.0	35.0	"
2.135	24.0	45.0	1.1.4	1.350	5.5	31.0	"
				1.230	2.0	25.0	"

1.1.4 = $LiI.PbI_2.4H_2O$

I

EQUILIBRIUM IN THE SYSTEM LITHIUM IODIDE, ANTIMONY IODIDE AND WATER.

(Francois and Delwaulle, 1936.)

The results are given only in the form of a diagram from which the following approximate values were read.

Results at 13°		Results at 35°		Results at 60°		
Gms. per 100 gms. H_2O		Gms. per 100 gms. H_2O		Gms. per 100 gms. H_2O		Solid Phase at each temp.
SbI_3	LiI	SbI_3	LiI	SbI_3	LiI	
0	160	0	175	0	195	$LiI.3H_2O$
50	162	50	176	50	196	"
75	163	105	176	135	205	" + 1.1.6
65	130	95	150	125	185	1.1.6
55	110	85	120	115	155	"
70	80	95	100	125	135	"
85	50	80	130	150	115	"

1.1.6 = $LiI.SbI_3.6H_2O$

DISTRIBUTION OF LITHIUM IODIDE BETWEEN WATER AND NITROBENZENE AT 25°.

(Robertson, 1935.)

Gm. Mols. LiI per liter		$\frac{W}{Nb}$
H_2O layer (W)	$C_6H_5NO_2$ layer (Nb)	
4.55	0.00140	3250
2.38	0.00222	1070
1.57	0.00363	430
1.11	0.00141	790
0.82	< 0.00012	> 6830

SOLUBILITY OF LITHIUM IODIDE IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms. LiI per 100 Gms. Solvent.	Authority.
Methyl Alcohol	25	343.4	(Turner and Bissett, 1913.)
Ethyl Alcohol	25	250.8	" "
Propyl Alcohol	25	47.52*	" "
Amyl Alcohol	25	112.5	" "
Glycol	15.3	38.9	(de Coninck, 1905.)
Furfurol	25	45.9†	(Walden, 1906.)
Nitromethane	0	1.22†	"
"	25	2.52	"

* Solid phase = $LiI.4C_3H_7OH$. † = gms. per 100 cc. sat. solution.

100 gms. pure Acetone (CH_3COCH_3) dissolve 42.56 gms. LiI at 18° and 75.25 gms. at 37° as determined by electrical conductivity. (Lannung, 1932.)

F.-pt. data for LiI + AgI are given by Sandonnini and Scarpa, 1913.

LITHIUM IODOMERCURATE $2LiI.HgI_2.6H_2O$.

100 gms. sat. solution of lithium iodomercurate in water prepared by cooling a hot solution and allowing to stand at 24.7° for 3 months, contained 1.30 gms. Li, 27.4 gms. Hg, 58 gms. I and 13.3 gms. H_2O; Sp. Gr. of the sat. sol. = 3.28. (Dubоin, 1905.)

IO

LITHIUM IODATE $Li(IO_3).\frac{1}{2}H_2O$.

100 gms. H_2O dissolve 80.3 gms. $LiIO_3$ at 18°, or 100 gms. solution contain 44.6 grams. Sp. gr. of sol. = 1.568. (Mylius and Funk, 1897.)

LITHIUM PERMANGANATE $LiMnO_4.3H_2O$

100 gms. water dissolve 71.4 gms. permanganate at 16°. (Ashoff.)

LITHIUM MOLYBDATE $4Li_2MoO_4.3H_2O$.

MoO

SOLUBILITY OF LITHIUM MOLYBDATE IN WATER.

(Rosenheim and Reglin, 1921.)

t°	Gms. Li_2MoO_4 per 100 gms. sat. sol.	Solid Phase	t°	Gms. Li_2MoO_4 per 100 gms. sat. sol.	Solid Phase
0	45.24	$4Li_2MoO_4.3H_2O$	30	44.26	$4Li_2MoO_4.3H_2O$
20	44.30	"	40	43.84	"
25	44.81	"	98	42.50	"

The result at 20° is by Wempe, 1913.

Fusion-point data for mixtures of Li_2MoO_4 + MoO_3 and $LiMoO_4$ + Na_2MoO_4 are given by Hoermann, 1929.

LITHIUM NITRIDE $LiN_3.H_2O$.

SOLUBILITY OF LITHIUM NITRIDE IN WATER.

(Rollet and Wohlgemuth, 1934.)

t°	Gms. LiN_3 per 100 gms. sat. sol.	Solid Phase	t°	Gms. LiN_3 per 100 gms. sat. sol.	Solid Phase
-10	10.0	Ice	+18	40.0	$LiN_3.H_2O$
-30	20.0	"	40	43.0	"
-47.5 Eutec.	26.0	" + $LiN_3.4H_2O$	68.2 tr.pt.	48.0	" + LiN_3
-31 tr.pt.	33.5	$LiN_3.4H_2O+LiN_3.H_2O$	100	50.0	LiN_3
0	38.0	$LiN_3.H_2O$			

The results in the above table, except those for the eutectic and the tr.pts., were estimated approximately from the authors' diagram. The preceding results of Curtius and Rissom, 1898, are considered to be in error except the value for 16° which agrees fairly well with the above.

LITHIUM NITRITE $LiNO_2.H_2O$.

NO

SOLUBILITY IN WATER. (Oswald, 1914.)

t°.	Gms. $LiNO_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t.	Gms. $LiNO_2$ per 100 Gms. Sat. Sol.	Solid Phase.
− 7.5	11.1	Ice	38.5	55.5	$LiNO_2.H_2O$
−11.7	15	"	42	56.9	"
−21	21.2	"	49	60.6	"
−28.8	29	"	49.5	61.2	" $+LiNO_2.\frac{1}{2}H_2O$
−31.3	29.4	" $+LiNO_2.H_2O$	65	63.8	$LiNO_2.\frac{1}{2}H_2O$
−19.3	33.9	$LiNO_2.H_2O$	81.5	68.7	"
0	41.5	"	91	72.4	"
+19	48.9 ($d_{19}=1.3186$.)	"	96	91.8	"
25	50.9	"	92.5	94.3	"

100 gms. H_2O dissolve 10.5 gms. $AgNO_2$ + 78.5 gms. $LiNO_2$ at 14°. (Oswald, 1914.)

Recent determinations of the Solubility of Lithium Nitrite by Bureau, 1935, 1937, gave the following results, differing from the above.

t°		Gms. $LiNO_2$ per 100 gms. sat. sol.	Solid Phase	t°	d. of sat. sol.	Gms. $LiNO_2$ per 100 gms. sat. sol.	Solid Phase
- 4.9		7.01	Ice	18.4	1.316	46.6	$LiNO_2.H_2O$
-10.25		12.31	"	34.7	1.358	55.85	"
-24.25		21.08	"	50.9	—	63.0	" + $LiNO_2.\frac{1}{2}H_2O$
-38.7	Eutec.	26.58	" + $LiNO_2.1\frac{1}{2}H_2O$	56.0	1.433	65.5	$LiNO_2.\frac{1}{2}H_2O$
-22.7		32.9	$LiNO_2.1\frac{1}{2}H_2O$	66.0	1.458	66.4	"
-10.95		40.5	"	79.5	1.495	70.2	"
- 7.95		43.5	" + $LiNO_2.H_2O$	94.0	—	75.9	" + $LiNO_2$
+ 1.0		44.0	$LiNO_2.H_2O$	99.0	1.545	76.4	$LiNO_2$

LITHIUM NITRATE $LiNO_3.3H_2O$.

SOLUBILITY IN WATER. (Donnan and Burt, 1903.)

t°.	Gms. $LiNO_3$ per 100 Gms. Solution.	Solid Phase.	t°.	Gms. $LiNO_3$ per 100 Gms. Solution.	Solid Phase.
0.1	34.8	$LiNO_3.3H_2O$	29.87	56.42	$LiNO_3.3H_2O$
10.5	37.9	"	29.86	56.68	"
12.1	38.2	"	29.64	57.48	"
13.75	39.3	"	29.55	58.05	"
19.05	40.4	"	43.6	60.8	$LiNO_3.\frac{1}{2}H_2O$
22.1	42.9	"	50.5	61.3	"
27.55	47.3	"	55	63	"
29.47	53.67	"	60	63.6	"
29.78	55.09	"	64.2	64.9	$LiNO_3$.
			70.9	66.1	"

The eutectic Ice + $LiNO_3.3H_2O$, is at −17.8° and about 33 gms. $LiNO_3$ per 100 gms. sat. sol. Transition points, 29.6° and 61.1°.

Data for the system $LiNO_3 + Li_2SO_4 + H_2O$ at 0°, 30° and 70° are given by Massink, 1916.

EQUILIBRIUM IN THE SYSTEM LITHIUM NITRATE, LITHIUM SULFATE AND WATER AT 25° AND AT 35°. (Massink, 1918.)

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
$LiNO_3$.	Li_2SO_4.	Solid Phase.	$LiNO_3$.	Li_2SO_4.	Solid Phase.	$LiNO_3$	Li_2SO_4.	Solid Phase.
Results at 25°.			62.14	±0.0	$LiNO_3+Li_2SO_4$	19.25	7.41	11.1.17
47.58	0.0	$LiNO_3.3H_2O$	59.65	±0.0	Li_2SO_4	19.12	7.50	» +9.1.27
47.60	±0	» $+Li_2SO_4.H_2O$	57.91	±0.0	» $+Li_2SO_4.H_2O$	16.79	9.25	9.1.27
43.45	0.19	$Li_2SO_4.H_2O$	52.03	±0.0	$Li_2SO_4.H_2O$	12.31	13.13	»
33.90	1.14	»	50.55	±0.0	»+11.1.17	8.98	16.10	»
18.64	8.41	»	49.54	0.08	11.1.17	4.99	20.48	»
0.0	25.79	»	41.83	0.17	»	3.04	22.19	»
Results at 35°.			28.63	2.26	»	1.48	23.88	»
59.49	0.0	$LiNO_3.\frac{1}{2}H_2O$	22.18	5.16	»	0.76	24.55	$Li_2SO_4.H_2O$
61.93	0.0	$LiNO_3$	20.14	6.78	»	0.0	23.76	»
61.97	±0.0	»$+Li_2SO_4$						

$11.1.17 = 11\,Li_2SO_4.LiNO_3.17\,H_2O$;

$9.1.27 = 9\,Li_2SO_4.LiNO_3.27\,H_2O$

NO

SOLUBILITY OF LITHIUM NITRATE IN AQUEOUS SOLUTIONS OF LEAD NITRATE AT 25° AND VICE VERSA.

(Malquori, 1928d)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$LiNO_3$	$Pb(NO_3)_2$		$LiNO_3$	$Pb(NO_3)_2$	
45.83	0.0	$LiNO_3.3H_2O$	21.54	9.36	$Pb(NO_3)_2$
44.75	2.47	"	10.88	15.50	"
40.45	2.65	" + $Pb(NO_3)_2$	0.97	33.20	"
33.96	5.10	$Pb(NO_3)_2$	0.57	33.12	"
29.15	6.30	"	0.0	37.07	"
28.36	8.65	"			

EQUILIBRIUM IN THE SYSTEM LITHIUM NITRATE, TERTIARY BUTYL ALCOHOL AND WATER AT 25°.

(Olnnings, Herring and Webb, 1933.)

The composition of the homogeneous mixture (plait point) of the three compounds as determined by the synthetic method is 16.0 gms. $LiNO_3$ + 23.0 gms. tertiary Butyl Alcohol, $(CH_3)_3COH$, per 100 gms. sat. solution. The original results for the remaining points on the binodal curve are not given but only the values corresponding to derived empirical equations for the curve.

LITHIUM NITRATE

SOLUBILITY OF LITHIUM NITRATE IN LIQUID AMMONIA, DETERMINED BY THE SYNTHETIC METHOD.

(Portnow and Dwilewitch, 1937.)

t^0	Gms. $LiNO_3$ per 100 gms. sat. sol.	Solid Phase	t^0	Gms. $LiNO_3$ per 100 gms. sat. sol.	Solid Phase	t^0	Gms. $LiNO_3$ per 100 gms. sat. sol.	Solid Phase
-77.7	0.0	NH_3	-28.5	40.51	Li 4	12.5	69.24	Li 2+$LiNO_3$
-77.8	3.03	"	-12.0	42.97	"	25.0	70.0	$LiNO_3$
-79.0	10.73	"	+ 5.5	49.28	"	25.0	(70.89)	"
-80.5	21.74	"	+ 3.0	52.82	"	42.0	71.59	"
-78.5	24.26	Li.8	- 3.0	56.96	"+Li.2	119.0	78.35	"
-62.0	30.62	"	+ 7.0	62.7	Li.2	160.0	82.60	"
-53.0	33.51	"	14.5	66.38	"	204.0	89.61	"
-54.0	35.66	Li.4				364.	100.00	"

Li.8 = $LiNO_3.8NH_3$; Li.4 = $LiNO_3.4NH_3$; Li.2 = $LiNO_3.2NH_3$. The authors also give results for the densities of solutions of $LiNO_3$ in NH_3 at 20°. The results at 25° in parenthesis above is by Hunt and Boncyk, 1933.

NO

SOLUBILITY OF LITHIUM NITRATE IN ACETIC ACID, DETERMINED BY THE SYNTHETIC METHOD.

(Davidson and Geer, 1938.)

t^0	Mol. Percent $LiNO_3$	Solid Phase	t^0	Mol. Percent $LiNO_3$	Solid Phase	t^0	Mol. Percent $LiNO_3$	Solid Phase
16.6	0.0	CH_3COOH	12.80	7.693*	CH_3COOH	66.7	12.64	$LiNO_3$
16.3	0.156	"	11.80	9.384*	"	82.6	14.66	"
16.03	0.983	"	10.92	10.310*	"	91.6	15.66	"
15.71	2.013	"	39.0	9.38	$LiNO_3$	101.0	17.08	"
15.0	4.115	"	46.3	10.31	"	118.3	19.84	"
14.46	5.305	"	54.2	11.26	"	132.2	22.34	"

* Metastable

A saturated solution of Lithium Nitrate in Acetone contains 0.343 gm. mols. = 23.67 gms. $LiNO_3$ per liter at about 20°. (Roshdestwensky and Lewis, 1911.)

SOLUBILITY OF LITHIUM NITRATE IN SEVERAL SOLVENTS. (Müller, R., 1924.)

Solvent.	Gms. $LiNO_3$ per 100 cc. solvent at 0°.	25°.
Acetonitrile	-	2.99
Iso amyl alcohol	6.41	9 5
Pyridine	27.4	37.15

EQUILIBRIUM IN THE SYSTEM LITHIUM NITRATE AND UREA.

(Howells, 1931.)

t°	Gms. $LiNO_3$ per 100 gms. Mixture	Solid Phase	t°	Gms. $LiNO_3$ per 100 gms. Mixture	Solid Phase	t°	Gms. $LiNO_3$ per 100 gms. Mixture	Solid Phase
132.0	0.0	$CO(NH_2)_2$	71.0	18.8	$Co(NH_2)_2$+1.2	123.7	39.39	1.2
126.7	2.78	"	64.1	19.83*	"	122.0	42.25	"
122.3	4.67	"	44.7	22.98*	"	113.2	46.36	"
113.9	7.93	"	106.8	25.68	1.2	104.1	48.63	"
105.0	10.79	"	113.5	27.89	"	100.6	50.38	"
102.9	11.31	"	117.5	29.56	"	98.5	50.00	"+$LiNO_3$
90.1	14.53	"	122.5	32.6	"	121.3	52.85	$LiNO_3$
74.0	19.52	"	125.9	35.92	"	127.9	54.10	"
						146.4	57.07	"

* Metastable. 1.2 = $LiNO_3.2CO(NH_2)_2$.

Fusion-point data are given for:

$LiNO_3$ + Li_2SO_4 (Amadori, 1913.)
" + $NaNO_3$ (Carveth, 1898; Lehrman and Breslow, 1938.)
" + $RbNO_3$ (Puschin and Radoicic, 1937.)
" + $TlNO_3$ (Briscoe, Evans, and Robinson, 1932.)

LITHIUM OXIDE Li_2O

Fusion-point data for the System Li_2O + V_2O_5 are given by Canneri, 1928.

LITHIUM HYDROXIDE $LiOH.H_2O$.

SOLUBILITY IN WATER.

(Dittmar, 1888; Pickering, 1893.)

t°.	Gms. per 100 Gms. Solution.		Gms. LiOH per 100 Gms. H_2O.	t°.	Gms. per 100 Gms. Solution		Gms. LiOH per 100 Gms. H_2O.
	Li_2O	= LiOH.			Li_2O	= LiOH.	
−10.5	...	7.23	...	30	7.05	11.27	12.9
−18 Eutec	...	11.2	...	40	7.29	11.68	13
0	6.67	10.64	12.7	50	7.56	12.12	13.3
10	6.74	10.80	12.7	60	7.96	12.76	13.8
20	6.86	10.99	12.8	80	8.87	14.21	15.3
25	6.95	11.14	12.9	100	10.02	16.05	17.5

100 gms. sat. solution of $LiOH.H_2O$ in Water contain 10.7 gms. LiOH at 0°; (Rollet and Lauffenburger, 1934.); 11.35 gms. at 25° (Van Meurs, 1916); 11.0 gms. at 25° (Ueda, 1933.)

SOLUBILITY OF LITHIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF LITHIUM SULFOANTIMONATE AT 30° AND VICE VERSA.

(Donk, 1908)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
LiOH.	Li_3SbS_4.		LiOH.	Li_3SbS_4.	
11.4	0	$LiOH.H_2O$	2.1	48.3	$LiOH.H_2O$
9.1	8.3	"	2.1	52.1	" +$Li_3SbS_4.10H_2O$
2.3	29.9	"	1.4	51.8	$Li_3SbS_4.10H_2O$
			0	51.3	"

EQUILIBRIUM IN THE SYSTEM LITHIUM HYDROXIDE, PHENOL AND WATER AT 25°.

(Van Meurs, 1916).

Mols. per 100 mols. sat. sol.			Mols. per 100 mols. sat. sol.		
LiOH.	C_6H_5OH.	Solid Phase.	LiOH.	C_6H_5OH.	Solid Phase.
8.79	0.0	$LiOH.H_2O$	4.36	30.48	$C_6H_5OLi.2H_2O$
8.30	0.23	»	3.85	45.05	»
8.25	0.41	» + $C_6H_5OLi.2H_2O$	3.56	51.34	»
5.26	1.02	$C_6H_5OLi.2H_2O$	2.32	68.19	»
2.64	2.37	»	2.08	68.71	»
3.25	7.72	»	2.11	70.42	» + C_6H_5OH
3.79	14.38	»	2.14	71.94	» »
4.28	22.64	»	1.82	73.11	C_6H_5OH

At concentrations of LiOH below 0.25 mol. per cent, liquid layers with the following composition are formed.

Aqueous layer.		Phenol layer.	
Mol. % LiOH.	Mol. % C_6H_5OH.	Mol. % LiOH.	Mol. % C_6H_5OH.
0.0	1.79	0.0	32.33
0.23	3.34	0.35	17.97

◆

LITHIUM PHOSPHATES, Li_3PO_4, LiH_2PO_4.

100 gms. sat. solution of neutral Lithium phosphate in water contain 0.022 gm. Li_3PO_4 at 0° and 0.030 gm. at 20°.

100 gms. sat. solution of acid Lithium phosphate in water contain 55.8 gms. LiH_2PO_4 at 0°. (Rollet and Lauffenburger, 1934.)

EQUILIBRIUM IN THE SYSTEM LITHIUM OXIDE. PHOSPHORUS

EQUILIBRIUM IN THE SYSTEM LITHIUM HYDROXIDE, PHENOL AND WATER AT 25°.

(Van Meurs, 1916).

OH

Mols. per 100 mols. sat. sol.			Mols. per 100 mols. sat. sol.		
LiOH.	C_6H_5OH.	Solid Phase.	LiOH.	C_6H_5OH.	Solid Phase.
8.79	0.0	$LiOH.H_2O$	4.36	30.48	$C_6H_5OLi.2H_2O$
8.30	0.23	»	3.85	45.05	»
8.25	0.41	» + $C_6H_5OLi.2H_2O$	3.56	51.34	»
5.26	1.02	$C_6H_5OLi.2H_2O$	2.32	68.19	»
2.64	2.37	»	2.08	68.71	»
3.25	7.72	»	2.11	70.42	» + C_6H_5OH
3.79	14.38	»	2.14	71.94	» »
4.28	22.64	»	1.82	73.11	C_6H_5OH

At concentrations of LiOH below 0.25 mol. per cent, liquid layers with the following composition are formed.

Aqueous layer.		Phenol layer.	
Mol. % LiOH.	Mol. % C_6H_5OH.	Mol. % LiOH.	Mol. % C_6H_5OH.
0.0	1.79	0.0	32.33
0.23	3.34	0.35	17.97

◆

LITHIUM PHOSPHATES, Li_3PO_4, LiH_2PO_4.

100 gms. sat. solution of neutral Lithium phosphate in water contain 0.022 gm. Li_3PO_4 at 0° and 0.030 gm. at 20°.

100 gms. sat. solution of acid Lithium phosphate in water contain 55.8 gms. LiH_2PO_4 at 0°. (Rollet and Lauffenburger, 1934.)

LITHIUM PHOSPHATE Li_3PO_4.

Aqueous solutions of lithium phosphate are colloidal and cannot be obtained clear. A solubility determination made by electrolytic conductivity gave 0.297 gm. Li_3PO_4 per liter sat. solution at 25°. (Rosenheim and Reglin, 1921.)

LITHIUM Sub PHOSPHATE $Li_2PO_3.3^1/_2H_2O$.

100 gms. sat. solution of lithium subphosphate in water contain 0.1018 gm. Li_2PO_3 at 0°, 0.0575 gm. at 25° and 0.048 gm. at 40°. These determinations are only approximately correct since it was impossible to obtain the saturated solution in a clear condition either by long standing or by filtration. A determination made by electrolytic conductivity gave 0.1267 gm. Li_2PO_3 per liter sat. sol. in water at 25°. (Rosenheim and Reglin, 1921.)

LITHIUM Hydrogen PHOSPHITE $Li_2HPO_3.H_2O$.

PO

SOLUBILITY OF LITHIUM HYDROGEN PHOSPHITE IN WATER. (Rosenheim and Reglin, 1921.)

t°.	Gms. Li_2HPO_3 per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. Li_2HPO_3 per 100 gms. sat. sol.	Solid Phase.
0	9.07	$Li_2HPO_3H_2O$	45	6.29	$Li_2HPO_3H_2O$
25	7.47	»	51	6.09	»
30	7.07	»	61	5.75	»
35	6.85	»	98	4.24	»
40	6.64	»			

LITHIUM (Hypo) PHOSPHATE $Li_4P_2O_6.7H_2O$.

100 gms. H_2O dissolve 0.83 gm. hypophosphate at ord. temp. (Rammelsberg, 1892.)

LITHIUM SULFIDE Li_2S

Fusion-point data are given for Li_2S + S by Pearson and Robinson, 1931.

LITHIUM Antimony SULFIDE $Li_3SbS_4.10H_2O$.

SOLUBILITY OF LITHIUM ANTIMONY SULFIDE IN WATER AND IN AQUEOUS ALCOHOL.

S

In Water. (Donk, 1908.)

t°.	Gms. Li_3SbS_4 per 100 Gms. Sat. Sol.	Solid Phase.
−1.7	7.1	Ice
−3.2	12.8	"
−5.1	17.5	"
−10.8	23.2	"
−15.9	28.5	"
−26.2	35.3	"
−42	40.4	Ice + $Li_3SbS_4.10H_2O$
0	45.5	$Li_3SbS_4.10H_2O$
+10	46.9	"
30	50.1	"
50	51.3	"

In Aqueous Alcohol at 10° and 30°.

t°.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Authority.
	C_2H_5OH.	Li_3SbS_4.		
10	10.7	41.8	$Li_3SbS_4.10H_2O$	(Donk, 1908.)
10	26.2	36.5	"	"
10	66.2	20.6	"	"
30	13.3	46.3	$Li_3SbS_4.8\frac{1}{2}H_2O$	(Schreinemakers and Jacobs, 1910.)
30	51.9	30.7	"	
30	54.8	29.9	"	
30	58.4	30.8	"	
30	58.6	32.3	" + Li_3SbS_4	
30	65.26	29.31	Li_3SbS_4	
30	74.3	24.1	"	
30	79.5	20.5	"	

LITHIUM SULFATE $Li_2SO_4.H_2O$.

SOLUBILITY OF LITHIUM SULFATE IN WATER.

(Friend, 1929.)

t°	Gms. Li_2SO_4 per 100 gms. sat. sol.	Solid Phase	t°	Gms. Li_2SO_4 per 100 gms. sat. sol.	Solid Phase
-16.0	27.32	$Li_2SO_4.2H_2O$(?)	35.0	24.76 (3)	$Li_2SO_4.H_2O$
-13.0	27.24	"	38.0	25.28	"
-11.5	27.18	"	43.7	25.00	"
- 6.5	26.73	$Li_2SO_4.H_2O$	51.6	24.82	"
0.0	25.43 (1)	"	52.4	24.71	"
0.0	26.33 (2)	"	55.	24.62 (2)	"
0.6	26.51	"	65.7	24.34	$Li_2SO_4.H_2O$
14.0	26.07	"	77.0	24.05	"
16.7	25.96	"	94.8	23.76	"
19.6	25.85	"	94.9	23.4 (1.182)(4)	"
25	25.50 (2)	"	100.1	23.5 (1.179)(4)	"
25	25.79 (3)	"	103.0	23.72	"
31.8	25.47	"	104.0	23.55(1.176)(4)	"

SO

(1) Sanders and Dobbins, 1931; (2) Crockford and Webster, 1930; (3) Massink, 1917-18; (4) Applebey, Crawford and Gordon, 1934. The figures in parentheses are densities.

SOLUBILITY OF LITHIUM SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 12.5°.

(Montemartini and Losana, 1928.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	Li_2SO_4	H_2SO_4			Li_2SO_4	H_2SO_4	
1.2401	25.98	0.0	$Li_2SO_4.H_2O$	1.4021	8.76	42.20	$Li_2SO_4 + Li_2SO_4.H_2O$
1.2498	22.75	8.75	"	1.5008	8.13	54.14	" + $LiHSO_4.H_2O$
1.2712	19.32	15.74	"	1.6278	12.12	58.92	$LiHSO_4.H_2O$
1.2992	15.82	23.72	"	1.7230	13.36	66.24	"
1.3263	13.35	28.36	"	1.8154	10.08	75.58	$LiHSO_4$
1.3618	10.42	38.12	" + Li_2SO_4	1.8998	12.32	87.02	" + $LiHSO_4.H_2SO_4$

SOLUBILITY OF LITHIUM SULFATE IN AQ. H_2SO_4 AT 30°. (van Dorp, 1910)

Gms per 100 Gms Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol		Solid Phase.
H_2SO_4.	Li_2SO_4.		H_2SO_4.	Li_2SO_4.	
5.05	22.74	$Li_2SO_4.H_2O$	55.08	13.69	$LiSO_4$
12.23	20.45	"	61.46	17.10	"
16.60	19.10	"	62.49	18.89	$Li_2SO_4.H_2SO_4$
32.70	13.37	"	69.40	13.75	"
42.98	10.57	"	78.23	11.64	"
52.72	11.44	"	83.43	15.65	"

SOLUBILITY OF LITHIUM SULFATE IN ABSOLUTE SULFURIC ACID.

(Bergius, 1910.)

10 cc. sat. solution in abs. H_2SO_4 contain 2.719 gms. Li_2SO_4 and the crystalline solid phase has the composition $Li_2SO_4.7H_2SO_4$ and melts at about 12°.

Freezing-point data for mixtures of Li_2SO_4 + H_2SO_4 are given by Kendall and Landon, 1920.

SOLUBILITY OF AMMONIUM SULFATE IN AQUEOUS SOLUTIONS OF LITHIUM SULFATE AND VICE VERSA.

(Schreinemakers, Cocheret, Filippo and deWaal, 1905, 1907.)

Results at 30°.			Results at 50°.		
Gms. per 100 Gms. Sat. Solution.		Solid Phase.	Gms. per 100 Gms. Sat. Solution.		Solid Phase.
$(NH_4)_2SO_4$.	Li_2SO_4.		$(NH_4)_2SO_4$.	Li_2SO_4.	
44.1	0	$(NH_4)_2SO_4$	45.7	0	$(NH_4)_2SO_4$
40.8	3		43.05	5.86	$(NH_4)_2SO_4+NH_4LiSO_4$
39.5	6.6	$(NH_4)_2SO_4+NH_4LiSO_4$	19.65	16.35	NH_4LiSO_4
30	10	NH_4LiSO_4	13.90	21.20	"
21.6	15	"	13.97	21.23	$NH_4LiSO_4+Li_2SO_4.H_2O$
15	20	"	11.45	21.75	$Li_2SO_4.H_2O$
12.5	21 9	$NH_4LiSO_4+Li_2SO_4.H_2O$	9.63	22.79	"
8.9	23	$Li_2SO_4.H_2O$	8.58	23.09	"
0	25.1	"	7.56	22.86	"
			0	24.3	"

Additional data for the triple points of the above system at 20°, 57° and 97° are given by Spielrein (1913), but the terms in which the results are presented are not clearly shown.

Data for the quaternary system, ammonium sulfate, lithium sulfate, alcohol and water at 6.5°, 30° and 50° are given by Schreinemakers and van Dorp (1907).

A mixture of an excess of ammonium and of potassium sulfates in water at 19° was found by Rüdorff (1873) to contain 37.97 gms. $(NH_4)_2SO_4$ + 39.3 gms. K_2SO_4 per 100 gms. sat. solution. SO

SOLUBILITY OF LITHIUM SULFATE IN AQUEOUS ALCOHOL AT 30°.

(Schreinemakers and van Dorp, Jr., 1906.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
C_2H_5OH.	Li_2SO_4.		C_2H_5OH.	Li_2SO_4.	
0	25.1	$Li_2SO_4.H_2O$	47.28	3.04	$Li_2SO_4.H_2O$
11.75	16.16	"	58.59	1.22	"
21.19	11.52	"	69.39	0.396	"
29.40	8.17	"	80.74	0	"
33.31	6.66	"	94.11	0	"

Fusion-point data are given for:

Li_2SO_4	+ Ag_2SO_4	(Nacken, 1907b)
"	+ K_2SO_4	(Nacken, 1907.)
"	+ $MnSO_4$	(Calcagni and Marotta, 1914.)
"	+ Na_2SO_4	(Nacken, 1907.)
"	+ $SrSO_4$	(Calcagni and Marotta, 1912.)

LITHIUM Ammonium SULFATE $LiNH_4SO_4$.

SOLUBILITY IN WATER.

(Schreinemakers, Cocheret, Filippo and deWaal, 1905, 1907.)

t°.	Gms. NH_4LiSO_4 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. NH_4LiSO_4 per 100 Gms. Sat. Sol.	Solid Phase.
0	0	Ice	−10	35.25	NH_4LiSO_4
− 5	14	"	+10	35.58	"
−10	23.5	"	30	35.87	"
−15	29.7	"	50	36	"
−20.6 Eutec.	35.15	Ice+NH_4LiSO_4	70	36.18	"

SOLUBILITY OF LITHIUM-POTASSIUM SULFATE IN WATER.

(Spielrein, 1913.)

t°.	Gms. per 100 cc. Sat. Sol.		Solid Phase.	t°.	Gms. per 100 cc. Sat. Sol.		Solid Phase.
	Li_2SO_4.	K_2SO_4.			Li_2SO_4.	K_2SO_4.	
20	35.6	3.6	$Li_2SO_4.K_2SO_4+Li_2SO_4$	60	10.6	16.3	$Li_2SO_4.K_2SO_4+K_2SO_4$
20	13.3	13.1	" $+K_2SO_4$	98	30.2	9.3	" $+Li_2SO_4$
60	32.5	6	" $+Li_2SO_4$	98	9	23	" $+K_2SO_4$

SOLUBILITY OF LITHIUM-SODIUM SULFATES IN WATER.

(Spielrein, 1913.)

t°.	Gms. per 100 cc. Sat. Sol.		Solid Phase.	t°.	Gms. per 100 cc. Sat. Sol.		Solid Phase.
	Li_2SO_4.	Na_2SO_4.			Li_2SO_4.	Na_2SO_4.	
0	31.4	5.9	$Li_2SO_4.Na_2SO_4.5\frac{1}{2}H_2O+Li_2SO_4$	33.5	25.8	13.9	$Li_2SO_4.Na_2SO_4.3H_2O+Li_2SO_4$
0	18.5	11.4	" " $+Na_2SO_4$	33.5	13.9	21.8	" $+Na_2SO_4$
7.5	20.4	11 17	" (triple pt.)	53	28	16 6	" $+Li_2SO_4$
16	32	9.3	" "	53	16.7	27.3	" $+Na_2SO_4$
24	26	14.9	$Li_2SO_4.Na_2SO_4.12H_2O+Li_2SO_4$	99	27.4	14.4	" $+Li_2SO_4$
24	16.5	21.4	" $+Na_2SO_4$	99	14.4	25.1	" $+Na_2SO_4$
32	20	16.8	" (triple pt.)				

There is some uncertainty as to whether all of the above results are in terms of grams per 100 cc. or per 100 gms. of sat. solution.

SeO

LITHIUM SELENITE $4Li_2SeO_3.3H_2O$.

SOLUBILITY OF LITHIUM SELENITE IN WATER. (Rosenheim and Krause, 1921.)

t	0°.	25°.	47°.5.	60°.	100°.
Gms. Li_2SeO_3 per 100 gms. sat. sol. . . .	19.99	16.76	14.53	12.75	9.05

LITHIUM SILICATE (ortho) Li_4SiO_4.

Fusion-point data for mixtures of $Li_4SiO_4 + Ca_2SiO_4$ and for $Li_4SiO_4 + ZrSiO_4$ are given by Schwarze and Haacke, 1921.

LITHIUM STANNATE $Li_2Sn(OH)_6$.

SOLUBILITY OF LITHIUM STANNATE AND OF HYDRATED LITHIUM STANNATE IN WATER. (Zocher, 1920.)

SnO

t°.	Gms. Li_2SnO_3 per 100 gms. sat. sol. in presence of	
	$Li_2Sn(OH)_6$	$Li_2Sn(OH)_6.2H_2O$.
28	3.14	2.08
40	3.25	2.02
61	3.66	2.58
80	4.36	2.99

LITHIUM VANADATE $Li_3VO_4.9H_2O$

SOLUBILITY OF LITHIUM VANADATE IN WATER. (Rosenheim and Roglin 1921.)

t°.	Gms. Li_3VO_4 per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. Li_3VO_4 per 100 gms. sat. sol.	Solid Phase.
0.0	2.40	$Li_3VO_4.9H_2O$	38.4	5.09	$Li_3VO_4.H_2O$
20.8	4.60	»	40.0	4.20	»
28.6	5.25	»	45.0	3.70	»
30.2	5.91	»	50.0	2.80	»
35.2	6.25	»	60.0	2.60	»

WO

LITHIUM TUNGSTATE Li_2WO_4.

Fusion-point data for mixtures of $Li_2WO_4 + K_2WO_4$, $Li_2WO_4 + Na_2WO$ and $Li_2WO_4 + WO_3$ are given by van Liempt, 1925. Hoermann, 1929.

LUTETIUM see Cassiopeium

THE SOLUBILITY OF MAGNESIUM AND OF MAGNESIUM ALLOYS IN AQUEOUS SALT SOLUTIONS AND SEA WATER.

(Whitby, 1932, 1933.)

A method based upon the oxygen absorbed and hydrogen evolution was developed. No absorption of oxygen could be detected but the evolution of hydrogen could be accurately measured in samples of gas periodically removed from above the corroding liquid. Large variations in rate of dissolution of different grades of Mg, containing varying traces of impurities in 0.1 n to 3.0 n NaCl and 0.05 n HCl, was encountered. The presence of 0.02 percent Mn causes an acceleration of attack with time. The rate of attack in sea water was lower, due to the presence of sulfates. Traces of saponin increase the rate of H evolution. Three magnesium-base alloys and one type of duraluminum gave substantially the same results as pure Mg. Non metallic impurities such as inclusions of nitride or oxide do not act either as cathodes or nuclei for anodic attack in NaCl solutions. The initial rate of dissolution of Mg in H_2O, conc. and dilute solutions of KCl, KBr, KI and K_2SO_4 and in aqueous solutions of alkali is always practically the same. A theory of "primary preferential hydroxyl ion discharge" is proposed and supported by free energy calculations.

100 gms. sat. solution of magnesium in mercury contain 0.323 gm. Mg at 25°. (Loomis, 1922.)

Data for the distribution of magnesium between aluminium and lead and between aluminium and bismuth are given by Tammann and Schaftmeister, 1924.

Fusion-points of mixtures of Mg + Hg are given by Cambi and Speroni, 1915.

MAGNESIUM ARSENATE.

Data for equilibrium in the system magnesium oxide, arsenic trioxide and water at 25° are given by Story and Anderson, 1924.

MAGNESIUM BROMIDE $MgBr_2.6H_2O$.

Br

SOLUBILITY OF MAGNESIUM BROMIDE IN WATER.

(Oetman, 1935.)

t°	Gms. $MgBr_2$ per 100 gms. H_2O	Solid Phase	t°	Gms. $MgBr_2$ per 100 gms. H_2O	Solid Phase
- 3.92	12.08	Ice	+ 10.4	99.3	$MgBr_2.6H_2O$
- 6.85	18.36	"	19.9	101.1	"
-15.2	32.86	"	24.8	103.3	"
-37.5	53.93	"	29.8	103.9	"
-42.7 Eutec	58.20	" + $MgBr_2.10H_2O$	34.8	105.4	"
-23.0	68.6	$MgBr_2.10H_2O$	39.8	106.5	"
-15.0	73.6	"	60.1	112.0	"
- 9.0	78.7	"	65.5	114.5	"
- 7.0	79.7	"	100.0	125.4	"
- 6.0	81.2	"	172.4	m.pt. 170.4	"
- 0.83 tr.pt.	97.7	" + $MgBr_2.6H_2O$			

d. of sat. sol. at 18° = 1.655 (Mylius & Funk, 1897.)

The previous results of Menschutkin, 1906, are shown to be too low.

Solubility of Magnesium Bromide in Aqueous Solutions of Hydrobromic Acid at 25 .

(Scott and Durham, 1930.)

Gms. per 100 gms. sat. sol.		Solid Phase
HBr	$MgBr_2$	
0.0	49.93	$MgBr_2.6H_2O$
4.70	45.40	"
9.83	40.33	"
14.79	35.55	"

100 gms. sat. solution of Magnesium Bromide in Liquid Ammonia contain 0.004 gm. $MgBr_2$ at 0°. (Linhard and Stephan, 1933. 1934.)

100 cc. acetonitrile dissolve 13.35 gms. $MgBr_2$ at 25°. (Müller, R., 1924.)

100 cc. pyridine dissolve 0.49 gms. $MgBr_2$ at 18°, 0.54 gms. at 25° and 2.5 gms. at 60°. (Müller R., 1924.)

Fusion point data for mixtures of $MgBr_2 + KBr$ and $MgBr_2 + NaBr$ are given by Kellner, 1917.

Solubility of Magnesium Bromide in Ethyl Ether.

(Rowley, 1936.)

The author made a very careful study of the factors influencing the accuracy of the results, including the effect of moisture and of light. The very greatest care is required to obtain accurate results. The values are considerably lower than those of Menschutkin.

Br

t°	Gms. $MgBr_2$ per 100 gms. $(C_2H_5)_2O$	Solid Phase	t°	Gms. $MgBr_2$ per 100 gms. $(C_2H_5)_2O$	Solid Phase
-20	0.22	$MgBr_2.3(C_2H_5)_2O$	20	2.50	$MgBr_2 2(C_2H_5)_2O$
-10	0.40	"	22	2.91	"
0	0.70	""	0	2.04	Immiscible Liquid Phase
+10	1.18	"	+10	2.47	
14	1.58	$MgBr_2.2(C_2H_5)_2O$	20	2.95	
16	1.84	"	30	3.49	
18	2.14	"			

MAGNESIUM BROMIDE ETHERATES, ALCOHOLATES, ACIDATES, ETC.

Solubilities Respectively in Ether, Alcohol, Acids, Etc., at Various Temperatures.

(Boris N. Menschutkin. Monograph in the Russian language entitled "On Etherates and Other Molecular Combinations of Magnesium Bromide and Iodide." St. Petersburg, 1907, pp. 267 and XLVIII. Also published in the Memoirs of the St. Petersburg Polytechnic Institute, Vols. 1-7, 1904-1907, and in condensed form in Vols. 49-62 of the Zeit. anorg. Chem., 1906-1909.)

Preparation of Material. The dietherate of magnesium bromide, $MgBr_2.2(C_2H_5)_2O$ (Z. anorg. Chem., **49**, 34, '06) was prepared by the very gradual addition of bromine to a cold mixture of magnesium powder and dry ether. It is very hygroscopic and is stable only under its ethereal solution. It is decomposed by water and reacts with very many organic compounds as alcohols, acids, ketones, esters, aldehydes, etc. The addition products thus formed constitute the material employed in the author's succeeding studies. The monoetherate of magnesium bromide, $MgBr_2.(C_2H_5)_2O$, was prepared just as the dietherate, but the temperature during crystallization was kept above 30°, at which point the dietherate is converted to monoetherate. It is also precipitated by dry ligröin.

Method of Determination of Solubility. At temperatures below 30° the determinations were made by agitating an excess of the salt with the solvent and analyzing the saturated solution. At the higher temperatures the synthetic (sealed tube) method of Alexejeff (Wied. Ann., 1885) was used.

See also Magnesium Iodide Etherates

SOLUBILITY OF MAGNESIUM BROMIDE DIETHERATE, $MgBr_2.2(C_2H_5)_2O$, AND OF MAGNESIUM BROMIDE ETHERATE, $MgBr_2(C_2H_5)_2O$, IN ETHYL ETHER, $(C_2H_5)_2O$, AT VARIOUS TEMPERATURES.

(Menschutkin. See preceding page.)

Solubility of the Dietherate in Ether.

t°.	Gms. per 100 Gms. Sat. Sol. $MgBr_2.2(C_2H_5)_2O$.	Gms. per 100 Gms. Sat. Sol. $MgBr_2$.	Mols. $MgBr_2.2(C_2H_5)_2O$ per 100 Mols. Sat. Sol.
−8	1.08	0.6	0.24
0	1.44	0.8	0.32
+10	2.3	1.27	0.52
14	2.95	1.64	0.67
16	3.48	1.93	0.80
18	4.14	2.3	0.96
20	4.86	2.7	1.125
22.8	6.3	3.5	1.6

Two liquid layers separate between these concentrations of $MgBr_2.2(C_2H_5)_2O$.

t°.	Gms. per 100 Gms. Sat. Sol. $MgBr_2.2(C_2H_5)_2O$.	Gms. per 100 Gms. Sat. Sol. $MgBr_2$.	Mols. $MgBr_2.2(C_2H_5)_2O$ per 100 Mols. Sat. Sol.
23	72.3	40.1	36.8
24	75.3	41.8	40.5
26	79.5	44.1	46.6
28.5	84.2	46.7	54.2
30	85.5	47.4	56.9

Solubility of the Monoetherate in Ether.

t°.	Gms. per 100 Gms. Sat. Sol. $MgBr_2.(C_2H_5)_2O$.	Gms. per 100 Gms. Sat. Sol. $MgBr_2$.	Mols. $MgBr_2.(C_2H_5)_2O$ per 100 Mols. Sat. Sol.
0	68.8	49.1	28.1
20	67.2	47.9	27.1
30	66.5	47.3	26.6
40	65.5	46.7	26.1
60	63.8	45.5	25.1
80	62.1	44.3	24.2
100	60.7	43.3	23.5
120	59.6	42.5	22.9
140	58.5	41.7	22.3
158	57.5	41	21.9

Two liquid layers separate between these concentrations of $MgBr_2.(C_2H_5)_2O$.

t°.	Gms. per 100 Gms. Sat. Sol. $MgBr_2.(C_2H_5)_2O$.	Gms. per 100 Gms. Sat. Sol. $MgBr_2$.	Mols. $MgBr_2.(C_2H_5)_2O$ per 100 Mols. Sat. Sol.
158	5.8	4.15	1.6
158	4.8	3.4	1.36
159	1.96	1.4	0.56
162	0.38	0.27	0.11
170	0.18	0.13	0.05

At 22.8° and 158° the saturated solutions of the dietherate and monoetherate, respectively, separate into two liquid layers which have at the intervening temperatures the following composition. Determinations of the specific gravity of the lower layer gave d[illegible] = 1.1628 and d[illegible] = 1.1492.

t°.	Gms. per 100 Gms. Solution. Lower Layer. $MgBr_2.2(C_2H_5)_2O$.	Lower Layer. $MgBr_2$.	Upper Layer. $MgBr_2.2(C_2H_5)_2O$.	Upper Layer. $MgBr_2$.	
−10	75.75	42	3.2	1.8	unstable
0	73.9	41	4.1	2.3	"
+10	72.2	40.1	5	2.8	"
20	70.8	39.3	5.9	3.3	stable
30	69.8	38.7	6.8	3.8	
40	68.8	38.2	7.7	4.3	
50	68	37.8	8.5	4.7	
60	67.7	37.6	9.2	5.1	
70	67.7	37.6	9.7	5.4	
80	68	37.8	10	5.6	
90	68.6	38.1	10.2	5.7	
100	69.4	38.5	10.4	5.8	
120	71	39.3	10.1	5.6	
140	72.4	40.15	9.2	5.1	
158	74	41	7.8	4.3	

MAGNESIUM BROMIDE ALCOHOLATES

SOLUBILITY OF ETHYL, METHYL, PROPYL, ETC., ALCOHOLATES OF MAGNESIUM BROMIDE IN THE RESPECTIVE ALCOHOLS. (Menschutkin, 1907.)

These compounds were all prepared by the action of magnesium bromide dietherate upon the several alcohols. The ether was expelled and the new alcoholate addition product recrystallized from the respective alcohol. The solubility determinations were made by the synthetic method.

Solubility of $MgBr_2.6CH_3OH$ in Methyl Alcohol.

t°.	Gms. $MgBr_2.6CH_3OH$ per 100 Gms. Sat. Sol.
0	42.6
20	44.6
40	46.7
60	48.9
80	51.4
100	55.5
120	60.7
140	66.8
160	74
180	84.5
185	88
190 m. pt.	100

Solubility of $MgBr_2.6C_2H_5OH$ in Ethyl, Alcohol.

t°.	Gms. $MgBr_2.6C_2H_5OH$ per 100 Gms. Sat. Sol.
0	17.2
10	24.9
20	32.7
30	40.3
40	47.8
60	62.2
80	73.8
90	78.7
100	86.7
103	90
106	94.4
108.5 m. pt.	100

Solubility of $MgBr_2.6C_3H_7OH$ in Propyl Alcohol.

t°.	Gms. $MgBr_2.6C_3H_7OH$ per 100 Gms. Sat. Sol.
0	77.9
10	81.5
20	85.1
30	88.5
40	92
43	93
46	94.3
48	95.8
50	97.8
52 m. pt.	100

Solubility of $MgBr_2.6\ Iso\ C_4H_9OH$ in IsoButyl Alcohol.

t°.	Gms. $MgBr_2.6C_4H_9OH$ per 100 Gms. Sat. Sol
0	55.8
10	60.5
20	65.2
30	69.8
40	74.3
50	78.5
60	82.4
65	84.2
71	88
75	92
77	94.6
80 m. pt.	100

Solubility of $MgBr_2.6\ Iso\ C_5H_{11}OH$ in IsoAmyl Alcohol.

t°.	Gms. $MgBr_2.6C_5H_{11}OH$ per 100 Gms. Sat. Sol.
0	70.2
10	75.6
20	80.2
30	84.5
35	86.7
38	88.7
40	90
42	92
44	94.2
46 m. pt.	100

Solubility of $MgBr_2.4(CH_3)_2CHOH$ in Dimethyl Carbinol.

t°.	Gms. $MgBr_2.4(CH_3)_2CHOH$ per 100 Gms. Sat. Sol.
0	40
20	42.2
40	45
60	48.5
80	53.3
100	59
120	67.3
130	74
136	83.6
138	90
139 m. pt.	100

Solubility of $MgBr_2.4(CH_3)_3COH$ in Trimethyl Carbinol.

t°.	Gms. $MgBr_2.4(CH_3)_3COH$ per 100 Gms. Sat. Sol.
24.7 m pt. of $(CH_3)_3COH$	
24.4 Eutec.	0.06
25	1
35	9.5
45	19.1
55	32.2
60	40.5
70	62.5
75	77
79	91.5
80 m. pt.	100

MAGNESIUM BROMIDE ANILINATES.

SOLUBILITY OF MAGNESIUM BROMIDE ANILINATES IN ANILINE AT DIFFERENT TEMPERATURES. (Menschutkin, 1907.)

The compounds were formed by the action of aniline on magnesium bromide dietherate. The three compounds were: $MgBr_2.6C_6H_5NH_2$, $MgBr_2.4C_6H_5NH_2$ and $MgBr_2.2C_6H_5NH_2$.

t°.	Gms. $MgBr_2.4C_6H_5NH_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $MgBr_2.4C_6H_5NH_2$ per 100 Gms. Sat. Sol.	Solid Phase.
10	3.2	$MgBr_2.6C_6H_5NH_2$	160	26	$MgBr_2.4C_6H_5NH_2$
50	5.1	"	180	28.3	"
70	7.5	"	200	33.5	"
90	12.8	"	220	45	"
100	18.5	"	230	55	"
103.5	27.5	"	237 tr. pt.	76.3	"
103 tr. pt.	24	$MgBr_2.4C_6H_5NH_2$	250	77.3	$MgBr_2.2C_6H_5NH_2$
120	24.3	"	260	78.1	"
140	24.3	"	270	79	"

MAGNESIUM BROMIDE PHENYLHYDRAZINATES.

SOLUBILITY OF MAGNESIUM BROMIDE. PHENYLHYDRAZINATES IN PHENYLHYDRAZINE.

(Menschutkin, 1907.)

(Approximate determinations.)

t°.	Gms. $MgBr_2.6C_6H_5NHNH_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $MgBr_2.6C_6H_5NHNH_2$ per 100 Gms. Sat. Sol.	Solid Phase.
20	3	$MgBr_2.6C_6H_5NHNH_2$	100 tr. pt.	54.8	$MgBr_2.4C_6H_5NH.NH_2$
40	7	"	140	60.8	"
60	16.4	"	180	68.4	"
80	33	"	200	73.4	"
99	54.8	"			"

MAGNESIUM BROMIDE COMPOUNDS with Benzaldehyde and with Acetone.

SOLUBILITY RESPECTIVELY IN BENZALDEHYDE AND IN ACETONES.

(Menschutkin, 1907.)

The compounds were prepared by the action of benzaldehyde and of acetone on magnesium bromide dietherate. On account of the nature of the compounds the results are only approximately correct.

Solubility of $MgBr_2.3C_6H_5COH$ in Benzaldehyde.				Solubility of $MgBr_2.3CH_3.CO.CH_3$. in Acetone.			
t°.	Gms. $MgBr_2.3C_6H_5COH$ per 100 Gms. Sat Sol.	t°.	Gms. $MgBr_2.3C_6H_5COH$ per 100 Gms. Sat. Sol.	t°.	Gms. $MgBr_2.3CH_3.CO\ CH_3$ per 100 Gms. Sat. Sol.	t°.	Gms. $MgBr_2.3CH_3COCH_3$ per 100 Gms. Sat. Sol.
0	0.7	140	17.8	0	0.2	75	50
30	1.3	145	37.5	30	0.8	76	71.6
60	1.9	146	65	60	1.45	80	83.3
100	3.4	148	84.5	70	2	84	89.8
120	6	153	93.2	73	5.5	88	95.2
130	9.5	159 m. pt.	100	74	14	92 m. pt.	100

MAGNESIUM BROMIDE COMPOUNDS with Methylal, Ortho Ethylformate, Formic Acid and Acetic Acid.

(Menschutkin, 1907a.)

The compounds were prepared by the action of methylal, ortho ethylformate, and absolutely dry formic and acetic acids on magnesium dietherate. In the case of the latter compounds the results are only approximately correct, due to their extreme hygroscopicity.

Solubility of $MgBr_2.2CH_2(OCH_3)_2$ in Methylal.		Solubility of $MgBr_2.2CH(OC_2H_5)_3$ in Orthoethylformate.		Solubility of $MgBr_2.6HCOOH$ in Formic Acid.		Solubility of $MgBr_2.6CH_3COOH$ in Acetic Acid.	
t°.	Gms. $MgBr_2.2CH_2(OCH_3)_2$ per 100 Gms. Sat Sol.	t°.	Gms. $MgBr_2.2CH(OC_2H_5)_3$ per 100 Gms. Sat. Sol.	t°.	Gms. $MgBr_2.6HCOOH$ per 100 Gms. Sat. Sol.	t°.	Gms. $MgBr_2.6CH_3COOH$ per 100 Gms. Sat. Sol.
20	0.3	0	11.1	0	49.8	17	0.3
40	0.45	20	12.5	20	57.5	30	1.5
60	0.6	40	14.8	40	65.1	50	4.5
80	0.75	60	18.6	60	73.1	60	7.9
100	0.9	80	25.7	70	78.1	70	16.2
106	1.1	90	35	80	86	80	38.5
2 liquid layers here		95	41	86	95	90	57.7
106	86.2	100	50	88 m. pt.	100	100	71.8
108	90.8	105	66			105	80
110	95.4	110	88.5			110	89.5
112 m. pt.	100	114 m. pt.	100			112 m. pt.	100

MAGNESIUM BROMIDE COMPOUNDS with Acetamide, Acetanilide and Acetic Anhydride.

(Menschutkin, 1909.)

The compounds were prepared by reaction with magnesium bromide dietherate.

Solubility of $MgBr_2.6CH_3CONH_2$ in Acetamide.

t°.	Gms. $MgBr_2.6CH_3CONH_2$ per 100 Gms. Sat. Sol.	Solid Phase.
82	m. pt. of CH_3CONH_2	CH_3CONH_2
80	3.1	"
70	21.7	"
60	40	"
50.5*	56	$CH_3CONH_2+MgBr_2.CH_3CONH_2$
70	57.8	$MgBr_2.CH_3CONH_2$
90	60.5	"
110	65	"
130	71.5	"
150	80	"
160	85	"
165	90	"
169†	100	"

Solubility of $MgBr_2.6CH_3CONHC_6H_5$ in Acetanilide.

t°.	Gms. $MgBr_2.6CH_3CONHC_6H_5$ per 100 Gms. Sat. Sol.	Solid Phase.
112	m. pt. of $CH_3CONHC_6H_5$	
110	3.7	$CH_3CONHC_6H_5$
108	7.7	"
107.5*	9	" $+MgBr_2CH_3CONHC_6H_5$
120	13.1	$MgBr_2.CH_3CONHC_6H_5$
140	19.3	"
160	25.5	"
180	35.3	"
200	59.5	"
205	73.2	"
207	82.5	"
209	100†	"

Solubility of $MgBr_2.6(CH_3CO)_2O$ in Acetic Anhydride.

t°.	Gms. $MgBr_2.6(CH_3COO)_2O$ per 100 Gms. Sat. Sol.
0	26.4
20	28.7
40	31.6
60	35.7
80	41.1
100	48.4
120	57.8
130	69.8
133	77
135	85
136.5†	100

* Eutec. † m. pt.

Br

MAGNESIUM BROMIDE COMPOUNDS with Urethan and with Urea.

(Menschutkin, 1909.)

Solubility of Magnesium Bromide Urethan Compounds in Urethan.

t°.	Gms. $MgBr_2.4C_2H_5OCONH_2$ per 100 Gms. Sat. Sol.	Solid Phase.
49	m. pt. of urethan	$C_2H_5OCONH_2$
45	18.5	"
39	36.5	"
35*	43.3	" $+MgBr_2.6C_2H_5OCONH_2$
50	45.6	$MgBr_2.6C_2H_5OCONH_2$
70	51.3	"
80	56.2	"
90	66.5	"
91.5	75.5	"
91†	69.4	" $+MgBr_2.4C_2H_5OCONH_2$
100	73.8	$MgBr_2.4C_2H_5OCONH_2$
110	80	"
115	84.1	"
120	90	"
123	100	"

Solubility of Magnesium Bromide Urea Compounds in Urea.

t°.	Gms. $MgBr_2.4CO(NH_2)_2$ per 100 Gms. Sat. Sol.	Solid Phase.
132	m. pt. of urea	$CO(NH_2)_2$
126	9.5	"
120	17.2	"
114	21.8	"
108.5*	24.2	$CO(NH_2)_2+MgBr_2.6CO(NH_2)_2$
115	29.8	$MgBr_2.6CO(NH_2)_2$
120	35	"
127	45.5	"
130	60	"
130†	58	" $+MgBr_2.4CO(NH_2)_2$
145	60.7	$MgBr_2.4CO(NH_2)_2$
160	67.2	"
165	71.4	"
170	83.7	"
171	96	"

* Eutec. † tr. pt.

MAGNESIUM BROMATE $Mg(BrO_3)_2.6H_2O$.

100 cc. sat. solution contain 42 grams $Mg(BrO_3)_2$, or 0.15 gram mols. at 18°.

(Kohlrausch — Sitzb. K. Akad. Wiss. (Berlin), i, 90, '97.)

MAGNESIUM FORMATE $Mg(HCOO)_2.2H_2O$.

SOLUBILITY OF MAGNESIUM FORMATE IN WATER.

(Ashton, Houston, and Saylor, 1933.)

t°	Gms. $Mg(HCOO)_2$ per 100 gms. H_2O	Solid Phase	t°	Gms. $Mg(HCOO)_2$ per 100 gms. H_2O	Solid Phase
-5.05 Eutec.	14.0	Ice+$Mg(HCOO)_2.2H_2O$	50	16.8	$Mg(HCOO)_2.2H_2O$
0	14.0	$Mg(HCOO)_2.2H_2O$	60	18.0	"
10	14.1	"	70	19.2	"
20	14.4	"	80	20.6	"
30	15.0	"	90	22.2	"
40	15.9	"	100	24.0	"

SOLUBILITY OF MAGNESIUM FORMATE IN AQUEOUS SOLUTIONS OF FORMIC ACID AT 25°.

(Dunn and Philip, 1934.)

Gms. per 100 gms. sat. sol. HCOOH	Gms. per 100 gms. sat. sol. $Mg(HCOO)_2$	Solid Phase	Gms. per 100 gms. sat. sol. HCOOH	Gms. per 100 gms. sat. sol. $Mg(HCOO)_2$	Solid Phase
0.00	12.23	$Mg(HCOO)_2.2H_2O$	60.9	4.68	$Mg(HCOO)_2.2H_2O$
15.73	10.10	"	76.2	3.19	"
31.28	8.01	"	90.8	2.15	"
46.7	6.22	"			

CH

MAGNESIUM METHANOLATE $Mg(CH_3O)_2.2CH_3OH$.

SOLUBILITY OF MAGNESIUM METHANOLATE IN METHYL ALCOHOL

(Quinet, 1935.)

t°	Gm. Mols. $Mg(CH_3O)_2$ per 100 gms. sat. solution	Solid Phase
-20	0.074	$Mg(CH_3O)_2.4CH_3OH$
+20	0.118	$Mg(CH_3O)_2.2CH_3OH$
66.	0.079	" (decomposition begins)

MAGNESIUM ACETATE $Mg(CH_3COO)_2.4H_2O$.

SOLUBILITY OF MAGNESIUM ACETATE IN WATER. (Rivett, 1926.)

t°.	Gms. $Mg(CH_3COO)_2$ per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. $Mg(CH_3COO)_2$ per 100 gms. sat. sol.	Solid Phase.
- 0.364..	1.068	Ice	+ 0.1...	36.2	$Mg(CH_3COO)_2.4H_2O$
- 0.531..	1.804	»	14.9...	37.97	»
- 1.083..	3.08	»	24.9...	39.61	»
- 2.179..	5.92	»	35.0...	41.78	»
- 4.687..	11.45	»	45.0...	44.76	»
- 9.99...	19.81	»	55.0...	49.46	»
-15.28...	25.00	»	±68.0...	66.4 approx. m. pt. of	»
-29.0...	34.5	» + $Mg(CH_3COO)_2.4H_2O$			

MAGNESIUM ACETATE $Mg(CH_3COO)_2.4H_2O$.

EQUILIBRIUM IN THE SYSTEM MAGNESIUM OXIDE–ACETIC ACID–WATER AT 25°.

(Iwaki, 1914.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
CH_3COOH.	MgO.		CH_3COOH.	MgO.	
3.36	1.73	MgO	31.37	7.99	$(CH_3COO)_2Mg.4H_2O$
5.65	2.93	"	36.23	8.18	+2.3.3
8.06	4.21	"	35.77	8.17	2.3.3
12.46	6.54	"	40.87	7.42	"
15.46	8.24	" $+(CH_3COO)_2Mg.4H_2O$	47.86	6.74	"
15.38	8.31	$(CH_3COO)_2Mg.4H_2O$	56.16	5.81	"
14.25	7.24	"	61.59	4.68	"
20.19	7.47	"	69.13	3.75	"
22.93	7.60	"	75.93	2.85	"
26.61	7.74	"	82.90	2.23	"

2.3.3 = $2(CH_3COO)_2Mg.3CH_3COOH.3H_2O$. More careful work in the region of the double salt showed that a second double salt of the composition $5(CH_3COO)_2Mg.10CH_3COOH.7H_2O$ was obtained. This compound usually separated from the more concentrated acetic acid solutions.

CH 100 gms. Methyl Alcohol sat. with anhydrous magnesium acetate dissolve 5.25 gm. $Mg(CH_3COO)_2$ at 15° and 7.50 gm. at 68.20° (b.pt.). (Herstock, 1934.)

MAGNESIUM TARTRATE $Mg(C_4H_4O_6).2^1/_2\ H_2O$.

100 cc. of sat. solution of $Mg(C_4H_4O_6).2^1/_2\ H_2O$ in water contain 0.76 gm. $Mg(C_4H_4O_6)$ at 30° and 1.44 gm. at 90°. (Chatterjee and Dhar, 1924.)

SOLUBILITY OF ACTIVE MAGNESIUM TARTRATE AND OF RACEMIC MAGNESIUM TARTRATE IN WATER AT SEVERAL TEMPERATURES.

(Duboux and Cuttat, 1921.)

Results for the Active Solt.

t°.	Gms. $MgC_4H_4O_6$ per 100 gms. sat. sol.	Solid Phase.
0.....	0.540	$MgC_4H_4O_6.4H_2O$
12.5...	0.848	»
25.....	1.174	»
26.2...	1.220	» $+MgC_4H_4O_6.2H_2O$
37.5...	1.050	$MgC_4H_4O_6.2H_2O$

Results for the Racemic Salt.

t°	Gms. $Mg_2C_8H_8O_{11}$ per 100 gms. sat. sol.	Solid Phase.
0.....	0.403	$Mg_2C_8H_8O_{12}.10H_2O$
12.5...	0.582	»
25.0...	0.826	»
37.5...	1.095	»

MAGNESIUM SUCCINATE $C_4H_4O_4Mg.5H_2O$.

100 gms. sat. solution in water contain 24.35 gms. succinate at 15° and 66.36 gms. at 100°. (Tarugi and Checchi, 1901.)

MAGNESIUM MALATE active, $C_4H_4O_5Mg.3H_2O$; racemic, $C_8H_8O_{10}Mg_2$, $5H_2O$.

SOLUBILITY OF EACH FORM IN WATER.

(Duboux and Cuttat, 1921.)

Active Salt.

t°.	Gms. $C_4H_4O_5.Mg$ per 100 gms. sat. sol.	Solid Phase.
0........	2.02	$C_4H_4O_5.Mg.3H_2O$
12.5......	2.28	»
25.0......	2.54	»
37.5......	2.80	»

Racemic Salt.

t°.	Gms. $C_8H_8O_{10}.Mg_2$ per 100 gms sat. sol.	Solid Phase.
0........	0.93	$C_8H_8O_{10}Mg_2.5H_2O$
12.5......	1.08	»
25.0......	1.23	»
37.5......	1.38	»

Saturation was obtained by continuous rotation for 7 to 10 hours.

MAGNESIUM LACTATE $Mg(C_3H_5O_3)_2.3H_2O$.

100 gms. Methyl Alcohol sat. with anhydrous magnesium lactate dissolve 2.27 gms. $Mg(C_3H_5O_2)_2$ at 15° and 1.14 gms. at 66.1° (b.pt.). (Henstock 1934.)

MAGNESIUM DiLACTATE $Mg(C_6H_{10}O_6).6H_2O$ racemic, $Mg(C_6H_{10}O_6).3H_2O$, inactive.

SOLUBILITY OF RACEMIC AND OF INACTIVE MAGNESIUM DILACTATE IN WATER.
(Jungfleisch, 1912.)

100 gms. H_2O dissolve 7 to 8 gms. racemic and 2.28 gms. inactive lactate at 15°.

MAGNESIUM GLUCONATE $Mg(C_6H_{11}O_7)_2.3H_2O$.

100 gms. sat. solution of $Mg(C_6H_{11}O_7)_2.3H_2O$ in Water contain 7.8 gms. $Mg(C_6H_{11}O_7)_2$ at 25°. (May, Weisberg and Herrick, 1929.)

MAGNESIUM BENZOATE $Mg(C_6H_5COO)_2.4H_2O$.

100 gms. H_2O dissolve 6.16 gms. $Mg(C_6H_5COO)_2$ at 15° and 19.6 gms. at 100°. CH
(Tarugi and Checchi, 1901.)

100 gms. H_2O dissolve 3.33 gms. $Mg(C_6H_5COO)_2$ at 15-20. (Squire and Caines, 1905.)

100 gms. Acetone sat. with anhydrous Mg benzoate dissolve 2.38 gm. $Mg(C_6H_5COO)_2$ at 15°. (Henstock, 1934.)

MAGNESIUM BENZOATE $Mg(C_6H_5COO)_2.4H_2O$.
MAGNESIUM 4-Nitro **BENZOATE** $Mg(C_6H_4.NO_2.COO)_2.6H_2O$.

100 cc. sat. solution of Magnesium benzoate in water contain 6.364 gms. $Mg(C_6H_5COO)_2$ at 20°.
100 cc. sat. solution of Magnesium 4-Nitro benzoate in water contain 1.840 gms. $Mg(C_6H_4NO_2COO)_2$ at 20°.
(Ephraim and Pfister, 1925.)

MAGNESIUM BENZOATE Tri Methyl Alcoholate $Mg(C_6H_5COO)_2.3CH_3OH$

100 gms. Methyl Alcohol sat. with the tri alcoholate dissolve 1.24 gms. $Mg(C_6H_5COO)_2$ at 15° and 70.98 gms. at 71.9° (b.pt.). (Henstock, 1934.)

MAGNESIUM SALICYLATE $Mg(C_7H_5O_3)_2.4H_2O$.

100 gms. sat. solution in water contain 20.4 gms. salicylate at 15° (14.3 gms. Squire and Caines, 1905), and 79.7 gms. at 100°. (Tarugi and Checchi, 1901.)

100 gms. 90% alcohol dissolve 0.6 gm. salicylate at 15°-20°. (Squire and Caines, 1905.)

MAGNESIUM PHTHALATE $2MgC_6H_4(COO)_2.11H_2O$.

SOLUBILITY OF MAGNESIUM PHTHALATE IN AQUEOUS SOLUTIONS OF PHTHALIC ACID.

(Smith and Ely, 1938.)

Gms. per 100 gms. sat. sol. $C_6H_4(COOH)_2$	Gms. per 100 gms. sat. sol. $MgC_6H_4(COO)_2$	Solid Phase
	Results at 0°	
0.0	30.63	$2MgC_6H_4(COO)_2.11H_2O$
0.39	30.78	" + $Mg(HP)_2.8H_2O$
0.47	26.58	$Mg(HP)_2.8H_2O$
0.76	16.20	"
1.06	7.69	"
1.58	1.95	" + $C_6H_4(COOH)_2$
1.00	0.99	$C_6H_4(COOH)_2$
0.29	0.0	"
	Results at 25°	
0.0	34.11	$2MgC_6H_4(COO)_2.11H_2O$
0.47	34.16	"
1.03	34.26	"
1.16	34.40	" + $Mg(HP)_2.8H_2O$
1.21	32.26	$Mg(HP)_2.8H_2O$
1.30	30.98	"
1.36	27.49	"
1.54	23.49	"
1.60	22.75	"
1.72	20.46	"
1.79	19.17	"
2.33	8.92	"
3.23	4.71	"
3.61	4.16	" + $C_6H_4(COOH)_2$
2.70	2.66	$C_6H_4(COOH)_2$
1.69	1.27	"
0.69	0.0	"
	Results at 50°	
0.0	42.28	$2MgC_6H_4(COO)_2.11H_2O$
3.12	42.71	"
3.53	42.80	" + $Mg(HP)_2.8H_2O$
3.67	41.19	$Mg(HP)_2.8H_2O$
3.88	38.25	"
4.64	31.51	"
5.52	24.20	"
6.56	18.72	"
7.95	13.68	"
10.21	11.19	" + $C_6H_4(COOH)_2$
9.47	9.95	$C_6H_4(COOH)_2$
7.43	6.95	"
6.15	5.36	"
4.13	2.85	"
1.72	0.0	"

CH

$Mg(HP)_2.8H_2O = MgC_6H_4(COO)_2.C_6H_4(COOH)_2.8H_2O$

MAGNESIUM MANDELATE (r), (l), $Mg(C_6H_5CH(OH)COO)_2$

SOLUBILITY OF MAGNESIUM MANDELATES IN WATER.

(Findlay and Campbell, 1930.)

t°	Gms. $Mg(C_6H_5CH(OH)COO)_2$ per 100 gms. H_2O Results for r-Salt	Gms. $Mg(C_6H_5CH(OH)COO)_2$ per 100 gms. H_2O Results for l-Salt	Solid Phase in solutions sat. with racemic salt
0	1.52	1.60	$Mg(Man)_2.H_2O$
5	1.36	1.68	"
10	1.15	0.72	"
15	1.06	1.77	$Mg(Man)_2.\frac{1}{2}H_2O$
20	1.04	1.83	"
25	0.95(2.61)	1.97(6.08)	"
30	0.88	2.11	$Mg(Man)_2$
35	1.16	2.72	"
40	1.33	5.07	"

Results (1) for Solutions in equilibrium with Solid Phases composed of both active and racemic Salt.

t°	Gms. per 100 gms. H_2O l Salt	Gms. per 100 gms. H_2O d Salt
0	1.94	0.24
5	2.12	0.55
10	1.59	0.32
15	2.66	0.60
20	2.23	0.39
25	1.96	0.41
30	2.16	0.49
35	2.40	0.49
40	2.50	0.50

Man = $C_6H_5CH(OH)COO$

(1) Determined polarimetrically

Other values for the solubility of the (r) and (l) salts in water are as follows.

CH

t°	Gms. $Mg(C_8H_7O_3)_2$ per 100 gms. sat. sol. (r) Salt	Gms. $Mg(C_8H_7O_3)_2$ per 100 gms. sat. sol. (l) Salt	Authority
16	—	4.5	McKenzie, 1899.
18	1.8	—	" "
25	2.61	—	Ross and Morrison, 1936.
25	—	6.08	" " " and Johnstone, 1937.

Ross and Morrison, 1936 also give results for the system Magnesium (r) Mandelate + (r) Mandelic Acid + H_2O at 25° in which the acid salt, $2Mg(C_8H_7O_3)_2C_8H_7O_3.2H_2O$ is formed.

Ross, Morrison and Johnston, 1937, give results for the system Magnesium (l) Mandelate + (l) Mandelic Acid + H_2O at 25° in which the acid salt which is formed probably has the same composition as that of the (r) compound but, due to analytical difficulties, metastability and slowness with which equilibrium is attained, conclusive results were not obtained.

MAGNESIUM CINNAMATE $Mg(C_6H_5CH.CHCOO)_2.1$ or $4\ H_2O(?)$.

SOLUBILITY OF MAGNESIUM CINNAMATE IN WATER.

t°	Gms. $Mg(C_6H_5CH.CHCOO)_2$ per 100 cc sat. solution	Authority
15	0.85*	(Tarugi and Checchi, 1901.)
18	1.114	(Fredholm, 1934.)
20	1.225	(Ephraim and Pfister.)
100	1.94*	(Tarugi and Checchi, 1901.)

* = per 100 gms. sat. solution.

SOLUBILITY OF MAGNESIUM CINNAMATE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE AND AMMONIA AT 18°.

(Fredholm, 1934.)

Comp. of Aq. solvent in Gm. Equiv. per liter	Gm. Equiv. Mg per liter sat. sol.	Comp. of Aq. solvent in Gm. Equiv. per liter	Gm. Equiv. Mg per liter sat. sol.
Water alone	0.07	0.2994 NH_4Cl + 0.5988 NH_3	0.0957
0.2994 NH_4Cl	0.0847	0.2994 " + 0.798 "	0.0981
0.2994 " + 0.1996 NH_3	0.0889	0.2994 " + 1.000 "	0.1004
0.2994 " + 0.3992 "	0.0928		

MAGNESIUM CAMPHORATE $C_{10}H_{14}O_4Mg.14H_2O$.

SOLUBILITY OF MAGNESIUM CAMPHORATE IN *d* CAMPHORIC ACID AT 15° AND VICE VERSA.

(Jungfleisch and Landrieu, 1914.)

Gms per 100 Gms. Sat. Sol.		Solid Phase.	Gms per 100 Gms. Sat. Sol.		Solid Phase.
$C_{10}H_{16}O_4$	$C_{10}H_{14}O_4Mg$.		$C_{10}H_{16}O_4$.	$C_{10}H_{14}O_4Mg$.	
0.622 (13.5°)	0	$C_{10}H_{16}O_4$	3.16	10.30	$C_{10}H_{16}O_4$
1.20	1.29	"	3.5	16.5	" $+C_{10}H_{14}O_4Mg.14H_2O$
1.98	3.53	"	3.6	16.7	$C_{10}H_{14}O_4Mg.14H_2O$
2.36	5.66	"	1.91	15.1	"
2.85	8.19	"	0	14.25	"

CH

MAGNESIUM CAMPHOR CARBONATE $Mg(C_{10}H_{15}OCOO)_2$

SOLUBILITY OF MAGNESIUM CAMPHOR CARBONATE IN ALCOHOLS.

(Picon, 1931.)

Solvent	Formula	t°	Gms. $Mg(C_{10}H_{15}OCOO)_2$ per liter sat. sol.
Methyl Alcohol	CH_3OH	10.5	10.5
Ethyl Alcohol	C_2H_5OH	9	0.36

MAGNESIUM Alkyl SULFONATES

SOLUBILITY OF EACH SEPARATELY IN WATER.

(Reed and Tartar, 1936.)

Compound	Formula	Gms. Compound per 100 gms. H_2O at: 25°	50°
Magnesium n Decyl Sulfonate	$Mg(CH_3(CH_2)_8CH_2SO_3)_2$	0.268	—
" Lauryl "	$Mg(CH_3(CH_2)_{10}CH_2SO_3)_2$	0.033	48.0
" Myristyl "	$Mg(CH_3(CH_2)_{12}CH_2SO_3)_2$	0.0035	0.016
" Cetyl "	$Mg(CH_3(CH_2)_{14}CH_2SO_3)_2$	0.0012	0.006
" n Octadecyl "	$Mg(CH_3(CH_2)_{16}CH_2SO_3)_2$	0.0010	0.003

MAGNESIUM Anthracene, Benzene and Naphthalene **SULFONATES.**

Solubility of Each in Water.

(Ephraim and Pfister, 1925, 1925 *a*; Ephraim and :eger, 1925.)

Compound.	Formula.	t°.	Gms. anhydrous cmpd. per 100 cc. sat. sol.
Magnesium Anthracene-1-sulfonate...	$Mg(C_{14}H_9SO_3)_2.4H_2O$	20....	0.0799
» » -2- » ...	$Mg(C_{14}H_9SO_3)_2.4H_2O$	20....	0.0077
» Benzene sulfonate.......	$Mg(C_6H_5SO_3)_2.6H_2O$	17....	7.496
» » »	»	20....	7.639
» » »	»	36....	11.153
» » »	»	50....	14.569
» » »	»	65....	20.420
» » »	»	80.5..	26.045
» » »	»	82.0..	26.804
» Naphthalene-1-sulfonate..	$Mg(C_{10}H_7SO_3)_2.6H_2O$	17....	6.978
» » -2- » ..	$Mg(C_{10}H_7SO_3)_2.4H_2O$	16.5..	0.2
» » -2- » ..	$Mg(C_{10}H_7SO_3)_2.6H_2O$	20.0..	0.223
» » » » ..	»	32	0.373
» » » » ..	»	45	0.490
» » » » ..	»	59	0.790
» » » » ..	»	74	1.336
» » » » ..	»	82	1.737
» »-6 oxy-2-sulfonate..	$Mg(C_{10}H_7SO_3)_2.8H_2O$	20	0.964

Results for the solubility of Magnesium Benzene Sulfonate in aqueous solutions of Benzene Sulfonic Acid at 25°, are given by Dunn and Philip, 1934.

CH

Solubility of Magnesium Naphthalene -2- Sulfonate in Aqueous Solutions of Ammonium Chloride and Ammonia at 18°.

(Fredholm, 1934.)

Composition of Aq. Solvent in Gm. Equiv. per liter	Gm. Equiv. Mg per liter sat. sol.	Composition of Aq. Solvent in Gm. Equiv. per liter	Gm. Equiv. Mg per liter sat. sol.
Water alone	0.010	0.1984 NH_4Cl + 0.784 NH_3	0.0170
0.1984 NH_4Cl	0.014	" " + 1.000 "	0.0175
" " + 0.196 NH_3	0.0151	0.2976 "	0.0150
" " + 0.392 "	0.0155	" " + 0.392 "	0.0166
" " + 0.588 "	0.0161	" " + 1.000 "	0.0191

MAGNESIUM Naphthylamine Di **SULFONATES** $MgC_{10}H_5(NH_2)(SO_3)_2$, 2.6.8 and 2.5.7.

100 gms. sat. sol. of the 2.6.8 cmpd. in water contain 8.7 gms. $MgC_{10}H_5(NH_2)(SO_3)_2$ at 15°.
100 gms. sat. sol. of the 2.5.7 cmpd. in water contain 21.09 gms. $MgC_{10}H_5(NH_2)(SO_3)_2$ at 15°.

(Braunschweig, 1922, 1926.)

One liter water sat. with Magnesium-1-Naphthalamine 2-4-7 Tri Sulfonate contains 193 gms. Mg $C_{10}H_4NH_2(SO_3)_3H$ at 20° and 235 gms. at 80°.

(Frisch, 1930.)

MAGNESIUM Anthraquinone SULFONATES

SOLUBILITY OF EACH SEPARATELY IN WATER.

(Fierz-David, Krebsen and Anderau, 1927.)

Compound	Formula	t°	Gms. anhydrous (?) Compound per 100 cc H_2O
Magnesium Anthraquinone:	$MgC_{14}H_7O_2SO_3.2H_2O$	18	0.36
2- Sulfonate	"	100	1.03
1.5 DiSulfonate	$MgC_{14}H_6O_2(SO_3)_2.8H_2O$	18	2.04
"	"	100	18.2
1.8 "	$MgC_{14}H_6O_2(SO_3)_2.6H_2O$	18	1.0
"	"	100	7.1
1.6 "	$MgC_{14}H_6O_2(SO_3)_2.8H_2O$	18	14.3
"	"	100	40.0
1.7 "	$MgC_{14}H_6O_2(SO_3)_2.10H_2O$	18	33.3
"	"	100	100.0
2.6 "	$MgC_{14}H_6O_2(SO_3)_2.3H_2O$	18	2.53
2.7 "	$MgC_{14}H_6O_2(SO_3)_2.5H_2O$	18	41.0
1.5 Chlorosulfonate	$MgC_{14}H_6O_2ClSO_3.8H_2O$	18	0.34

MAGNESIUM Phenanthrene SULFONATES

SOLUBILITY OF EACH SEPARATELY IN WATER.

(Sandquist, 1912.)

CH

Compound	Gms. anhydrous Salt per 100 gms. H_2O
Magnesium Phenanthrene -2- Mono Sulfate	0.051
" " -3- " "	0.116
" " -10- " "	0.220

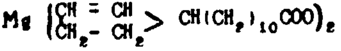
MAGNESIUM *o* and *p* Xylol SELENATES.

SOLUBILITY OF EACH IN WATER.

(Anschütz, Kallen and Riepenkröger, 1919.)

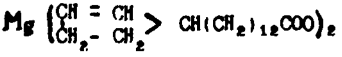
Compound.	Formula.	t°.	Gms. anhydrous cmpd. per 100 gms. H_2O
Ortho compound...	$[C_6H_3(CH_3)_2(1.2)SeO_3(4)]_2Mg$	20	0.85
Para » ...	$[C_6H_3(CH_3)_2(1.4)SeO_3]_2Mg.8H_2O$	15	2.02

MAGNESIUM HYDNOCARPATE



$$Mg\left(\begin{matrix}CH = CH\\ CH_2 - CH_2\end{matrix} > CH(CH_2)_{10}COO\right)_2$$

MAGNESIUM CHAULMOOGRATE



$$Mg\left(\begin{matrix}CH = CH\\ CH_2 - CH_2\end{matrix} > CH(CH_2)_{12}COO\right)_2$$

SOLUBILITY OF EACH SEPARABELY IN SEVERAL SOLVENTS.

(Cole, 1932.)

Solvent	t°	Gms. Mg Hydnocarpate per 100 cc sat. solution	Gms. Mg Chaulmoograte per 100 cc sat. solution
95% Ethyl Alcohol	15	0.51	0.37
" " "	30	0.67	0.44
" " "	b. pt.	0.56	0.46
Ethyl Ether	15	0.04	0.02
" "	30	0.045	0.036
" "	b. pt.	0.036	0.024
Benzene	15	0.02	0.01
"	30	0.04	0.004
"	b. pt.	21.42	20.07
Petroleum Ether	30	0.0008	0.0005

MAGNESIUM ERUCATE $C_8H_{17}CH:CH(CH_2)_{11}COOMg$.

SOLUBILITY OF MAGNESIUM ERUCATE IN AQUEOUS ETHYL ALCOHOL AT 25°. (Thomas and Mattikow, 1926.)

Wt. per cent C_2H_5OH.	d_{25} of Sat. sol.	Gms. $C_8H_{17}CH:CH(CH_2)_{11}.COOMg$ per 100 cc. sat. sol.	Gms. $C_8H_{17}CH:CH(CH_2)_{11}.COOMg$ per 100 gms. solvent
0.0 (= H_2O).........	—	0.006	0.006
18.13..................	0.9690	0.004	0.005
28.37..................	0.9535	0.007	0.008
45.67..................	0.9194	0.019	0.020
65.82..................	0.8734	0.142	0.171
75.40..................	0.8504	0.179	0.240
88.38..................	0.8177	0.268	0.349
94.28..................	0.8018	0.323	0.420

MAGNESIUM HELIANTHATE $Mg(C_{14}H_{14}N_3SO_3)_2.4H_2O$.

100 cc. H_2O dissolve 0.035 gm. magnesium helianthate at 20-25°. (Stark and Dehn, 1918.)

MAGNESIUM LIGNOCERATE.

100 gms. H_2O dissolve 0.002 gm. magnesium lignocerate at 25°.

100 gms. 44.13 per cent aq. alcohol dissolve 0.003 gm., and 100 gm. 91.53 per cent alcohol dissolve 0.006 gm. (Thomas and Yu, 1923.)

MAGNESIUM OLEATE $(CH_3(CH_2)_7CH:CH.CH_7COO)_2Mg$.

CH

One liter H_2O dissolves about 0.23 gm. oleate (soap). (Fahrion, 1916.)
100 gms. glycerol (*d* 1.114) dissolve 0.94 gm. oleate. (Asselin, 1873.)

MAGNESIUM OLEATE $(C_{17}H_{33}COO)_2Mg$.

Solutions prepared by rubbing magnesium oleate (prepared from technical sodium oleate) with water or salt solution and allowing to stand at room temperature for 36 hours, contained from 4.28 to 5.42 milligrams Mg per liter of water and 5.85 to 5.77 milligrams Mg per liter of 0.05 or 0.1 per cent aqueous Na Cl solution. (Zink and Liere, 1915.)

Solutions prepared by heating a suspension of magnesium oleate in water or aqueous salt solution to the boiling point and allowing to cool, contained 50.6 parts Mg per liter of water, 99.89 parts Mg per liter of 0.1 per cent aq. Na Cl and 90.26 parts Mg per liter of 0.1 per cent aq. K Cl solution. (Haupt, 1914.)

100 gms. 63.07 wt. % aq. alcohol dissolve 4.69 gms. $(C_{17}H_{33}COO)_2Mg$ at 25°
» 72.17 » » » 6.64 » »
» 86.16 » » » 8.60 » »
(Thomas and Yu, 1923.)

MAGNESIUM PALMITATE $(C_{15}H_{31}COO)_2Mg$.

Solutions prepared by rubbing magnesium palmitate (prepared from pure sodium palmitate) with water or aqueous salt solution and allowing to stand at room temperature for 36 hours contained from 2.82 to 3.03 milligrams Mg per liter of water and 3.12 to 3.03 milligrams Mg per liter of 0.05 to 0.10 per cent aqueous Na Cl solution. (Zink and Liere, 1915.)

Solutions prepared by heating a suspension of magnesium palmitate in water or aqueous salt solution to the boiling point and allowing to cool, contained 55.68 parts Mg per liter of water, 92.21 parts Mg per liter of 0.1 per cent aq. Na Cl and 72.39 parts Mg per liter of 0.1 per cent aq. K Cl. (Haupt, 1914.)

MAGNESIUM STEARATE $(C_{17}H_{35}COO)_2Mg$.

Solutions prepared by rubbing magnesium stearate (prepared from commercial sodium stearate) with water or salt solutions and allowed to stand at room temperature for 36 hours contained from 3.17 to 3.23 milligrams Mg per liter of water and 3.70 to 3.84 milligrams Mg per liter of 0.05 to 0.1 % aq. Na Cl. solution. (Zink and Liere, 1915.)

Solutions prepared by heating a suspension of magnesium stearate in water or aqueous salt solution to the boiling point and allowing to cool, contained 65.89 parts Mg per liter of H_2O, 95.79 parts Mg per liter of 0.1 % aq. Na Cl solution and 99.62 parts Mg per liter of 0.1 % aq. K Cl solution. (Haupt, 1914.)

SOLUBILITY OF MAGNESIUM STEARATE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 25°. (Thomas and Yu, 1923.)

Constant agitation was employed for obtaining saturation.

Wt. per cent C_2H_5OH in solvent.	$d_{\frac{25}{4}}$ of sat. sol.	Gms. $(C_{17}H_{35}COO)_2Mg$ per 100 cc. sat. sol.	Gms. $(C_{17}H_{35}COO)_2Mg$ per 100 gms. solvent.
0.0 (= H_2O)	0.99709	0.004	0.004
19.9	0.97122	0.004	0.004
27.29	0.95792	0.003	0.003
44.13	0.92275	0.003	0.003
63.07	0.87783	0.004	0.005
72.17	0.85821	0.005	0.006
86.16	0.82356	0.006	0.007
91.53	0.80935	0.006	0.007

CH

MAGNESIUM LAURATE, MYRISTATE, PALMITATE and STEARATE.

SOLUBILITY OF EACH IN SEVERAL SOLVENTS: (Jacobson and Holmes, 1916.)

Solvent.	t°.	Gms. Each Salt Determined Separately per 100 Gms. Solvent. Mg Laurate $(C_{11}H_{23}COO)_2Mg$.	Mg Myristate $(C_{13}H_{27}COO)_2Mg$.	Mg Palmitate $(CH_3(CH_2)_{14}COO)_2Mg$.	Mg Stearate $(CH_3(CH_2)_{16}COO)_2Mg$.
Water	15	0.010	0.006	0.005	0.003
"	25	0.007	0.006	0.008	0.004
"	35	0.010	0.007	0.006	0.007
"	50	0.026	0.014	0.009	0.008
Abs. Ethyl Alcohol	15	0.519	0.158	0.034	0.017
"	25	0.591	0.236	0.058	0.023
"	35	0.805	0.373	0.085	0.031
"	50	1.267	0.577	0.151	...
Methyl Alcohol	15	1.095	0.571	0.227	0.084
"	25	1.108	0.763	0.36	0.100
"	51.5	...	...	0.50	0.166
Ether	25	0.015	0.010	0.004	0.003
Ethyl Acetate	15	0.004	0.004	0.004	0.004
"	35	0.011	0.010	0.007	0.008
"	50	0.024	0.021	0.013	...
Amyl alcohol	15	0.191	0.086	0.043	0.014
"	25	0.236	0.145	0.066	0.018
"	35	1.481	0.438	0.104	0.039
"	50	4.869	1.893	0.263	0.105
Amyl Acetate	15	0.119	0.063	0.039	0.029
"	25	0.162	0.073	0.045	0.030
"	34.6	0.259	0.105	0.057	0.046
"	50	1.939	0.605	0.216	0.115

MAGNESIUM PLATINIC CYANIDE $MgPt(CN)_4$.

SOLUBILITY IN WATER.

(Buxhoevden and Tamman — Z. anorg. Ch. 15, 319 '97.)

t°.	Gms. $MgPt(CN)_4$ per 100 Gms. Solution.	Solid Phase.	t°.	Gms. $MgPt(CN)_4$ per 100 Gms. Solution.	Solid Phase.
−4.12	24.90	$MgPt(CN)_4.6.8–8.1H_2O$	48.7	40.89	$MgPt(CN)_4.4H_2O$
0.5	26.9	" (Red)	55	41.33	"
5.5	28.65	"	58.1	42.15	"
18.0	32.46	"	69.0	43.40	"
36.6	39.53	"	77.8	44.90	"
45.0	41.33	"	87.4	45.52	"
46.2	42.0	"	90.0	45.65	"
42.2	40.21	$MgPt(CN)_4.4H_2O$	93.0	45.04	"
46.3	39.85	" (Bright Green)	96.4	44.33	$MgPt(CN)_4.2H_2O$
			100.0	44.0	" (White)

CN

MAGNESIUM FerroCYANIDES.

SOLUBILITY IN WATER AT 17°.

(Robinson, 1909.)

One liter sat. sol. contains 1.95 gms. magnesium potassium ferrocyanide, $MgK_2FeC_6N_6$.

One liter sat. sol. contains 2.48 gms. magnesium ammonium ferrocyanide, $Mg(NH_4)_2FeC_6N_6$.

MAGNESIUM CARBONATE $MgCO_3.3H_2O$.

SOLUBILITY OF MAGNESIUM CARBONATE IN WATER AT 25° AND PRESSURES OF CARBON DIOXIDE UP TO ONE ATMOSPHERE.

(Kline, 1929.)

CO

The saturated solutions were prepared by bubbling mixtures of carbon dioxide and air in constant proportions through conductivity water in contact with finely divided solid for periods of three to five days.

Partial Pressure of CO_2 in Atmospheres	Millimols per 1000 gms. H_2O			Partial Pressure of CO_2 in Atmospheres	Millimols per 1000 gms. H_2O		
	$[Mg^{++}]$	$[HCO_3^-]$	$[CO_2^{--}]$		$[Mg^{++}]$	$[HCO_3^-]$	$[CO_2^{--}]$
0.000107	0.00433	0.00488	0.00189	0.000510	0.01437	0.01710	0.00582
0.000113	0.00445	0.00501	0.00195	0.000680	0.01512	0.01872	0.00576
0.000170	0.00577	0.00745	0.00205	0.000845	0.01566	0.01990	0.00571
0.000179	0.00593	0.00763	0.00212	0.000887	0.01593	0.02046	0.00570
0.000197	0.00658	0.00795	0.00261	0.000930	0.01624	0.02119	0.00565
0.000210	0.00708	0.00806	0.00305	0.00160	0.01859	0.02698	0.00510
0.000233	0.00780	0.00837	0.00361	0.00334	0.02210	0.03548	0.00436
0.000251	0.00807	0.00855	0.00380	0.00690	0.02507	0.04468	0.00273
0.000310	0.01013	0.01184	0.00421	0.0150	0.03127	0.06022	0.00116
0.000376	0.01296	0.01404	0.00594	0.0432	0.04601	0.08998	0.00102
0.000380	0.01355	0.01432	0.00639	0.1116	0.06266	0.1236	0.00085
				0.9684	0.2135	0.4269	—

The activity product constant of magnesium carbonate at 25° is taken as 1×10^{-5} and that of magnesium hydroxide similarly as 5×10^{-12}.

The author also gives the following interpolated values of the molarity of magnesium in aqueous solutions saturated with $MgCO_3.3H_2O$ at 25° and at partial pressures of Carbon Dioxide up to 15 atmospheres.

Partial Pressure of CO_2 in Atms.	Millimols [Mg] per 1000 gms. H_2O	Partial Pressure of CO_2 in Atms.	Millimols [Mg] per 1000 gms. H_2O
0.001	0.0178	0.7	0.181
0.01	0.0270	1.0	0.217
0.05	0.0489	2.0	0.287
0.10	0.0660	5.0	0.384
0.3	0.117	10.0	0.471
0.5	0.152	15.0	0.526

MAGNESIUM CARBONATE $MgCO_3.3H_2O$.

SOLUBILITY OF MAGNESIUM CARBONATE IN WATER CONTAINING INCREASING AMOUNTS OF CARBON DIOXIDE AT 25°. (Mitchell, 1923.)

A silver lined steel bulb was used. The mixture was stirred by a current of CO_2.

Atmospheres pressure of Carbon Dioxide.	Mols. per liter of sat. solution Total [Mg].	Total [CO_2].
6	0.376	0.896
9	0.450	1.147
11	0.485	1.250
13	0.505	1.350
16	0.530	1.395
21	0.613	1.738

EQUILIBRIUM IN THE SYSTEM MAGNESIUM OXIDE. CARBON DIOXIDE AND WATER.

(Takahashi, 1927.)

CO

t°	d. of sat. sol.	Gms. per 100 gms. sat. sol. CO_2	MgO	Solid Phase	t°	d. of sat. sol.	Gms. per 100 gms. sat. sol. CO_2	MgO	Solid Phase
-1.80	1.0411	3.410	1.526	$MgCO_3.5H_2O$	20	1.0287	2.109	0.9858	$MgCO_3.3H_2O$
0	1.0407	3.219	1.496	"	25	1.0250	1.839	0.8654	"
+5	1.0395	2.942	1.423	"	30	1.0210	1.572	0.7634	"
10	1.0383	2.962	1.363	"	35	1.0170	1.381	0.6780	"
15	1.0373	2.744	1.312	"	40	1.0135	1.206	0.6017	"
20	1.0363	2.606	1.256	"	45	1.0097	1.044	0.5323	"
5	1.0407	3.232	1.530	$MgCO_3.3H_2O$	50	1.0050	0.922	0.4718	"
10	1.0360	2.736	1.314	"	55	1.0008	0.833	0.4083	"
15	1.0330	2.270	1.143	"	60	0.9980	0.746	0.3648	"

Results are also given for the solubility of $5MgO.4CO_2.7H_2O$ in Water saturated with CO_2 at one atmosphere pressure.

Data for the system $MgO + MgCl_2 + H_2O$ at 25° and at 50° are given by Magda and Yamane, 1928.

Determinations of the equilibrium in the system $MgCO_2 + CO_2 + H_2O$ made by passing CO_2 at atmospheric pressure through mixtures of $H_2O + MgO$ and $H_2O + Mg_2CO_3$ at temperatures from 0° to 40°, are given by Tereda, 1928. There is, however, some uncertainty in regard to the exact terms in which the results are expressed.

SOLUBILITY OF MAGNESIUM CARBONATE IN CO_2 FREE WATER AT 100°.

(Leick, 1932, 1933.)

The determinations showed that 0.030 gm. MgO = 0.063 gm. $MgCO_3$ per liter was dissolved at 100°. It was found that the solubility is increased by NaCl and Na_2SO_4. NaOH and Na_2CO_3 do not reduce the solubility of $MgCO_3$ as much as they do that of $CaCO_3$. Results for the simultaneous solubility of $MgCO_3$ and $CaCO_3$ in water at 100° show that with increasing time of boiling, from 1½ to 48 hours, the dissolved CaO increased about 5 times while the dissolved MgO decreases about 10 times. The results are of interest in connection with the purification of boiler waters.

MAGNESIUM CARBONATE $MgCO_3.3H_2O$.

Solubility in Water in Presence of Carbon Dioxide at 15°.

(Treadwell and Reuter — Z. anorg. Ch. 17, 200, '98.)

cc CO_2 per 100 cc. Gas Phase (at 0° and 760 mm.).	Partial Pressure of CO_2 in mm. Hg.	Grams per 100 cc. Solution.			
		Free CO_2.	$MgCO_3$.	$Mg(HCO_3)_2$.	Total Mg.
18.86	143.3	0.1190	...	1.2105	0.2016
5.47	41.6	0.0866	...	1.2105	0.2016
4.47	33.8	0.0035	...	1.2105	0.2016
1.54	11.7	...	0.0773	1.0766	0.2016
1.35	10.3	...	0.0765	0.7629	0.1492
1.07	8.2	...	0.0807	0.5952	0.1224
0.62	4.7	...	0.0701	0.3663	0.0865
0.60	4.6	...	0.0758	0.3417	0.0788
0.33	2.5	...	0.0748	0.2632	0.0655
0.21	1.6	...	0.0771	0.2229	0.0594
0.14	1.1	...	0.0710	0.2169	0.0566
0.03	0.3	...	0.0711	0.2036	0.0545
...	...	...	0.0685	0.2033	0.0536
...	...	...	0.0702	0.1960	0.0529
...	...	...	0.0625	0.2036	0.0520
...	...	...	0.0616	0.1954	0.0511
...	...	...	0.0641	0.1954	0.0518

Therefore at 0 partial pressure of CO_2 and at 15° and mean barometric pressure, one liter of saturated aqueous solution contains 0.641 gm. of $MgCO_3$ plus 1.954 gms. $Mg(HCO_3)_2$.

It is pointed out by Johnston (1915) that although Treadwell and Reuter made very painstaking analyses, their mode of working did not secure equilibrium conditions, a fact which is borne out by the lack of constancy of the calculated solubility-product constant.

Solubility of Magnesium Carbonate in Water Charged with Carbon Dioxide at Pressures Greater than One Atmosphere.

(Engel and Ville — Compt. rend. 93, 340, '81; Engel — Ann. chim. phys. [6] 13, 349, '88.)

Pressure of CO_2 in Atmospheres.	G. $MgCO_3$* per Liter.		Pressure of CO_2 in Atmospheres.	G. $MgCO_3$* per Liter.	
	At 12°.	At 19°.		At 12°.	At 19°.
0.5	20.5	...	4.0	42.8	...
1.0	26.5	25.8	4.7	...	43.5
2.0	34.2	33.1 (2.1 At.)	6.0	50.6	48.5 (6.2 At.)
3.0	39.0	37.2 (3.2 At.)	9.0	...	56.6

Solubility in Water Saturated with CO_2 at One Atmosphere.

(Engel.)

t°.	Gms. $MgCO_3$* per Liter.	t°.	Gms. $MgCO_3$* per Liter.	t°.	Gms. $MgCO_3$* per Liter.
5	36	30	21	60	11
10	31	40	17	80	5
20	26			100	0

* Dissolved as $Mg(HCO_3)_2$.

SOLUBILITY OF MAGNESIUM CARBONATE IN WATER CONTAINING CARBON DIOXIDE UNDER HIGH PRESSURES AND AT DIFFERENT TEMPERATURES.

(Haehnel, 1924.)

The saturated solutions were prepared in a platinum vessel provided with an electrically driven stirrer and contained in an autoclave. After stirring one hour and allowing to stand one-half hour the saturated solution was withdrawn through a platinum tube and analyzed by evaporating and weighing the ignited Mg O. Equilibrium was approached from above. Magnesium carbonate from different sources was used.

CO

Results at 18°.

Atmospheres Pressure.	Gms. $MgCO_3$ per 100 gms. sat. sol.
2.0	3.5
2.5	3.74
4.0	4.28
10.0	5.90
16.0	7.05
18.0	7.49
35.0	7.49
56.0	7.49

Results at different temperatures.

	Gms. $MgCO_3$ per 100 gms. sat. sol. at		
t°.	1 atmosphere of CO_2 (Engle and Ville).	5 atmospheres. of CO_2 (Beckurts).	34 atmospheres of CO_2 (Haehnel).
0...	–	–	8.58
5...	–	–	8.32
10...	–	3.57	7.93
30...	1.58	–	6.88
40...	1.18	1.37	6.44
50...	0.95	–	6.18
60...	–	–	5.56

The determinations of Beckurts and of Engle and Ville were made in 1881 and 1885.

Electrolytic conductivity results are also given by Haehnel.

EQUILIBRIUM IN THE SYSTEM MAGNESIUM CARBONATE, AMMONIUM CARBONATE AND WATER AT 30°. (Lafontaine, 1925.)

To a concentrated solution of magnesium bicarbonate containing 20-25 grams $Mg(HCO_3)_2$ per liter, increasing quantities of ammonia, ammonium bicarbonate or of mixtures of the two were added. The solutions were agitated mechanically 10 hours per day for 8 days. The composition of the solid phase did not change but its quantity increased with time. The zones of formation of the several solid phases were determined.

Mols. per 100 mols. H_2O.			Solid Phase.
Mg O	CO_2.	NH_3.	
0.160	1.487	1.193	$MgCO_3.3H_2O$
0.103	2.508	2.099	»
0.097	2.256	0.129	»
0.041	0.816	0.875	»
0.021	0.089	0.144	»
0.020	0.292	1.168	»
0.055	0.952	0.970	»
0.075	2.427	2.233	1.1.4
0.056	1.065	1.087	»
0.026	1.315	1.514	»
0.024	3.357	3.269	»
0.016	0.623	1.277	»
0.008	3.745	3.837	»
0.006	1.593	10.386	1.1.4
0.091	2.172	1.932	»+$MgCO_3.3H_2O$
0.021	0.463	1.351	» »
0.019	0.888	1.402	» »
0.012	1.300	1.582	» »
0.008	0.084	5.562	4.1.4 + »
0.008	0.095	11.029	» »
0.020	0.220	3.783	» +5(»)
0.006	0.178	4.369	» »
0.015	0.196	5.524	» »
0.012	0.152	8.604	» »
0.001	0.010	10.981	»
0.007	0.102	15.710	»

1.1.4 = $MgCO_3.(NH_4)_2CO_3.4H_2O$, 4.1.4 = $4MgCO_3.Mg(OH)_2.4H_2O$.

Data for the system magnesium carbonate-carbonic acid-water at 20°, 25°, 30°, 34° and 39° are given by Leather and Sen (1914). In connection with these results, it is pointed out by Johnston (1915), that it is questionable whether equilibrium was really obtained and furthermore, the accuracy of the analytical results cannot be trusted since the ratio of *total* amount of CO_2 in solution, to the magnesia is very irregular. The results when plotted directly show great inconsistencies.

THE CALCULATED SOLUBILITY OF $MgCO_3.3H_2O$ IN WATER AT 18° IN CONTACT WITH AIR CONTAINING PARTIAL PRESSURES OF CO_2 FROM 0.0002 TO 0.0005 ATMOSPHERES.

(Johnston, 1915.)

It is shown that if the CO_2 pressure is kept constant at P and the water evaporated off so slowly at 18° that equilibrium conditions are continuously maintained, the following amounts of $Mg(OH)_2$ or of $MgCO_3.3H_2O$ will be obtained.

Partial Pressure P of CO_2 in Atms.	Total Mg $\frac{\text{Mols.}}{l}$.	Gms. per Liter.	
0	0.00015	0.0087	$Mg(OH)_2$
0.00020	0.01934	1.13	"
0.00025	0.02218	1.29	"
0.00030	0.02486	1.45	"
0.00035	0.02742	1.60	"
0.00040	0.02868	3.97	$MgCO_3.3H_2O$
0.00045	0.02924	4.05	"
0.00050	0.02976	4.12	"

SOLUBILITY OF MAGNESIUM CARBONATE IN NATURAL WATERS.

(Wells, 1915.)

(In all cases the solutions were in equilibrium with atmospheric air at 20°.)

Mixture.	Milligrams per Liter of Sat. Solution.		
	Mg.	Free CO_2.	CO_2 as Bicarbonate.
Natural Magnesite in Distilled H_2O	0.018	trace	0.065
" in Aq. NaCl (27.2 g. per l.)	0.028	trace	0.086
$MgCO_3.3H_2O$ (equilibrium from bicarbonate end)	0.038	0.28 CO_2 as carbonate	0.83
$MgCO_3.3H_2O$ (" " under saturation ")	0.034	0.32 CO_2 " "	0.59

SOLUBILITY OF MAGNESIUM CARBONATE IN AQUEOUS SOLUTIONS OF POTASSIUM BICARBONATE.

(Auerbach, 1904.)

The conditions necessary for preventing changes in equilibrium due to hydrolysis and loss of CO_2 are discussed. The mixtures were shaken from 1-4 days. The sat. sol. analyzed for total alkali $\left(K + \frac{Mg}{2}\right)$ by titration with standard HCl using methyl orange as indicator. The neutralized solution was boiled to expel CO_2 and then excess 0.1 *n* NaOH added and the filtrate from magnesium precipitate back titrated with 0.1 *n* HCl. The $\frac{Mg}{2}$ was calculated from the used 0.1 *n* NaOH and the K obtained by difference.

Results at 15°.

Mols. per Liter.		Solid Phase.
$KHCO_3$.	$MgCO_3$.	
0	0.0095	$MgCO_3.3H_2O$
0.0992	0.0131	"
0.1943	0.0167	"
0.3992	0.0211	" (labil)
0.2681	0.0192	" +1.1
0.5243	0.0097	1.1
0.6792	0.0074	"
0.981	0.0028	"

1.1 = $MgCO_3.KHCO_3.4H_2O$.

Results at 25°.

Mols. per Liter.		Solid Phase.
$KHCO_3$.	$MgCO_3$.	
0	0.0087	$MgCO_3.3H_2O$
0.0985	0.0115	"
0.2210	0.0149	"
0.3434	0.0181	"
0.4985	0.0217	" (labil)
0.3906	0.0196	" +1.1
0.5893	0.0128	1.1
0.6406	0.0117	"
1.125	0.0061	"

Results at 35°.

Mols. per Liter.		Solid Phase.
$KHCO_3$.	$MgCO_3$.	
0	0.0071	$MgCO_3.3H_2O$
0.1092	0.0098	"
0.2811	0.0142	"
0.4847	0.0177	"
0.5807	0.0198	" (labil)
0.5088	0.0184	" +1.1
0.6231	0.0153	1.1
0.8535	0.0119	"

Additional data for this system are given by Nanty, 1911.

Data for the solubility of $MgCO_3$ in aq. NaCl and other salt solutions, determined by prolonged boiling and subsequent cooling of the solution out of contact with air, are given by Gothe (1915).

SOLUBILITY OF MAGNESIUM CARBONATE IN AQUEOUS SOLUTIONS OF SODIUM CARBONATE AT 25°. The solutions being in equilibrium with an atmosphere free from CO_2.

(Cameron and Seidell — J. Physic. Ch. 7, 588, '03.)

Wt. of 1 Liter of Solution.	Grams per Liter.		Reacting Weights per Liter.	
	Na_2CO_3.	$MgCO_3$.	Na_2CO_3.	$MgCO_3$.
996.8	0.00	0.223	0.000	0.00266
1019.9	23.12	0.288	0.220	0.00344
1047.7	50.75	0.510	0.482	0.00620
1082.5	86.42	0.879	0.820	0.01027
1118.9	127.3	1.314	1.209	0.01570
1147.7	160.8	1.636	1.526	0.01955
1166.1	181.9	1.972	1.727	0.02357
1189.4	213.2	2.317	2.024	0.02770

SOLUBILITY OF MAGNESIUM BI CARBONATE AND OF MAGNESIUM CARBONATE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AT 23°. The solutions being in equilibrium with an atmosphere of CO_2 in the one case, and in equilibrium with air free from CO_2 in the other.

CO

(C. and S.)

In Presence of CO_2 as Gas Phase.		In Presence of Air Free from CO_2.		
Gms. NaCl per Liter.	Gms. $Mg(HCO_3)_2$ per Liter.	Wt. of 1 Liter.	Gms. NaCl per Liter.	Gms. $MgCO_3$ per Liter.
7.0	30.64	996.9	0.0	0.176
56.5	30.18	1016.8	28.0	0.418
119.7	27.88	1041.1	59.5	0.527
163.9	24.96	1070.5	106.3	0.585
224.8	20.78	1094.5	147.4	0.544
306.6	10.75	1142.5	231.1	0.460
		1170.1	272.9	0.393
		1199.3	331.4	0.293

SOLUBILITY OF MAGNESIUM CARBONATE IN AQUEOUS SOLUTIONS OF SODIUM SULPHATE AT 24° AND AT 35.5°. The solutions being in equilibrium with an atmosphere free from CO_2.

(Cameron and Seidell.)

Results at 24°.			Results at 35.5.°		
Wt. of 1 Liter.	Gms. Na_2SO_4 per Liter.	Gms. $MgCO_3$ per Liter.	Wt. of 1 Liter.	Gms. Na_2SO_4 per Liter.	Gms. $MgCO_3$ per Liter.
007.5	0.00	0.216	995.1	0.32	0.131
1021.2	25.12	0.586	1032.9	41.84	0.577
1047.6	54.76	0.828	1067.2	81.84	0.753
1080.9	95.68	1.020	1094.8	116.56	0.904
1133.8	160.8	1.230	1120.4	148.56	0.962
1157.3	191.9	1.280	1151.7	186.7	1.047
1206.0	254.6	1.338	1179.8	224.0	1.088
1242.0	305.1	1.388	1236.5	299.2	1.130

MAGNESIUM OXALATE $MgC_2O_4.2H_2O$.

One liter of sat. solution of magnesium oxalate in water contains 0.32 gm. MgC_2O_4 at 36° and 0.40 gm. at 92°. (Chatterjee and Dhar, 1924.)

SOLUBILITY OF MAGNESIUM OXALATE IN AQUEOUS SOLUTIONS OF MAGNESIUM SULFATE AT 25°.

(Walker, 1925.)

Gms. per liter sat. solution		Solid Phase
$MgSO_4$	MgC_2O_4	
0.0	0.345	$MgC_2O_4.2H_2O$
0.327	0.264	"
0.591	0.241	"

SOLUBILITY OF MAGNESIUM OXALATE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE AND AMMONIA AT 18°.

(Fredholm, 1934.)

COO

Composition of Aq. Solvent in Gm. Equiv. per liter	Gm. Equiv. Mg per liter sat. solution	Composition of Aq. Solvent in Gm. Equiv. per liter	Gm. Equiv. Mg per liter sat. solution
Water alone	0.0066(1)	0.0906 NH_4Cl + 0.599 NH_3	0.01044
0.0996 NH_4Cl	0.00976	" + 0.798 "	0.01050
" + 0.1996 NH_3	0.00999	" + 1.000 "	0.01079
" + 0.3999 "	0.01013		

(1) This figure should probably be 0.0661 which corresponds to 0.304 gm. MgC_2O_4 per liter sat. solution in Water.

MAGNESIUM OXALATE

SOLUBILITY OF MAGNESIUM OXALATE IN AQUEOUS SOLUTIONS OF OXALIC ACID AND OF AMMONIUM SALTS.

(Bobtelsky and Malkowa-Janowski, 1927.)

Results for Aqueous Solutions of:

Oxalic Acid			Ammonium Oxalate			Ammonium Chloride		
t°	Gms. per 100 gms. sat. sol.		t°	Gms. per 100 gms. sat. sol.		t°	Gms. per 100 gms. sat. sol.	
	$H_2C_2O_4$	Mg		$(NH_4)_2C_2O_4$	Mg		NH_4Cl	Mg
15	0.71	0.04703	15	0.87	0.01097	15	1.0	0.01057
"	2.14	0.06885	"	2.62	0.02492	"	2.0	0.02774
"	3.57	0.07757	"	4.36	0.03557	"	5.0	0.03235
100	1.79	0.0891	100	2.18	0.04286	"	10.0	0.03385
"	4.64	0.1234	"	5.24	0.1194	"	20.0	0.03365
"	7.15	0.1340	"	8.73	0.2269	100	1.0	0.03467
"	8.57	0.1446	"	10.47	0.3281	"	4.0	0.0441
"	14.29	0.1485	"	13.09	0.4845	"	8.0	0.0513
				17.45	0.7545	"	18.0	0.0508

The solid phase is $Mg_2C_2O_4.2H_2O$ in all cases.

SOLUBILITY OF MAGNESIUM OXALATE AT 18° IN AQUEOUS SOLUTIONS OF:

(Britton and Jarrett, 1936.)

Oxalic Acid

Gm. Mols. per liter sat. sol. $H_2C_2O_4$	Gm. Mols. per liter sat. sol. MgC_2O_4	Solid Phase
0.0	0.00230	$MgC_2O_4.2H_2O$
0.02	0.00997	"
0.05	0.0155	"
0.10	0.0217	"
0.25	0.0322	"
0.50	0.0513	"

Sulfuric Acid

Gm. Mols. per liter sat. sol. H_2SO_4	Gm. Mols. per liter sat. sol. MgC_2O_4	Solid
0.05	0.0437	$MgC_2O_4.2H_2O$
0.125	0.0877	"
0.25	0.1498	"
0.50	0.2633	"
1.00	0.4407	"

SOLUBILITY OF MAGNESIUM OXALATE IN AQUEOUS SOLUTIONS OF SODIUM OXALATE AND VICE VERSA AT 18°.

(Britton and Jarrett, 1936.)

COO

Gm. Mols. per liter sat. sol. $Na_2C_2O_4$	Gm. Mols. per liter sat. sol. MgC_2O_4	Solid Phase
0.00	0.00230	$MgC_2O_4.2H_2O$
0.01	0.00246	"
0.02	0.00261	"
0.04	0.00325	"
0.06	0.00380	"
0.08	0.00439	"
0.10	0.00529	"
0.15	0.00794	"
0.20	0.01031	"

Gm. Mols. per liter sat. sol. $Na_2C_2O_4$	Gm. Mols. per liter sat. sol. MgC_2O_4	Solid Phase
0.2384-	0.0126	$MgC_2O_4.2H_2O$
0.2881	0.0164	"
0.3093	0.0188	"
0.3295	0.0205	"
0.3249	0.0185	$Na_2C_2O_4$
0.308	0.0149	"
0.296	0.0117	"
0.2691	0.0062	"
0.240	0.000	"

MAGNESIUM CHLORIDE $MgCl_2.6H_2O$.

FREEZING-POINTS OF AQUEOUS SOLUTIONS OF MAGNESIUM CHLORIDE

(Rodebush, 1918.)

The temperatures were measured with thermoelements.

t° of freezing	−3.71.	−8.46.	−13.79.	−19.57.	−25.86.	−33.5. (Eutec.)
Gms. $MgCl_2$ per 100 gms. H_2O ...	8.79	11.74	16.31	20.36	24.21	28.0

MAGNESIUM CHLORIDE $MgCl_2$.

SOLUBILITY IN WATER.

(van't Hoff and Meyerhoffer, 1898; Engel; Lowenherz. Results quoted from Landolt and Börnstein, 1912.)

Cl

t°.	Gms. $MgCl_2$ per 100 Gms. Solution.	Gms. $MgCl_2$ per 100 Gms. Water.	Solid Phase.
−10	11.1	12.5	Ice
−20	16.0	19.0	"
−30	19.4	24.0	"
−33.6	20.6	26.0	Ice + $MgCl_2.12H_2O$
−20	26.7	36.5	$MgCl_2.12H_2O$
−16.4	30.6	44.04 f. pt.	"
−16.8	31.6	46.2	$MgCl_2.12H_2O$ + $MgCl_2.8H_2O$ α
−17.4	32.3	47.6*	$MgCl_2.12H_2O$ + $MgCl_2.8H_2O$ β
−19.4	33.3	49.9*	$MgCl_2.12H_2O$ + $MgCl_2.6H_2O$
− 9.6	33.9	51.3*	$MgCl_2.8H_2O$ β + $MgCl_2.6H_2O$
− 3.4	34.4	52.3	$MgCl_2.8H_2O$ α + $MgCl_2.6H_2O$

t°	Gms. $MgCl_2$ per 100 Gms. Solution.	Gms. $MgCl_2$ per 100 Gms. Water.	Solid Phase.
0	34.5	52.8	$MgCl_2.6H_2O$
10	34.9	53.5	"
20	35.3	54.5	"
22	35.6	55.2	"
25	36.2	56.7	"
40	36.5	57.5	"
60	37.9	61.0	"
80	39.8	66.0	"
100	42.2	73.0	"
116.7	46.2	85.5	$MgCl_2.6H_2O$ + $MgCl_2.4H_2O$
152.6	49.1	96.4	$MgCl_2.4H_2O$
about 181.5	55.8	126.0	$MgCl_2.4H_2O$ + $MgCl_2.2H_2O$
186	56.1	128.0	$MgCl_2.2H_2O$

* = Unstable.

More recent determinations of the Solubility of Magnesium Chloride in water are as follows:

t°	Gms. $MgCl_2$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $MgCl_2$ per 100 gms. sat. sol.	Solid Phase
-15	14.69	Ice	60	37.90	$MgCl_2.6H_2O$
-30	20.47	"	70	38.85	"
-30	22.19	$MgCl_2.12H_2O$	80	39.80	"
-15	31.85	$MgCl_2.8H_2O\alpha$	90	41.00	"
-15	33.86*	$MgCl_2.6H_2O$	100	42.20	"
0	34.61	"	100	42.40	"
+10	34.9	"	130	48.58	$MgCl_2.4H_2O$
20	35.30	"	150	51.81	"
25	35.36	"	170	54.55	"
30	35.80	"	200	56.80	$MgCl_2.2H_2O$
40	36.50	"	220	59.51	"
50	37.20	"	300	67.84	"

* Metastable.

The determinations below 0° are by Prutton, 1932; those from 0° to 100° are by Küpper, 1927, with which the results of Queisser, 1921, are in very close agreement; those above 100° are by Achumow and Wassilijew, 1932.

SOLUBILITY OF MAGNESIUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 0°.

(Engel — Compt. rend. 104, 433, '87.)

Milligram Mols. per 10 cc. Solution.		Sp. Gr. of Solutions.	Grams per Liter of Solution.	
HCl.	½$MgCl_2$.		HCl.	$MgCl_2$.
0.0	99.55	1.362	0.0	474.2
4.095	95.5	1.354	14.93	454.8
9.5	90.0	1.344	34.63	428.6
17.0	82.5	1.300	61.97	393.0
20.5	79.0	1.297	74.74	376.2
28.5	71.0	1.281	103.9	338.3
42.0	60.125	...	153.1	286.4
58.75	46.25	...	214.2	220.3
76.0	32.0	...	277.1	152.0
			sat. HCl (Ditte)	6.5

100 gms. H_2O dissolve 52.65 gms. $MgCl_2$ at 3.5°, 55.26 gms. at 25° and 58.66 gms. at 50°. (Biltz and Marcus, 1911.)

SOLUBILITY OF BASIC MAGNESIUM CHLORIDE IN WATER AT 25°.

(Robinson and Waggaman, 1909.)

An excess of MgO was shaken with each of 20 $MgCl_2$ solutions at 25° for six months and the supernatant clear solutions and solid phases with adhering liquid, analyzed. The solutions were titrated with 0.02 *n* HCl for dissolved MgO (present as $Mg(OH)_2$). The composition of the solid phase in each case was ascertained by plotting the analytical results on a triangular diagram.

d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.	d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
	$MgCl_2$.	MgO.			$MgCl_2$.	MgO.	
1.019	2.36	0.00008	Indefinite	1.141	17.53	0.0024	$2MgO.HCl.5H_2O$
1.038	4.47	0.00028	Solid Solution	1.162	18.52	0.0025	"
1.056	6.79	0.00048	"	1.192	22.04	0.00245	"
1.075	9.02	0.00080	"	1.245	26.88	0.0025	"
1.111	13.14	0.00115	"	1.274	29.80	0.0024	"
				1.321	34.22	0.0030	"

Cl

EQUILIBRIUM IN THE SYSTEM MAGNESIUM CHLORIDE, MAGNESIUM OXIDE AND WATER AT 25°.

(Bury and Davies, 1932.)

Due to the formation of either cement or gels equilibrium is reached very slowly. Continuous shaking for two months is required. It is also necessary to keep the solid phase reduced to a fine powder by repeatedly breaking up the lumps. In order to avoid metastable equilibrium it is necessary to add a trace of finely ground magnesium cement which contains hydroxide and oxychloride. The MgO contained about 0.3% CaO. It was prepared by heating magnesium carbonate (light) to 850°. MgO which has been heated to higher temperatures or "burnt" is very slow in attaining equilibrium. Both the filtered saturated solutions and the solid phases were analyzed. The identities of the latter were ascertained by extrapolation by the Jänecke method.

Gms. $MgCl_2$ per 100 gms. sat. sol.	Solid Phase	Gms. $MgCl_2$ per 100 gms. sat. sol.	Solid Phase	Gms. $MgCl_2$ per 100 gms. sat. sol.	Solid Phase
2.13	$Mg(OH)_2$	12.08*	$Mg(OH)_2$	26.59	1.3.11
2.65	"	15.32*	"	31.14	"
6.44	"	10.98	1.3.11	33.69	"
8.61	"	14.98	"	34.77	"
10.52	"	17.36	"	35.71	" + $MgCl_2.6H_2O$
10.89	" + 1.3.11	21.12	"	35.72	$MgCl_2.6H_2O$
10.62*	1.3.11	24.21	"		

* Metastable

1.3.11 = $MgCl_2.3MgO.11H_2O$. The authors consider that Robinson and Waggamans value for the triple point $Mg(OH)_2$ + 1.3.11, viz. 16.0% $MgCl_2$, erroneous due to their failure to recognize metastable equilibrium.

In a later paper, Bury and Davies, 1933, give results for the four component (reciprocal Salt pair) system $MgCl_2$ + CaO + H_2O at 25°. The authors discuss these results in their relation to the properties of magnesium oxychloride cements.

EQUILIBRIUM IN AQUEOUS SOLUTIONS CONTAINING MAGNESIUM CHLORIDE AND VARIOUS OTHER SALTS.

Several exhaustive papers describing the hetereogeneous systems encountered in the technical production of particular salts from oceanic salt deposits have appeared in recent years. Among these should be mentioned those of Janecke, 1917, 1918, Serowy, 1923 and Frowein and von Mühlendahl, 1926. The experiments of Serowy are a repetition with great care, and an extension of the fundamental work of Van't Hoff, D'Ans and others. The compositions of the solutions saturated at regular intervals of temperature between 0° and 120° with all possible combinations of the solid phases, are shown in tables and triangular diagrams. The results are expressed in ion per cent of the constituents of the salts, Mg, K, Na, Cl and SO_4, and are also calculated to the molecular per cent and weight per cent basis and by the aid of density determinations, which are also given, to grams per liter. The paper of Jänecke gives an exhaustive treatment of equilibria in hetereogeneous systems. That of Frowein and von Mühlendahl is concerned particularly with double ternary mixtures derived from Mg, K_2, Na_2 $(NO_3)_2$ and Cl_2.

100 gms. sat. solution of magnesium chloride in selenium oxychloride ($SeOCl_2$) contain 4.96 gms. $MgCl_2$ at 25°. (Wise, 1923.)

SOLUBILITY OF MIXTURES OF MAGNESIUM CHLORIDE, POTASSIUM CHLORIDE AND OF MAGNESIUM POTASSIUM CHLORIDE (CARNALLITE) IN WATER AT VARIOUS TEMPERATURES.

(van't Hoff and Meyerhoffer, 1899, 1912.)

C1

t°.	Gms. per 100 Gms. H_2O.		Solid Phase.	Kind of Point on Curve.	
	$MgCl_2$.	KCl.			
− 11.1	...	24.6	Ice + KCl	Cryohydric of KCl	
− 33.6	26	...	" $+MgCl_2.12H_2O$	" $MgCl_2.12H_2O$	
− 34.3	22.7	1.24	" $+KCl+MgCl_2.12H_2O$	" " $+KCl$	
− 21	34.9	2.03	Carnallite $+MgCl_2.12H_2O+KCl$	Formation Temp. of Carnallite	
− 0	35.5	3.02	" + KCl	Point on Curve	
25	38.4	4.76	" + "	" "	
50	42	6.17	" + "	" "	(Uhlig, 1913.)
61.5	42.6	7.20	" + "	" "	
154.5	65.5	14.07	" + "	" "	
167.5	88.1	17.26	" + "	M. pt. of Carnallite	
25	55.5	0.83	" $+MgCl_2.6H_2O$	Point on Curve	
50	59.13	0.50	" + "	" "	(Uhlig, 1913.)
80	65	1.24	" + "	" "	
115.7	85.6	1.66	" + " $+MgCl_2.4H_2O$	Transition Point	[Carnallite
152.5	105.7	9.93	" $+MgCl_2.4H_2O+KCl$	Upper Formation Temp. of	
176	126.9	16.97	$MgCl_2.4H_2O+MgCl_2.2H_2O+KCl$	Transition Point	
186	126.9	26.1	$MgCl_2.2H_2O+KCl$	Point on Curve	

Carnallite = $MgKCl_3.6H_2O$.

SOLUBILITY OF MIXTURES OF MAGNESIUM CHLORIDE AND OTHER SALTS IN WATER AT 25°.

(Löwenherz, 1894.)

Mixture.	Gms. Mols. per 1000 Mols. H_2O.	Gms. per Liter of Solution.
$MgCl_2.6H_2O+MgSO_4.6H_2O$	104 $MgCl_2$ + 14 $MgSO_4$	25. Cl + 4.4 SO_4
$MgCl_2.7H_2O+MgSO_4.6H_2O$	73 " + 15 "	19.5 Cl + 5.3 SO_4
$MgCl_2.6H_2O+MgCl_2.KCl.6H_2O$	106 Cl_2 + 1 K_2 + 105 Mg	26.9 Cl + 0.3 K + 45.7 SO_4

Results for all possible combinations of magnesium sulfate and potassium chloride and of magnesium chloride and potassium sulfate are also given.

100 cc. anhydrous hydrazine dissolve 2 gms. $MgCl_2$ at room temp. A flocculant ppt. separates on standing. (Welsh and Broderson, 1915.)

Data for the System $MgCl_2$ + KCl + $MgSO_4$ + K_2SO_4 + H_2O at 100° are given by Campbell, Downes and Samis, 1934.

Data for the System $MgCl_2$ + KCl + NaCl at temperatures above 100° are given by Achoumow and Wassilijew, 1932.

SOLUBILITY OF MAGNESIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM PERMANGANATE AT 25°.

(Herz and Hiebenthal, 1929.)

Gm. Mols. per liter sat. sol.	
$1/5\text{-}KMnO_4$	$1/2\ MgCl_2$
0.0	9.56
0.10	9.46
+0.16	9.52

SOLUBILITY OF MAGNESIUM CHLORIDE IN AQUEOUS SOLUTIONS OF MAGNESIUM NITRATE AND VICE VERSA.

(Sieverts and Müller, 1930.)

Cl

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$MgCl_2$	$Mg(NO_3)_2$	
	Results at 15°		
1.336	35.0	0.0	$MgCl_2.6H_2O$
1.352	32.5	4.29	"
1.371	29.9	8.24	"
1.386	27.7	12.2	"
1.397	26.1	14.9	" + Mg6
1.379	20.0	19.5	Mg6
1.373	15.0	24.2	"
1.372	9.54	29.9	"
1.373	5.04	34.4	"
1.377	0.0	40.5	"
	Results at 25°		
1.338	35.5	0.0	$MgCl_2.6H_2O$
1.353	33.1	4.06	"
1.372	30.7	8.25	"
1.386	28.6	11.5	"
1.412	24.9	17.8	" + Mg6
1.392	18.3	22.7	Mg6
	Results at 25° (con.)		
1.384	13.7	27.1	Mg6
1.376	8.72	32.7	"
1.382	4.60	36.8	"
1.387	0.0	41.9	"
	Results at 50°		
1.345	37.0	0.0	$MgCl_2.6H_2O$
1.372	33.3	6.5	"
1.424	26.4	18.5	"
1.452	23.0	24.4	"
1.462	21.6	26.5	" + Mg6
1.443	18.2	28.6	Mg6
1.425	13.0	32.7	"
1.419(?)	9.75	35.9	"
1.414(?)	6.16	39.3	"
1.415	3.32	42.4	"
1.418	0.0	46.0	"

Mg6 = $Mg(NO_3)_2.6H_2O$

The authors give similar results for the Reciprocal Salt Pair $MgCl_2$ + $NaNO_3$ + H_2O at 15°, 25° and 50°.

SOLUBILITY OF MAGNESIUM CHLORIDE IN AQUEOUS SOLUTIONS OF MAGNESIUM NITRATE AND VICE VERSA.

(Sieverts and Müller, 1931.)

Results at 75°

d. of sat. sol.	Gms. per 100 gms. sat. sol. $MgCl_2$	Gms. per 100 gms. sat. sol. $Mg(NO_3)_2$	Solid Phase
1.360	39.1	0.0	$MgCl_2.6H_2O$
1.380	34.6	7.3	"
1.390	33.4	9.4	"
—	28.5	17.6	"
—	24.3	28.2	"
—	25.8	30.2	" + $MgCl_2.4H_2O$
1.575	23.0	37.5	$MgCl_2.4H_2O$
—	17.1	46.2	"
—	13.1	54.0	" + $Mg(NO_3)_2.2H_2O$
—	11.6	56.1	$Mg(NO_3)_2.2H_2O$
1.679	4.9	63.1	"
—	3.9	65.3	"
—	1.8	67.8	"
—	0.0	68.8	"
1.461	0.0	50.6	$Mg(NO_3)_2.6H_2O$
1.528	9.9	43.2	"
—	9.0	48.0	"
1.581	6.5	53.3	"
—	7.0	57.7	"
—	0.0	63.4	"

Results at 110°

d. of sat. sol.	Gms. per 100 gms. sat. sol. $MgCl_2$	Gms. per 100 gms. sat. sol. $Mg(NO_3)_2$	Solid Phase
1.40	44.3	0.0	$MgCl_2.6H_2O$
—	43.95	3.65	" + $MgCl_2.4H_2O$
—	28.3	29.1	$MgCl_2.4H_2O$
—	23.1	41.7	"
—	22.4	45.2	"
—	23.3	46.0	"
—	22.2	47.4	" + $MgCl_2.2H_2O$
1.60	20.1	50.8	$MgCl_2.2H_2O$
—	19.3	51.8	"
1.58	17.5	54.0	"
—	16.3	56.9	"
—	16.6	57.8	"
—	16.0	57.8	"
—	15.9	58.7	"
—	14.9	58.5	"
—	14.2	59.3	"
—	15.0	61.0	" + $Mg(NO_3)_2.2H_2O$
—	9.95	65.0	$Mg(NO_3)_2.2H_2O$
—	0.0	73.5	"

Cl

The authors give similar results for the Reciprocal Salt Pair $MgCl_2 + NaNO_3 + H_2O$ at 75° and at 110°.

EQUILIBRIUM IN THE SYSTEM MAGNESIUM CHLORIDE MAGNESIUM SULFATE AND WATER AT 100°.

(Campbell, Downes and Samis, 1934.)

Gms. per 100 gms. sat. sol. $MgCl_2$	Gms. per 100 gms. sat. sol. $MgSO_4$	Solid Phase
42.40	0.00	$MgCl_2.6H_2O$
41.20	1.08	$MgSO_4$
41.50	1.23	"
40.25	0.87	"
40.60	0.60	"
33.16	0.37	"
29.0	0.99	"
37.6	2.12	"
36.9	2.81	$MgSO_4$
37.35	2.82	" + $MgSO_4.H_2O$
31.0	3.30	$MgSO_4.H_2O$
20.85	9.05	"
19.85	8.65	"
12.50	16.30	"
8.42	21.20	"
2.83	29.50	"
0.0	33.50	"

These authors also give data for the systems $MgCl_2 + MgSO_4 + KCl + K_2SO_4$ at 100°.

Data for the System $MgCl_2 + MgSO_4 + NaCl + Na_2SO_4$ at 0°, 5°, 15.3°, 17.9°, 20.6°, 25°, 27°,31°, 35.5°, 49°, 55°, 57°, 59°, 61°, 64°, 71° and 83° are given by Küpper, 1927.

EQUILIBRIUM IN THE SYSTEM MAGNESIUM CHLORIDE, MAGNESIUM SULFATE AND WATER.

Results of Kournakow and Zemcuznyj, 1919, 1924 :

At 0°. Mols. per 1000 mols. H_2O. $MgCl_2$.	$MgSO_4$.	Solid Phase.	At 25°. Mols. per 1000 mols. H_2O. $MgCl_2$.	$MgSO_4$.	Solid Phase.
99.8	0.0	$MgCl_2.6H_2O$	104.9	0.0	$MgCl_2.6H_2O$
97.7	3.4	» + $MgSO_4.7H_2O$	100.1	9.3	» + $MgSO_4.6H_2O$
84.0	3.3	$MgSO_4.7H_2O$	91.6	9.0	$MgSO_4.6H_2O$
78.2	3.3	»	80.1	9.2	» + $MgSO_4.7H_2O$
71.8	3.5	»	68.3	10.7	$MgSO_4.7H_2O$
64.1	4.2	»	60.4	12.0	»
42.8	8.1	»	39.3	19.0	»
23.7	16.8	»	20.4	31.4	»
9.2	27.6	»	17.2	34.6	»
0.0	38.9	»	8.0	45.0	»

Results of Takegami, 1921, at 25°.

Cl

Gms. per 100 gms sat. sol $MgCl_2$.	$MgSO_4$.	Solid Phase.	Gms. per 100 gms. sat. sol $MgCl_2$.	$MgSO_4$.	Solid Phase
35.86	0.0	$MgCl_2.6H_2O$	28.72	4.14	$MgSO_4.6H_2O$
34.80	1.45	»	28.21	4.35	»
33.89	2.99	»	27.84	4.29	»
34.03	2.96	» + $MgSO_4.4H_2O$	26.36	4.90	»
33.56	2.81	$MgSO_4.4H_2O$	26.06	5.02	» + $MgSO_4.7H_2O$
33.09	2.82	»	23.53	5.44	$MgSO_4.7H_2O$
32.97	2.91	$MgSO_4.5H_2O$	16.22	10.14	»
32.48	3.04	»	14.77	11.08	»
30.79	3.87	»	14.05	10.68	»
32.36	3.85	$MgSO_4.6H_2O$	10.51	14.02	»
32.14	3.77	»	9.42	14.89	»
31.39	3.75	»	5.31	19.63	»
30.91	3.76	»	1.62	24.43	»
30.08	3.80	»	0.0	26.68	»

In both cases constant agitation was employed and all necessary precautions for accuracy were observed.

SOLUBILITY OF MIXTURES OF AMMONIUM CHLORIDE AND MAGNESIUM CHLORIDE IN WATER. (Biltz and Marcus, 1911.)

t°.	Gms. per 100 Gms. Sat. Sol. $MgCl_2$.	NH_4Cl.	Solid Phase.	t°.	Gms. per 100 Gms. Sat. Sol. $MgCl_2$.	NH_4Cl.	Solid Phase.
3.5	21.41	5.93	$NH_4Cl+MgCl_2.6H_2O$	3.5	34.43	0.09	$(NH_4)MgCl_3.6H_2O + MgCl_2.6H_2O$
25	20.95	8.78	"	25	35.41	0.09	" "
50	20.84	12.46	"	50	36.92	0.15	" "

SOLUBILITY OF MAGNESIUM CHLORIDE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE AND VICE VERSA.

(Woskrassenskai, 1934.)

Results at 25°

Gms. per 100 gms. sat. sol.		Solid Phase
$MgCl_2$	NH_4Cl	
35.7	0.0	$MgCl_2.6H_2O$
35.55	0.08	" + 1.1.6
28.05	1.31	1.1.6
25.71	3.0	"
23.88	4.88	"
21.08	8.69	" + NH_4Cl
12.36	15.75	NH_4Cl
7.50	20.45	"
0.0	28.26	"

Results at 60°

Gms. per 100 gms. sat. sol.		Solid Phase
$MgCl_2$	NH_4Cl	
37.9	0.0	$MgCl_2.6H_2O$
38.2	0.15	" + 1.1.6
35.9	0.49	1.1.6
31.7	1.2	"
27.8	3.6	"
22.1	11.8	"

Results at 60° (con.)

Gms. per 100 gms. sat. sol.		Solid Phase
$MgCl_2$	NH_4Cl	
20.7	14.3	1.1.6 + NH_4Cl
18.5	15.9	NH_4Cl
15.5	18.6	"
8.4	26.0	"
0.0	35.6	"

Results at 115°

Gms. per 100 gms. sat. sol.		Solid Phase
$MgCl_2$	NH_4Cl	
45.0	0.0	$MgCl_2.6H_2O$
44.8	0.17	" + 1.1.6
41.9	0.54	1.1.6
35.6	3.29	"
26.7	12.4	"
21.2	22.3	" + NH_4Cl
19.0	24.1	NH_4Cl
9.5	34.2	"
4.2	40.7	"
0.0	46.5	"

1.1.6 = $MgCl_2.NH_4Cl.6H_2O$.

The author also made a long series of determinations by the freezing-point method (observing the temperature of the appearance of first crystal) and from these results obtained the values for the isotherms at -10°, -20°, -25°, as well as for the invariant points of the system at other temperatures.

EQUILIBRIUM IN THE SYSTEM MAGNESIUM CHLORIDE, SODIUM CHLORIDE AND WATER AT 0° AND AT 25°.

(Kournakov and Zemcuzny, 1919, 1924.)

Results at 0°.

Mols per 1000 mols. H_2O		Solid Phase.
$MgCl_2$.	Na_2Cl_2.	
99.8	0.0	$MgCl_2.6H_2O$
98.0	1.7	» + NaCl
75.0	3.2	NaCl
49.1	12.8	»
38.0	20.0	»
18.95	37.0	»
0.0	54.9	»

Results at 25°.

Mols. per 1000 mols. H_2O		Solid Phase.
$MgCl_2$.	Na_2Cl_2.	
104.9	0.0	$MgCl_2.6H_2O$
102.5	2.45	» + NaCl
95.0	3.0	NaCl
79.2	4.1	»
58.5	9.0	»
48.4	14.5	«
40.5	19.5	»
26.7	29.6	»
16.0	40.0	»
0.0	55.5	»

Data for the Systems:

$MgCl_2$ + NaCl + Na_2SO_4 at 0° and at 50°
$MgCl_2$ + NaCl + Na_2SO_4 + $NaNO_3$ at 10° and 50°
$MgCl_2$ + NaCl + Na_2SO_4 + $NaNO_3$ + $Mg(NO_3)_2$ at 50°

are given by Leimbach and Pfeiffenberger, 1929, 1930.

EQUILIBRIUM IN THE SYSTEM MAGNESIUM CHLORIDE, SODIUM CHLORIDE AND WATER AT DIFFERENT TEMPERATURES. (Keitel, 1923.)

	Gms. per 100 gms. sat. sol.				Gms. per 100 gms. sat. sol.		
t°.	$MgCl_2$.	NaCl.	Solid Phase.	t°.	$MgCl_2$.	NaCl.	Solid Phase.
15...	35.10	0.0	$MgCl_2.6H_2O$	55...	8.29	18.34	NaCl
15...	23.84	3.68	NaCl	55...	7.37	19.30	»
15...	15.80	10.07	»	55...	0.0	27.01	»
15...	7.60	18.95	»	83...	39.81	0.0	$MgCl_2.6H_2O$
25...	35.60	0.0	$MgCl_2.6H_2O$	83...	38.80	0.40	» + NaCl
25...	35.00	0.97	» + NaCl	83...	34.89	0.74	NaCl
25...	30.87	1.39	NaCl	83...	30.86	2.28	»
25...	24.28	4.01	»	83...	22.51	7.65	»
25...	9.68	16.38	»	83...	15.37	12.91	»
25...	8.01	17.74	»	83...	7.83	20.81	»
55...	37.55	0.0	$MgCl_2.6H_2O$	83...	0.0	27.60	»
55...	37.51	0.28	» + NaCl	105..	43.47	0.0	$MgCl_2.6H_2O$
55...	34.49	0.97	NaCl	105..	42.93	0.09	» + NaCl
55...	30.80	1.65	»	105..	31.01	2.61	NaCl
55...	25.05	4.32	»	105..	24.68	7.22	»
55...	23.59	5.01	»	105..	0.0	28.35	»
55...	16.18	10.74	»				

A solution of Bischofite ($MgCl_2.6H_2O$) served as the starting solution. The solutions were stirred constantly for not less than two hours.

The following determinations at 25° are given by Takegami, 1921.

Gms. per 100 gms. sat. sol.		
$MgCl_2$.	NaCl.	Solid Phase.
35.86	0.0	$MgCl_2.6H_2O$
35.73	0.21	»
35.68	0.48	» + NaCl
31.65	1.12	NaCl
24.40	4.11	»
18.79	7.80	»
9.15	16.62	»
6.24	19.77	»
0.5	26.49	»

EQUILIBRIUM IN THE SYSTEM MAGNESIUM CHLORIDE, MAGNESIUM SULFATE, SODIUM CHLORIDE, SODIUM SULFATE AND WATER AT 105°. (Mayeda, 1920.)

Mols. per 1000 mols. H_2O.				
$MgCl_2$	$MgSO_4$.	Na_2Cl_2.	Na_2SO_4.	Solid Phase.
133.0		0.225	–	NaCl
139.5	-	trace	–	$MgCl_2.NaCl.6H_2O$
138.5	1.5	–	-	$MgCl_2.6H_2O + MgSO_4.H_2O$
123.1	2.02	–	–	$MgSO_4.H_2O$
–	76.69		–	»
-	64.31		13.07	» + $2Na_2SO_4.2MgSO_4.5H_2O$
–	41.84	·	32.22	$3Na_2SO_4.MgSO_4$ + »
-	49.88	-	11.05	» + Na_2SO_4
–	-	–	52.99	Na_2SO_4
–	-	57.99	8.054	» + NaCl
4.632	–	52.78	7.382	» + » + $3Na_2SO_4.MgSO_4$
33.64	–	27.02	10.12	$NaCl + 3Na_2SO_4.MgSO_4 + 2Na_2SO_4.2MgSO_4.5H_2O$
55.40	–	9.978	11.32	$NaCl + 2Na_2SO_4.2MgSO_4.5H_2O + MgSO_4.H_2O$

EQUILIBRIUM IN THE SYSTEM MAGNESIUM CHLORIDE, MAGNESIUM SULFATE, SODIUM CHLORIDE, SODIUM SULFATE AND WATER AT 0° AND AT 25°.

(Kournakoff and Zemcuznyj, 1919, 1924.)

t°.	Mols. per 1000 mols H_2O.				Solid Phase.
	$MgCl_2$.	$MgSO_4$.	Na_2Cl_2.	Na_2SO_4.	
0..	96.5	3.9	1.1	0.0	$MgCl_2.6H_2O+MgSO_4.7H_2O+NaCl$
0..	85.7	2.9	1.0	0.0	$MgSO_4.7H_2O+NaCl$
0..	48.2	6.0	11.0	0.0	» »
0..	25.2	12.0	25.3	0.0	$MgSO_4.7H_2O+Na_2SO_4.10H_2O+NaCl$
0..	23.7	13.3	19.2	0.0	$MgSO_4.7H_2O+Na_2SO_4.10H_2O$
0..	11.0	23.8	9.7	0.0	» »
0..	0.0	38.5	0.0	6.5	» »
25..	100.0 (101.85)	9.5 (3.78)	2.5 (0.28)	0.0	$MgCl_2$ $6H_2O+MgSO_4$ $6H_2O+NaCl$
25..	— (103.9)	0.0	0.0	0.0	» +NaCl
25..	— (102.1)	— (5.4)	0.0	0.0	» $+MgSO_4.6H_2O$
25..	— (77.0)	— (9.53)	0.0	0.0	$MgSO_4.7H_2O+$ »
25..	77.7 (78.5)	9.8 (9.78)	2.3 (3.39)	0.0	» + » +NaCl
25..	— (71.79)	— (18.0)	— (15.08)	0.0	» + 1 1 4 + »
25..	30.2	15.1	22.0	0.0	$MgSO_4$ + » + »
25..	53.6	13.8	8.8	0.0	$MgSO_4.7H_2O+NaCl$
25..	44.2	17.0	12.4	0.0	» »
25..	37.4	16.1	16.4	0.0	» »
25..	35.6	16.2	17.1	0.0	» »
25..	24.2	15.3	26.6	0.0	1.1.4+NaCl
25..	17.6	15.0	31.9	0.0	» »
25..	13.1	16.0	36.1	0.0	» »
25..	4.1	16.9	43.6	0.0	» »
25..	30.2	14.3	21.0	0.0	» $+MgSO_4(7H_2O?)$
25..	21.9	22.2	19.8	0.0	» »
25..	4.5	38.6	18.1	0.0	» »
25..	3.8	39.8	19.7	0.0	» »
25..	0.0	45.1	14.2	8.9	» »
25..	0.0	44.2	8.2	18.3	» »
25..	0.0	45.3 (47.90)	0.0	28.1 (24.97)	» »
25..	0.0	16.0	46.9	2.03	» + NaCl $+Na_2SO_4$
25..	0.0	15.9 (18.84)	46.8 (45.72)	2.5 (1.28)	» » »
25..	0.0	15.6	39.7	9.7	» $+Na_2SO_4.10H_2O+$ »
25..	0.0	17.2 (11.54)	30.4 (23.89)	16.6 (23.67)	» » »
25..	0.0	— [11.6]	— [26.3]	— [26.0]	» » » (Rose, 1925.)
25..	0.0	— [30.8]	— [10.2]	— [32.3]	» » » (Takegami, 1920.)
25..	0.0	17.7	28.5	18.6	» $+Na_2SO_4.10H_2O$
25..	0.0	18.1	25.4	20.1	» »
25..	0.0	19.3	22.6	24.3	» »
25..	0.0	20.2	20.8	25.6	» »
25..	0.0	25.0	11.8	31.3	» »
25..	0.0	36.2 (37.96)	0.0	35.8 (34.36)	» »
25..	0.0	17.2	30.1	16.6	» + » $+Na_2SO_4$
25..	0.0	16.0	46.8	2.2	» + NaCl + »
25..	0.0	0.0	31.4 (29.0)	26.9 (27.8)	$Na_2SO_4.10H_2O+Na_2SO_4$
25..	0.0	5.7	30.2	23.1	» »
25..	0.0	12.1	30.1	19.8	» »
25..	0.0	0.0	50.9 (49.36)	12.4 (12.44)	NaCl + »
25..	0.0	8.1	48.6	7.0	» »
25..	0.0	4.7	35.8	21.0	Na_2SO_4
25..	0.0	11.8	41.5	11.0	»

C1

1.1.4 = astrakanite, $MgSO_4.Na_2SO_4 4H_2O$. The results in parentheses are by Blasdale, 1920.

Data for the systems composed of Magnesium and Sodium Chlorides, Nitrates and Sulfates at 0°, 10°, 25° and 50° are given by Leisbach and Pfeiffenberger, 1929, 1930.

MAGNESIUM CHLORIDE

EQUILIBRIUM IN THE SYSTEM MAGNESIUM CHLORIDE, RUBIDIUM CHLORIDE, POTASSIUM CHLORIDE AND WATER AT 25°.

(D'Ans and Busch, 1937.)

Gm. Mols. per 1000 gms. H_2O			Mols. Rb per 100 mols. Rb + K in:		Solid Phase
$MgCl_2$	Rb_2Cl_2	K_2Cl_2	sat. sol.	Solid Phase	
104.0	trace	0.0	—	—	$MgCl_2.6H_2O$ + 1.1.6
49.2	24.8	0.0	—	—	1.1.6
(31.0)	(38.0)	1.3	100	—	" + RbCl
32.2	36.7	0.0	—	—	"
(72.0)	0.0	(5.5)	0.0	—	KCl + $KCl.MgCl_2.6H_2O$
57.3	6.2	7.9	44.0	—	(K,Rb)Cl+(K,Rb)Cl+$MgCl.6H_2O$
50.2	12.9	10.2	55.7	—	" " "
44.3	29.7	7.2	81.5	—	" " "
41.5	33.3	5.7	85.0	—	" " "
68.7	0.4	7.0	4.8	0.0	(K,Rb)Cl
72.3	0.6	5.9	9.7	17.2	(K,Rb)Cl.$MgCl.6H_2O$
46.5	19.7	8.8	69.2	86.0	"
34.0	32.8	8.5	79.3	54.1	(K,Rb)Cl
45.0	27.4	3.5	89.0	95.4	(K,Rb)Cl.$MgCl_2.6H_2O$
50.3	18.0	9.4	65.7	83.4	"
48.7	18.2	6.8	72.3	86.5	"
46.6	19.0	6.3	75.1	90.2	"
49.3	21.9	4.0	86.3	91.6	"

Cl

1.1.6 = $MgCl_2.RbCl.6H_2O$ (Rubidium Carnallite)

MAGNESIUM CHLORIDE Methyl and Ethyl Alcoholates.

SOLUBILITY OF MAGNESIUM CHLORIDE METHYL ALCOHOLATE IN METHYL ALCOHOL.

(Lloyd, Brown, Glynwyn, Bonnel and Jones, 1928.)

t°	Gms. $MgCl_2$ per 100 gms. CH_3OH	Solid Phase	t°	Gms. $MgCl_2$ per 100 gms. CH_3OH	Solid Phase
0	15.5	$MgCl_2.6CH_3OH$	40	17.8	$MgCl_2.6CH_3OH$
10	15.7	"	50	19.0	"
20	16.0	"	60	20.4	"
30	16.7	"			

SOLUBILITY OF MAGNESIUM CHLORIDE ETHYL ALCOHOLATE IN ETHYL ALCOHOL.

(Lloyd, Brown, Glynwyn, Bonnel and Jones, 1928.)

t°	Gms. $MgCl_2$ per 100 gms. C_2H_5OH	Solid Phase	t°	Gms. $MgCl_2$ per 100 gms. C_2H_5OH	Solid Phase
0	3.61	$MgCl_2.6C_2H_5OH$	50	12.80	$MgCl_2.6C_2H_5OH$
10	4.34	"	60	15.87	"
20	5.60	"	65	17.20	"
30	7.40	"	70	18.63	"
40	10.00	"			

Fusion-point data are given for mixtures of:

$MgCl_2$ + $MgSO_4$ (Jänecke, 1912.)
" + $MnCl_2$ (Sandonnini, 1912, 1914.)
" + NaCl (Scholich, 1920; Menge, 1911.)
" + KCl (Scholich, 1920.)
" + " + NaCl " "

$MgCl_2$ + $PbCl_2$ (Menge, 1911.)
" + $SnCl_2$ " "
" + $SrCl_2$ (Sandonnini, 1912, 1914.)
" + TlCl (Korreng, 1914.)
" + $ZnCl_2$ (Menge, 1911.)

MAGNESIUM CHLORATE $Mg(ClO_3)_2.6H_2O$.

SOLUBILITY IN WATER.

(Meusser — Ber. 35, 1416, '02.)

t°.	Gms. $Mg(ClO_3)_2$ per 100 Gms. Solution.	Mols. $Mg(ClO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Mg(ClO_3)_2$ per 100 Gms. Solution.	Mols. $Mg(ClO_3)_2$ per 100 Mols. H_2O.	Solid. Phase.
-18	51.64	10.05	$Mg(ClO_3)_2.6H_2O$	42	63.82	16.60	$Mg(ClO_3)_2.4H_2O$
0	53.27	10.73	"	65.5	69.12	20.08	"
18	56.50	12.22	"	39.5	65.37	17.76	$Mg(ClO_3)_2.2H_2O$
29	60.23	14.25	"	61.0	69.46	21.40	"
35	63.65	16.48	"	68	70.69	22.69	"
				93	(73.71)	(26.38)	"

C10

Sp. Gr. of saturated sol. at + 18° = 1.564.

MAGNESIUM Per CHLORATE $Mg(ClO_4)_2.6H_2O$ and $3H_2O$.

SOLUBILITY OF HYDRATED MAGNESIUM PERCHLORATE IN WATER AND OF ANHYDROUS MAGNESIUM PERCHLORATE IN OTHER SOLVENTS AT 25°.

(Willard and Smith, 1926.)

Solvent.	*d* of solvent.	*d* of sat. sol.	Gms. $Mg(ClO_4)_2$ per 100 gms. sat. sol.	Solvent.	*d* of solvent.	*d* of sat. sol.	Gms. $Mg(ClO_4)_2$ per 100 gms. sat sol.
Water	—	1.4720	49.90	*iso* Butyl alcohol.	0.7981	1.0609	31.27
Methyl alcohol	0.78705	1.1057	34.14	Acetone	0.7864	1.0798	30.015
Ethyl alcohol	0.78515	0.9518	19.33	Ethyl acetate	0.89457	1.3057	41.49
n Propyl alcohol.	0.7989	1.1926	42.33	Ethyl ether	0.7081	0.7101	0.29
n Butyl alcohol	0.8059	1.1399	39.16				

MAGNESIUM Hexa Antipyrine Per CHLORATE $[Mg(OC_{10}H_{12}N_2)_6](ClO_4)_2$.

100 gms. sat. solution of Magnesium Hexa Antipyrine Perchlorate in Water contain 7.69 gms. $[Mg(OC_{10}H_{12}N_2)_6](ClO_4)_2$ at 20°. (Wilke, Dörfurt and Schliephake, 1929.)

MAGNESIUM CHROMATE $MgCrO_4.7H_2O$.

100 grams H_2O dissolve 72.3 grams $MgCrO_4$ at 18°, or 100 grams solution contain 42.0 grams. Sp. Gr. = 1.422. (Mylius and Funk, 1897.)

MAGNESIUM POTASSIUM CHROMATE $MgCrO_4.K_2CrO_4.2H_2O$.

100 grams H_2O dissolve 28.2 grams at 20°, and 34.3 grams at 60°.

(Schweitzer.)

MAGNESIUM FLUORIDE MgF_2

SOLUBILITY OF MAGNESIUM FLUORIDE IN WATER.

t^0	Gms. MgF_2 per liter sat. sol.		Authority
18	0.076	(conductivity method)	(Kohlrausch, 1905.)
27	0.084	" "	(" 1908.)
25	0.130	(analytical method)	(Carter, 1928.)

SOLUBILITY OF MAGNESIUM FLUORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID.

(Tananaew and Tchrelachwili, 1938.)

Normality of Aq. HCl	Gm. Mols. MgF_2 dissolved per liter	pH of sat. sol.
0.01	0.0036	1.94
0.10	0.0086	1.15
1.00	0.0428	0.25

F

F. pt data for MgF_2 + NaF are given by Grube, 1927 and Jaisle, 1926.

MAGNESIUM Hexa Antipyrine Boro FLUORIDE $[Mg(COC_{10}H_{12}N_2)_6](BF_4)_2$.

100cc sat. solution of Magnesium Hexa antipyrine Boro fluoride in Water contain 6.6 gms. $[Mg(COC_{10}H_{12}N_2)_6](BF_4)_2$ at 20°. (Wilke, Dörfurt and Mureck, 1929.)

SOLUBILITY OF MAGNESIUM SILICO FLUORIDE IN WATER.

(Watlov and Pinaevskaji, 1938.)

t^0	Gms. $MgSiF_6$ per 100 gms. sat. sol.	Solid Phase	t^0	Gms. $MgSiF_6$ per 100 gms. sat. sol.	Solid Phase
-0.9	5.0	Ice	20	(1.2399)23.00(1)	$MgSiF_6 \cdot 6H_2O$
-2.2	10.0	"	40	25.86	"
-3.8	15.0	"	50	28.54	"
-6.0	19.5	" + $MgSiF_6 \cdot 6H_2O$	57	28.66	"
0	20.85	$MgSiF_6 \cdot 6H_2O$	60	30.74	"
+20	23.53	"			

(1) Worthington and Haring, 1931. The figure in parentheses is density of sat. solution.

SOLUBILITY OF MAGNESIUM SILICO FLUORIDE IN AQUEOUS SOLUTIONS OF SILICOFLUORIC ACID AT 20°.

(Jatlov and Pinaevskaja, 1938.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
H_2SiF_6	$MgSiF_6$		H_2SiF_6	$MgSiF_6$	
0.0	23.53	$MgSiF_6.6H_2O$	15.28	8.68	$MgSiF_6.6H_2O$
0.97	23.07	"	28.82	2.94	"
1.96	21.84	"	38.30	1.68	"
7.53	16.68	"	46.18	0.20	"

MAGNESIUM Ortho GERMANATE Mg_2GeO_4.

GeO

SOLUBILITY IN WATER AND IN AQUEOUS SOLUTIONS AT 26°. (Müller, 1922.)

Solvent.	Gms. Mg_2GeO_4 per 100 cc. sat. sol.
Water	0.0016
3 vols. H_2O + 2 vols. NH_4OH	0.002
Aq. 10% $(NH_4)_2SO_4$ + excess NH_4OH	0.013

MAGNESIUM IODIDE $MgI_2.8H_2O$.

I

SOLUBILITY IN WATER. (Menschutkin, 1905, 1907.)

The salt was prepared by the action of water upon magnesium iodide dietherate by which the octrahydrate and not the hexahydrate is formed. The crystals of this hydrate melt at 43.6°. The solubility determinations were made by the synthetic method.

t°.	Gms per 100 Gms. Sat. Solution.		Solid Phase.
	$MgI_2.6H_2O$ =	MgI_2.	
0	76	54.7	$MgI_2.8H_2O$
18	...	59.7 (d=1.909)	" (Mylius and Funk, 1897.)
20	81	58.3	"
40	88	63.4	"
43.5 tr. pt.	90.8	65.4	" $+MgI_2.6H_2O$
43	89.8	64.7	$MgI_2.6H_2O$
80	90.3	65	"
120	90.9	65.4	"
160	91.7	66	"
200	93.4	67.2	"
215	94.3	67.9	"

100 gms. sat. solution of Magnesium Iodide in Liquid Ammonia contain 0.156 gm. MgI_2 at 0°. (Linhard and Stephan, 1933, 1934.)

MAGNESIUM IODIDE ETHERATES, ALCOHOLATES, ACIDATES, etc.

SOLUBILITIES RESPECTIVELY IN ETHER, ALCOHOL AND ACID SOLVENTS AT VARIOUS TEMPERATURES.

Boris N. Menschutkin. Monograph in the Russian Language entitled "On Etherates and Other Molecular Combinations of Magnesium Bromide and Iodide," St. Petersburg, 1907, pp. 267 + XLVIII. Also published in "Memoirs of the St. Petersburg Polytechnic Institute," vols. 1-7, 1904-07 and in condensed form in vols. 49-67 of the Zeit. anorg. Chem., 1906-09.

Preparation of Material. The dietherate of magnesium iodide, $MgI_2.2C_4H_{10}O$, was prepared by the very gradual addition of iodine to a mixture of magnesium and dry ether. The reaction is not so violent as that which takes place during the preparation of the magnesium bromide dietherate (see p. 936). Two liquid layers are present at the end of the reaction and by slight cooling beautiful white needle-like crystals separate from the lower one. The growth of these crystals is also accompanied, as in the case of the magnesium bromide compound, by an evolution of ether droplets. Magnesium iodide dietherate is very hygroscopic, it is less stable than magnesium bromide dietherate, and becomes yellowish even after several hours, and brown after a day, owing probably to separation of iodine. As in the case of the magnesium bromide compound it reacts with very many organic compounds as alcohols, acids, ketones, etc., with liberation of ether and formation of addition products. These latter constitute the material used for the following solubility studies.

I

Method of Determination of Solubility. The synthetic (sealed tube) method of Alexejeff (Wied. Ann., 1885) was used almost exclusively.

Explanation of Results. As is seen from the following table, the solubility increases much more rapidly with temperature than in the case of magnesium bromide dietherate, especially in the vicinity of the melting point of $MgI_2.2C_4H_{10}O$ under its ethereal solution, which is at 23.6°. At this temperature there appears two layers, the lower one of which may be considered as a solution of ether in dietherate, and the upper one as a solution of the lower layer in ether. By increase of temperature a point is reached, at which both layers are miscible in all proportions (critical point). In the case of magnesium bromide dietherate no such critical point could be obtained. Both layers may be cooled below 23.6°, but only to about + 15° since here spontaneous crystallization of the dietherate almost always occurs, and the temperature rises to 23.6°. The great tendency to crystallize is probably due to the difference between the composition of the lower layer and of the saturated solution of the dietherate. The determinations in the vicinity of the critical point were quite difficult to make on account of the considerable opalescence which occurred and also the formation of a white substance, the nature of which was not ascertained. The critical concentration, as determined by means of the law of straight averages of Cailletet and Mathias, was approximately 40.3 per cent $MgI_2.2(C_2H_5)_2O$; the temperature, 38.5°. At concentrations of $MgI_2.2C_4H_{10}O$ greater than 54 per cent, a single liquid is again formed and the solubility curve can be followed up to the melting point of the **dietherate at 51°.**

SOLUBILITY OF MAGNESIUM IODIDE DIETHERATE IN ETHER AT DIFFERENT TEMPERATURES. (Menschutkin, 1906.)

t°.	Gms. per 100 Gms. Sat. Sol.		Mols. $MgI_2.2(C_2H_5)_2O$ per 100 Mols. Sat. Sol.	Solid Phase.
	$MgI_2.2(C_2H_5)_2O$	= MgI_2.		
5.4	2.2	1.45	0.39	$MgI_2.2(C_2H_5)_2O$
11.8	3.7	2.43	0.66	"
15.6	5.3	3.46	0.96	"
18.1	8.3	5.4	1.55	"
20.4	11.6	7.55	2.24	"
22.2	17.3	11.28	3.56	"
23.6	22	14.4	4.67	"

Between these two concentrations of $MgI_2.2(C_2H_5)_2O$ two liquid layers separate (see below).

t°.	$MgI_2.2(C_2H_5)_2O$	= MgI_2.	Mols.	Solid Phase.
23.6	54.4	35.5	17.1	"
25	73	47.6	31.9	"
30	82.5	54	42.9	"
35	87	57	53.4	"
40	89.6	58.6	60.4	"
45	93.5	61.2	71.4	"
51.5 m. pt.	100	65.2	100	"

At 23.6° the saturated solution separates into two liquid layers which have the following composition at different temperatures.

I

t°.	Gms. per 100 Gms. Solution.				
	Lower Layer.		Upper Layer.		
	$MgI_2.2(C_2H_5)_2O$	= MgI_2.	$MgI_2.2(C_2H_5)_2O$	= MgI_2.	
15	54.4	35.5	20.5	13.4	unstable
20	54.4	35.5	21.5	14.1	"
25	54.4	35.5	22.5	14.7	stable
30	54.4	35.5	23.5	15.4	"
35	54.1	35.3	26	17	"
36	53.5	34.9	27	17.7	"
37	52.2	34.2	28.5	18.7	"
38	50.5	33.1	32	21	"
38.5 crit. temp.	40.3	26.3	40.3	26.3	

MAGNESIUM IODIDE ALCOHOLATES and ANILINATE.

SOLUBILITY OF EACH IN THE RESPECTIVE ALCOHOLS OR ANILINE. (Menschutkin.)

$MgI_2.6CH_3OH$ in Methyl Alcohol.		$MgI_2.6C_2H_5OH$ in Ethyl Alcohol.		$MgI_2.6C_6H_5NH_2$ in Aniline.		$MgI_2.6(CH_3)_2CHOH$ in Dimethyl Carbinol.	
t°.	Gms. $MgI_2.6CH_3OH$ per 100 Gms. Sat. Sol.	t°.	Gms. $MgI_2.6C_2H_5OH$ per 100 Gms. Sat. Sol.	t°.	Gms. $MgI_2.6C_6H_5NH_2$ per 100 Gms. Sat. Sol.	t°.	Gms. $MgI_2.6(CH_3)_2$-CHOH per 100 Gms. Sat. Sol.
0	49.6	0	21.9	0	3.3	10	57.1
20	52.6	20	33.2	60	3.9	30	60
40	55.3	40	44.4	100	5	50	63.3
60	58.8	60	55.3	130	8.5	70	67
80	60.6	80	65.5	150	17.5	90	71.2
100	63.3	100	74.7	170	38	110	6.2
120	66.2	120	82.7	180	52	120	79.4
140	69.5	130	87.2	188‡	64.5	130	84.8
160	73.2	140	93.3	200	65.9*	136	91.7
180	77.1	143	96	210	67.2*	138†	100
200	81.5	146.5†	100	230	69.8*		

* Solid Phase, $MgI_2.4C_6H_5NH_2$. † M. pt. ‡ Tr. pt.

MAGNESIUM IODIDE COMPOUNDS.

SOLUBILITY OF MAGNESIUM IODIDE COMPOUNDS WITH BENZALDEHYDE, ACETONE, ACETAL, AND ACETIC ACID IN EACH OF THESE LIQUIDS.

(Menschutkin.)

$MgI_2.6C_6H_5COH$ in Benzaldehyde. t°.	Gms. $MgI_2.6C_6H_5COH$ per 100 Gms. Sat. Sol.	$MgI_2.6CH_3COCH_3$ in Acetone. t°.	Gms. $MgI_2.6CH_3COCH_3$ per 100 Gms. Sat. Sol.	$MgI_2.2CH_3CH(OC_2H_5)_2$ in Acetal. t°.	Gms. $MgI_2.2CH_3CH(OC_2H_5)_2$ per 100 Gms. Sat. Sol.	$MgI_2.6CH_3COOH$ in Acetic Acid. t°.	Gms. $MgI_2.6CH_3COOH$ per 100 Gms. Sat. Sol.
0	3.2	0	4.9	20	0.15	20	0.6
20	3.8	30	6.7	60	0.45	40	2
40	5.3	50	8.3	77	0.60	60	5
60	7.7	60	10.2	(Between these two concentrations the mixture separates into two liquid layers.)		70	9.5
80	11	70	15.2			80	18.5
100	18.5	80	28.6			95	42
110	26.5	85	40			105	54.5
120	40	90	59.2	77	92	115	65
125	53	95	80	79	93.7	125	73.8
130	74.5	100	92.5	81	95.5	135	85
136	94.2	105	98.5	83	97.3	140	94
139 m. pt.	100	106.5 m. pt.	100	86 m. pt.	100	142 m. pt.	100

On account of the properties of these molecular compounds, their great hygroscopicity, etc., the solubility determinations are not strictly accurate in all cases.

SOLUBILITY OF MAGNESIUM IODIDE COMPOUNDS WITH FORMIC AND ACETIC ACID ESTERS IN THE RESPECTIVE ESTERS.

(Menschutkin.)

$MgI_2.6HCOOC_2H_5$ in Ethyl Formate. t°.	Gms. $MgI_2.6HCOOC_2H_5$ per 100 Gms. Sat. Sol.	$MgI_2.6CH_3COOCH_3$ in Methyl Acetate. t°.	Gms. $MgI_2.6CH_3COOCH_3$ per 100 Gms. Sat. Sol.	$MgI_2.6CH_3COOC_2H_5$ in Ethyl Acetate. t°.	Gms. $MgI_2.6CH_3COOC_2H_5$ per 100 Gms. Sat. Sol.	$MgI_2.6CH_3COOC_3H_7$ in Propyl Acetate. t°.	Gms. $MgI_2.6CH_3COOC_3H_7$ per 100 Gms. Sat. Sol.
0	15.1	0	0.4	0	3.2	0	4.1
10	17.4	60	0.75	20	4.8	20	5.4
20	20.5	90	0.9	40	8.6	30	6.5
30	25	100	1.8	50	13.7	35	7.8
40	31.8	103	2.4	55	21.5	40	19
50	44	(Two layers here.)		60	38	45	46
60	68	103	74.2	65	63.5	50	72.5
70.5 m. pt.	100	110	81.7	70	90.5	55	88.2
		120	98	75	92.7	60	96
		121 m. pt.	100	78.5 m. pt.	100	65 m. pt.	100

$MgI_2.6CH_3COO$ (iso) C_4H_9 in Isobutyl Acetate. t°.	Gms. $MgI_2.6CH_3COO$ (iso) C_4H_9 per 100 Gms. Sat. Sol.	$MgI_2.6CH_3COO$ (iso) C_5H_{11} in Isoamyl Acetate. t°.	Gms. $MgI_2.6CH_3COO$ (iso) C_5H_{11} per 100 Gms. Sat. Sol.
0	10.5	0	7.7
20	13.6	20	11.5
40	17.6	40	20.9
60	24.9	45	25.5
70	33.7	50	33.2
80	52	55	47.8
85	89	57.5	63.
87.5 m. pt.	100	60 m. pt.	100

SOLUBILITY OF MAGNESIUM IODIDE COMPOUNDS WITH ACETONITRILE, ACETAMIDE AND URETHAN IN THESE LIQUIDS. (Menschutkin.)

$MgI_2.6CH_3CN$ in Acetonitrile.		$MgI_2.6CH_3CONH_2$ in Acetamide.			$MgI_2.6NH_2COOC_2H_5$ in Urethan.		
t°.	Gms. MgI_2.-$6CH_3CN$ per 100 Gms. Sat. Sol.	t°.	Gms. MgI_2.-$6CH_3CONH_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. MgI_2.-$6NH_2COOC_2H_5$ per 100 Gms. Sat. Sol.	Solid Phase.
0	37.2	82 m. pt. of acetamide			49 m. pt. of urethan		
30	49.8	70	28	CH_3CONH_2	45	27.5	$NH_2COOC_2H_5$
50	58.2	58	46.7	"	39	45	"
70	67.9	49*	56.5	" + $MgI_2.6CH_3CONH_2$	32*	51.8	" + $MgI_2.NH_2COOC_2H_5$
75	71.7	80	63.4	$MgI_2.6CH_3CONH_2$	40	55	$MgI_2.NH_2COOC_2H_5$
80	76.5	130	76	"	60	64.7	"
85	83	160	85.5	"	80	78.8	"
89	91.3	170	90.8	"	86	92.5	"
		177†	100	"	87†	100	"

* Eutec. † m. pt.

MAGNESIUM IODOMERCURATE $MgI_2.2HgI_2.7H_2O$.

The sat. solution in water at 17.8° has the composition $MgI_2.1.29HgI_2.11.06H_2O$ and Sp. Gr. 2.92. (Dubois, 1906.)

IO

MAGNESIUM IODATE $Mg(IO_3)_2.4H_2O$.

SOLUBILITY OF MAGNESIUM IODATE IN WATER.
(Hill and Moskowitz, 1931.)

The previous determinations of Mylius and Funk, 1897, 1900, are shown to be incomplete.

t°	d of sat. sol.	Gms. $Mg(IO_3)_2$ per 100 gms. sat. sol.	Solid Phase	t°	d of sat. sol.	Gms. $Mg(IO_3)_2$ per 100 gms. sat. sol.	Solid Phase
-0.36	1.026	3.18	Ice + Mg10	40	1.090	10.51	Mg4
-5.0	1.034	4.39	Mg10	50	1.115	12.05	"
10.0	1.049	5.87	"	57.5	—	13.1	" + $Mg(IO_3)_2$
15.0	1.073	7.79*	"	70	—	15.7*	"
13.3 trpt.	—	—	" + Mg4	90	—	19.6*	"
5.0	1.047	6.09*	Mg4	60	—	13.2	$Mg(IO_3)_2$
10.0	1.060	6.68*	Mg4	70	—	13.3	"
15.0	1.065	7.29	"	80	—	13.4	"
25	1.075	8.55	"	90	—	13.5	"
35	1.086	9.83	"				

* Metastable; Mg10 = $Mg(IO_3)_2.10H_2O$; Mg4 = $Mg(IO_3)_2.4H_2O$.

SOLUBILITY OF MAGNESIUM IODATE IN AQUEOUS SOLUTIONS OF MAGNESIUM NITRATE AND VICE VERSA.

(Hill and Moskowitz, 1931.)

d. of sat. sol.	Gms. per 100 gms. sat. sol. $Mg(NO_3)_2$	$Mg(IO_3)_2$	Solid Phase
Results at 5°			
1.034	0.0	4.39	Mg10
1.053	2.49	3.93	"
1.076	5.45	3.92	"
1.105	8.86	4.03	"
1.149	13.10	4.26	"
1.184	17.0	4.55	" + Mg4
1.197	18.52	4.44	Mg4
1.244	24.08	3.95	"
1.333	34.21	2.82	"
1.368	38.10	2.39	" + Mg6
1.352	39.02	0.46	Mg6
1.347	39.25	0.0	"
Results at 25°			
1.075	0.0	8.55	Mg4
1.089	3.49	7.35	"
1.116	7.31	6.66	"
1.171	14.60	5.66	"
1.202	18.48	5.14	Mg4
1.261	25.81	4.20	"
1.325	33.50	3.25	"
1.398	41.00	2.46	"+Mg6
1.380	41.60	0.90	Mg6
1.378	42.03	0.0	"
Results at 50°			
1.115	0.0	12.05	Mg4
1.141	7.29	9.00	"
1.186	15.17	7.31	"
1.253	24.35	5.58	"
1.321	32.15	4.36	"
1.368	38.82	3.57	"
—	44.41	3.13	"+Mg6
—	45.27	1.52	Mg6
—	46.09	0.0	"

Mg4 = $Mg(IO_3)_2.4H_2O$; Mg6 = $Mg(NO_3)_2.6H_2O$; Mg10 = $Mg(IO_3)_2.10H_2O$

SOLUBILITY OF MAGNESIUM IODATE IN AQUEOUS SOLUTIONS OF SODIUM IODATE AND VICE VERSA.

(Hill and Ricci, 1931.)

d. of sat. sol.	Gms. per 100 gms. sat. sol. $NaIO_3$	$Mg(IO_3)_2$	Solid Phase
Results at 5°			
1.038	0.0	4.37	Mg10
1.047	1.45	3.74	"
1.055	2.53	3.33	" + Na5
1.043	2.68	2.19	Na5
1.028	3.28	0.0	"
Results at 25°			
1.078	0.0	8.54	Mg4
1.091	2.80	7.24	"
1.113	6.16	6.05	"
1.125	7.49	5.86	" + $NaIO_3.H_2O$
1.128	7.66	5.73*	"
1.139	8.79	5.57*	" + $NaIO_3$
1.134	8.74	5.42*	$NaIO_3$
1.121	7.52	5.40	$NaIO_3.H_2O$
1.122	7.50	5.33	"
1.119	7.77	4.76	$NaIO_3.H_2O$
1.102	7.94	2.99	"
1.081	8.30	1.18	"
1.076	8.57	0.00	"
Results at 50°			
—	0.0	11.97	Mg4
—	4.59	9.95	"
—	8.94	8.41	"
—	11.07	7.67	" + $NaIO_3.H_2O$
—	12.42	4.93	$NaIO_3.H_2O$
—	13.05	3.73	"
—	13.26	3.05	"
—	13.37	2.64	"
—	13.64	1.55	"
—	13.49	0.00	"

Mg4 = $Mg(IO_3)_2.4H_2O$; Mg10 = $Mg(IO_3)_2.10H_2O$; Na5 = $NaIO_3.5H_2O$

MAGNESIUM NITRITE $Mg(NO_2)_2.6H_2O$

SOLUBILITY OF MAGNESIUM NITRITE IN WATER DETERMINED BY THE SYNTHETIC METHOD.

(Bureau, 1936, 1937.)

t°	Gms. $Mg(NO_2)_2$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Mg(NO_2)_2$ per 100 gms. sat. sol.	Solid Phase
- 3.25	7.04	Ice	- 1.65	31.75	Mg9
-14.03	17.25	"	-10.5 tr.pt.	38.6	" + Mg6
-21.15 Eutec.	23.2	" + Mg9	16.35	40.9	Mg6
-16.15	24.4	Mg9	25.65	47.0	"
-12.15	26.6	"	29.5 tr.pt.	52.0	" + Mg3
- 2.15	30.25	"			

Mg3 = $Mg(NO_2)_2.3H_2O$; Mg6 = $Mg(NO_2)_2.6H_2O$; Mg9 = $Mg(NO_2)_2.9H_2O$.

At temperatures above the tr.pt. 29.5°, hydrolysis of the salt occurs with rapid decomposition of the solution.

MAGNESIUM NITRATE $Mg(NO_3)_2.6H_2O$.

SOLUBILITY OF MAGNESIUM NITRATE IN WATER.

(Sieverts and Petzold, 1932; Ewing, Brander, Slichter and Griesinger, 1933.)

The closely agreeing results of the above investigators made by the freezing-point and direct solubility methods, were plotted and the following values taken from the average curve.

t°	d. of sat. sol.	Gms. $Mg(NO_3)_2$ per 100 gms. sat. sol.	Solid Phase	t°	d. of sat. sol.	Gms. $Mg(NO_3)_2$ per 100 gms. sat. sol.	Solid Phase
- 5.0	1.092	12.0	Ice	85	1.484	53.3	Mg6
-10.0	1.150	18.5	"	88	1.515	55.5	"
-15.0	1.202	22.7	"	89.5 m.pt.	-	58.0	"
-20	1.238	26.5	"	88	—	60.0	"
-25	1.268	29.5	"	85	—	61.5	"
-30	1.295	31.5	"	80	—	63.2	"
-34.1	—	33.4*	"	70	—	65.5	"
-31.6	1.302	32.3	" + Mg9	60	--	66.3	"
-30	—	32.5	Mg9	55.6 tr.pt.		67.4	" + Mg2
-25	—	33.7	"	52.5	—	68.0*	"
-20	—	35.2	"	40.5	—	69.0*	"
-15 tr.pt.	—	37.0	" + Mg6	60	—	67.5	Mg2
-33	—	35.5*	Mg6	70	—	68.5	"
-23	—	36.5*	"	80	—	69.5	"
- 8	—	37.5	"	100	—	71.7	"
+ 1.0	1.365	38.5	"	120	—	75.4	"
15	1.379	40.4	"	125	—	77.0	"
25	1.388	42.1	"	129 m.pt.	—	80.0	"
35	1.399	43.2	"	127.7 tr.pt.		81.8	" + $Mg(NO_3)_2$
40	1.405	44.1	"	130	—	82.0	$Mg(NO_3)_2$
50	1.432	45.8	"	140	—	82.4	"
60	1.445	47.7	"	160	—	83.8	"
75	1.454	50.3	"	186	—	84.6	"
80	1.468	51.5	"				

Mg2 = $Mg(NO_3)_2.2H_2O$; Mg6 = $Mg(NO_3)_2.6H_2O$; Mg9 = $Mg(NO_3)_2.9H_2O$.
* = Metastable.

SOLUBILITY OF MAGNESIUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 25°.

(Ewing and Klinger, 1933.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
HNO_3	$Mg(NO_3)_2$		HNO_3	$Mg(NO_3)_2$		HNO_3	$Mg(NO_3)_2$	
0.0	42.5	Mg6	56.7	16.5	Mg6	68.5	19.0	Mg2
12.6	33.2	"	54.6	20.2	"	77.0	13.0	"
18.5	28.6	"	40.9	34.3	"	84.4	9.4	"
28.1	22.1	"	39.6	36.0	"	89.7	6.2	"
36.7	17.1	"	41.0	36.7	Mg2	91.0	4.7	$Mg(NO_3)_2$
45.4	13.2	"	54.8	27.6	"	93.9	3.8	"
55.4	11.5	"	58.4	25.2	"	99.6	0.2	"

Mg6 = $Mg(NO_3)_2.6H_2O$; Mg2 = $Mg(NO_3)_2.2H_2O$.

Results for this system at 20° and for concentrations of HNO_3 up to 59.38 percent are given by Malquori, 1928.

NO

MAGNESIUM NITRATE $Mg(NO_3)_2.6H_2O$.

SOLUBILITY OF MAGNESIUM NITRATE IN AQUEOUS SOLUTIONS OF MAGNESIUM SULFATE AND VICE VERSA AT 0°.

(Benrath and Benrath, 1930.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$MgSO_4$	$Mg(NO_3)_2$			$MgSO_4$	$Mg(NO_3)_2$	
1.368	0.0	38.58	MN6	1.230	6.41	17.82	MS7
1.368	0.99	37.65	"	1.216	10.83	10.83	"
1.368	1.38	37.03(1)	" + MS7	1.214	11.98	9.17	"
1.369	1.48	36.99	" "	1.222	16.58	3.94	"
1.370	1.56	37.04	" "	1.224	17.98	2.73	"
1.372	1.62	36.80(2)	" "	1.234	19.70	1.09	"
1.290	2.52	28.69	MS7	1.236	20.82	0.0	"

(1) The solid phase contained 11.99 gm. $MgSO_4$ + 42.5 gm. $Mg(NO_3)_2$ per 100 gms. moist solid.

(2) The solid phase contained 8.36 gm. $MgSO_4$ + 46.99 gm. $Mg(NO_3)_2$ per 100 gms. moist solid.

MN6 = $Mg(NO_3)_2.6H_2O$; MS7 = $MgSO_4.7H_2O$

SOLUBILITY OF MAGNESIUM NITRATE IN AQUEOUS SOLUTIONS OF MAGNESIUM SULPATE AND VICE VERSA AT 25°.

(Benrath, 1928, 1929.)

d of	Gms. per 100 gms. sat. sol.		Solid	d.of	Gms. per 100 gms. sat. sol.		Solid
sat. sol.	$MgSO_4$	$Mg(NO_3)_2$	Phase	sat. sol.	$MgSO_4$	$Mg(NO_3)_2$	Phase
1.397	0.0	42.89	MN6	1.316	5.50	28.49	MS7
1.396	0.99	41.10	"	1.277	10.00	19.06	"
1.399	1.77	40.65	"	1.271	15.90	11.25	"
1.401	2.28	40.05	"	1.271	16.36	10.71	"
1.403	2.85	39.79	" + MS7	1.280	20.03	6.68	"
1.345	3.90	33.55	MS7	1.304	26.68	0.0	"

MN6 = $Mg(NO_3)_2.6H_2O$; MS7 = $MgSO_4.7H_2O$.

Previous results at 25°, differing slightly from the above, are given by Jackman and Browne, 1922.

Additional determinations for the system $Mg(NO_3)_2 + MgSO_4 + H_2O$ at 25°, 35°, 41°, 50° and 60° are given by Schröder, 1929; Results at 74.6° by Schröder, 1929a, 1929b; Results at 15°, 50° and 97° by Benrath, 1928, 1929; and Results at 99.5° by Benrath and Benrath, 1930.

The above named investigators also give very complete data for equilibrium in the reciprocal salt pair.

$Mg(NO_3)_2 + K_2SO_4 \rightleftarrows MgSO_4 + K_2(NO_3)_2$ at the several temperatures indicated above.

NO

SOLUBILITY OF MAGNESIUM NITRATE IN AQUEOUS SOLUTIONS OF MANGANESE NITRATE AND VICE VERSA AT 20°.

(DiCapua, 1929.)

Gms. per 100 gms. sat. sol.		Solid	Gms. per 100 gms. sat. sol.		Solid
$Mn(NO_3)_2$	$Mg(NO_3)_2$	Phase	$Mn(NO_3)_2$	$Mg(NO_3)_2$	Phase
0.0	43.68	$Mg(NO_3)_2.6H_2O$	27.40	29.0	$MgSO_4.6H_2O$
2.88	41.25	"	28.36	27.78	"
7.15	38.00	"	29.15	26.50	" + $MnSO_4.5H_2O$
9.90	37.15	"	32.0	24.35	$MnSO_4.5H_2O$
12.41	35.40	"	39.92	16.17	"
18.85	31.60	"	44.30	10.05	"
31.30	20.60	"	49.76	6.15	"
26.25	29.92	"	56.81	0.0	"

MAGNESIUM NITRATE

SOLUBILITY OF MAGNESIUM NITRATE IN AQUEOUS SOLUTIONS OF SODIUM NITRATE AND VICE VERSA AT 25°.

(Jackman and Browne, 1922; Benrath, 1928, 1929; Sieverts and Muller, 1930.)

The results of the above named investigators were plotted and the following values read from the average curve.

Gms. per 100 gms. sat. solution		Solid Phase	Gms. per 100 gms. sat. solution		Solid Phase
$Mg(NO_3)_2$	$NaNO_3$		$Mg(NO_3)_2$	$NaNO_3$	
42.5	0.0	$Mg(NO_3)_2.6H_2O$	32.0	12.5	$NaNO_3$
41.2	2.0	"	24.0	20.0	"
40.2	4.0	"	16.0	28.8	"
39.4	6.0	"	8.0	38.5	"
38.6	8.0	"	4.0	43.2	"
38.2	9.0	" + $NaNO_3$	0.0	48.0	"

NO

SIMULTANEOUS SOLUBILITY OF MAGNESIUM NITRATE AND SODIUM NITRATE IN WATER AT SEVERAL TEMPERATURES.

t°	d. of sat. sol.	Gms. per 100 gms. sat. solution			Solid Phase
		$Mg(NO_3)_2$	$NaNO_3$		
0	--	35.17	6.59	(5)	$Mg(NO_3)_2.6H_2O$ + $NaNO_3$
15	1.412	36.62	8.43	(1)	" "
"	1.414	36.5	7.7	(2)	" "
25	--	38.25	9.22	(3)	" "
"	--	38.01	7.72	(5)	" "
"	1.441	37.99	9.28	(1)	" "
"	1.427	37.8	8.2	(2)	" "
50	1.488	42.40	7.92	(1)	" "
"	1.463	41.8	8.9	(2)	" "
75	1.521	47.9	8.6	(4)	" "
"	1.721	66.4	5.5	(4)	$Mg(NO_3)_2.2H_2O$ + $NaNO_3$
110	—	69.4	10.2	(4)	" "

(1) = Benrath, 1928, 1929; (2) Sieverts and Müller, 1930; (3) Jackman and Browne, 1922; (4) Sieverts and Muller, 1931; (5) Schroder, 1930.

MAGNESIUM Ammonium NITRATE $Mg(NO_3)_2.2NH_4NO_3$.

100 gms. H_2O dissolve 10 gms. $Mg(NO_3)_2.2NH_4NO_3$ at 12.5°. (Foucroy)

MAGNESIUM Neodymium NITRATE $3Mg(NO_3)_2.2Nd(NO_3)_3.24H_2O$.

SOLUBILITY OF MAGNESIUM NEODYMIUM NITRATE IN WATER AND IN AQUEOUS SOLUTIONS OF NITRIC ACID AND OF MAGNESIUM NITRATE.

(Friend, 1930.)

Solubility in Water		Solubility in Aqueous HNO_3 and $Mg(NO_3)_2$		
t°	Gms. $3Mg(NO_3)_2.2Nd(NO_3)_3.24H_2O$ per 100 gms. sat. sol.	Aqueous Solvent	t°	Gms. $3Mg(NO_3)_2.2Nd(NO_3)_3.24H_2O$ per 100 gms. sat. sol.
0.4	60.42	1.0 Normal HNO_3	0.6	57.21
0.6	60.84	" " "	14.4	d=1.499 60.25
4.4	61.92	" " "	24.2	63.06
14.2	64.0	" " "	77.2	78.26
17.0	63.81	2.2 Normal HNO_3	15.2	54.49
27.2	67.28	" " "	50.2	63.14
40.6	70.72	5.2 Normal HNO_3	14.8	42.01
48.8	72.50	" " "	24.8	45.84
65.4	77.64	" " "	74.0	64.40
75.6	81.07	11.25 Normal HNO	14.8	d=1.357 5.64
87.0	84.35	" " " "	49.0	30.98
90.6	86.89	" " "	78.0	62.47
109.om.pt.	100.00	0.7 Normal $Mg(NO_3)_2$	24.8	59.23
		1.77 " "	24.4	50.31
		saturated "	24.2	2.92

NO

MAGNESIUM NITRATE Methyl and Ethyl Alcoholates

SOLUBILITY OF EACH RESPECTIVELY IN METHYL AND ETHYL ALCOHOL.

(Lloyd, Brown, Glynwyn, Bonnell and Jones, 1928.)

Results for $Mg(NO_3)_2.6CH_3OH$

t°	Gms. $Mg(NO_3)_2$ per 100 gms. CH_3OH	Solid Phase
10	15.7	$Mg(NO_3)_2.6CH_3OH$
20	17.3	"
30	20.9	"
40	23.3	"
50	26.9	"
60	35.0	"

Results for $Mg(NO_3)_2.6C_2H_5OH$

t°	Gms. $Mg(NO_3)_2$ per 100 gms. C_2H_5OH	Solid Phase
0	1.47	$Mg(NO_3)_2.6C_2H_5OH$
20	3.07	"
30	5.39	"
40	10.86	"
50	16.53	"
60	24.23	"
70	34.02	$Mg(NO_3)_2$
80	32.63	"

MAGNESIUM OXIDE MgO

SOLUBILITY OF MAGNESIUM OXIDE IN AQUEOUS SOLUTIONS OF MAGNESIUM CHLORIDE AT 30°.

(Lukens, 1932.)

Magnesium oxide dissolves in aqueous $MgCl_2$ solutions with subsequent precipitation of a compound of the composition $5MgO.MgCl_2.xH_2O$. The rate of the reaction is influenced by the previous heat treatment of the MgO and the temperature at which the reaction occurs. The compound initially precipitated is transformed by continued contact with $MgCl_2$ solutions of Sp. Gr. above 1.16, to a new compound, $5MgO.MgCl_2.yH_2O$, containing a different amount of water. The water content, x and y, of these compounds could not be determined.

In previous studies of this system at 25° and at 50° by Maeda and Yamane, 1928, the authors reported the composition of the compound formed to be, $3MgO.MgCl_2.12H_2O$.

SOLUBILITY OF MAGNESIUM OXIDE IN AQUEOUS SOLUTIONS CONTAINING SODIUM CHLORIDE AND SODIUM HYDROXIDE.

(Maigret, 1905.)

Gms. NaCl per Liter.	Gms. MgO per Liter Solution with Added: 0.8 g. NaOH per Liter.	4.0 g. NaOH per Liter.
125	0.07	0.03
140	0.045	...
160	none	none

MAGNESIUM HYDROXIDE $Mg(OH)_2$.

SOLUBILITY OF MAGNESIUM HYDROXIDE IN WATER AT 18°.

A saturated solution prepared by agitating freshly ignited Mg O with conductivity water for 4 hours, taking greatest care to exclude CO_2, was found to contain 0.016 gm. Mg O per liter. This corresponds to 0.397 millimols Mg O or Mg $(OH)_2$ per liter. By conductometric measurements the solubility was found to be 0.348 millimols per liter and by conductivity titration, 0.39 millimols per liter. The value 0.2 millimol, of Kohbranch is considered to be too low.

(Remy and Kuhlmann, 1924.)

According to Gjalbaek, 1925, magnesium hydroxide exists in two well defined modifications of which the more easily soluble is the labil form and the more difficultly soluble is the stable form. The labil form is obtained by precipitating magnesium salts with bases, by hydration of magnesium oxide and by replacement between metallic magnesium and water. The stable magnesium hydroxide is formed from the labil. The change (recrystallization) goes quickly at high magnesium concentrations and slower at lower concentrations.

The following comparative results are reported. Temp. 18°.

Method.	Minimum Solubility (stable.)	Maximum Solubility (labil).
Direct solubility determination..............	2. 2.10^{-4}	6.5.10^{-4}
$Mg^{++} + 2NH_4OH \rightleftharpoons Mg(OH)_2 + 2NH_4^+$......	1. 9.10^{-4}	5.5.10^{-4}
Conductivity method......................	(1.35.10^{-4})	4.6.10^{-4}
Electrometric method......................	1. 6.10^{-4}	7.0.10^{-4}

More recent determinations gave 0.000214 gm. mol. MgO per liter at 29° (Busch, 1927) and 0.00046 gm. Mol. $Mg(OH)_2$ per liter at 25°. Whitby, 1933. This author also gives results for the solubility of $Mg(OH)_2$ in aqueous solutions of KOH, KCl, KBr, KI and K_2SO_4 at 25°.

SOLUBILITY OF MAGNESIUM HYDROXIDE IN WATER AT HIGH TEMPERATURES.

(Travers and Nouvel, 1929.)

Crystalline $Mg(OH)_2$ was used and the determinations were made in a copper flask or copper lined autoclave at the higher pressures. The dissolved magnesia was determined by the electrometric method (hydrogen electrode) and also by direct titration using phenol red as indicator and operating in an atmosphere free of CO_2.

t°	Gm. Mol. $Mg(OH)_2$ per liter sat. sol.	t°	Gm. Mol. $Mg(OH)_2$ per liter sat. sol.
18	0.000168	110	0.000074
35	0.000169	142	0.000042
45	0.000150	150	0.000037
70-75	0.000118	158	0.000031
100	0.000072	178	0.00000

The presence of NaCl and of Na_2SO_4 increase the solubility. Thus in an aqueous solution of 1.0 gm. Na_2SO_4 per 100cc, the solubility of the $Mg(OH)_2$ is 0.000238 gm. mols. per liter at 110° and 0.000142 gm. mols. at 160°.

SOLUBILITY OF MAGNESIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE AND OF AMMONIUM NITRATE AT 29°.

(Herz and Muhs — Z. anorg. Ch. 38, 140, '04.)

NOTE. — Pure $Mg(OH)_2$ was prepared and an excess shaken with solutions of ammonium chloride and of ammonium nitrate of different concentrations.

Concentration of NH_4Cl or of NH_4NO_3. (Normal.)		Acid Required for Liberated NH_4OH in 25 cc. (Normal)	Normality of:		Grams per Liter.	
			$Mg(OH)_2$.	NH_4Cl.	$Mg(OH)_2$.	NH_4Cl.
.7	(NH_4Cl)	0.09835	0.156	0.388	4.55	20.86
0.466	"	0.1108	0.108	0.250	3.15	13.39
0.35	"	0.09835	0.089	0.172	2.60	9.21
0.233	"	0.1108	0.0638	0.106	1.86	5.67
0.175	"	0.1108	0.049	0.0771	1.43	4.13
0.35	(NH_4NO_3)	0.1108	0.0833	0.1834 (NH_4NO_3)	2.43	14.69 (NH_4NO_3)
0.175	"	0.1108	0.0495	0.076 "	1.45	6.09 "

OH

SOLUBILITY OF MAGNESIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF AMMONIA AND AMMONIUM CHLORIDE AT 18°.

(Fredholm, 1934.)

Paraffined flasks were used and CO_2 carefully excluded. In order to approach equilibrium from both sides a part of the mixtures were prepared by adding NH_3 and NH_4Cl to aqueous $MgCl_2$ solutions and the others (last three in table) by adding an excess of carefully prepared $Mg(OH)_2$ to NH_4Cl solutions. The solutions were shaken from 2 to 8 days. The clear saturated solutions were analyzed for Mg, NH_3 and NH_4^+.

Gm. Mols. per liter			Gm. Mols. per liter		
NH_3	NH_4^+	Mg	NH_3	NH_4^+	Mg
0.0637	0.0409	0.0317	0.0357	0.0167	0.0175
0.0369	0.0228	0.0338	0.1024	0.0952	0.0512
0.0308	0.0220	0.0410	0.0577	0.0411	0.0289
0.0760	0.0285	0.0120	0.0391	0.0201	0.0196

MAGNESIUM PHOSPHATE $MgHPO_4.3H_2O$.

SOLUBILITY OF MAGNESIUM PHOSPHATE IN AQUEOUS SOLUTIONS OF PHOSPHORIC ACID AT 25°. (Cameron and Bell, 1907.)

PO

The mixtures were constantly agitated for two months and the clear solutions analyzed for magnesia and phosphoric acid.

d_{25} of Sat. Sol.	Gms per Liter.		Solid Phase.	d_{25} of Sat. Sol.	Gms. per Liter		Solid Phase.
	MgO.	P_2O_5.			MgO.	P_2O_5.	
...	0.207	0.486	$MgHPO_4.3H_2O$	...	109.5	439	$MgHPO_4.3H_2O$
..	0.280	0.732	"	1.470	122.6	498	"
...	0.553	1.917	"	...	129.9	546.5	"
...	1.438	4.85	"	...	140	584	"
1.006	2.23	7.35	"	1.595	146.8	623.3	"
1.017	4.73	16.84	"	...	147.3	625.9	"
1.042	11.19	38.59	"	...	150.3	645.8	"
1.069	17.33	61.21	"	...	155.5	680.7	"
1.109	26.09	93.09	"	...	160	700	" $+MgH_4(PO_4)_2.XH_2O$
1.144	37.40	130.7	"	1.626	87.1	779.6	$MgH_4(PO_4)_2.XH_2O$
1.285	75.5	281.8	"	1.644	77.1	809.6	"
			"	1.654	70.6	835.1	"

MAGNESIUM (Hypo) PHOSPHATE $Mg_2P_2O_6.12H_2O$.

One liter of water dissolves 0.066 gm. hypophosphate. (Salzer, 1886.)

One liter of water dissolves 5 gms. magnesium hydrogen hypophosphate, $MgH_2P_2O_6.4H_2O$. (Salzer.)

MAGNESIUM Ammonium PHOSPHATE $MgNH_4PO_4.6H_2O$ and $1H_2O$. $1H_2O$.

SOLUBILITY IN WATER AND SALT SOLUTIONS.

(Buhe, 1910.)

The solutions were saturated in 7–16 liter flasks. The stirrer was introduced through a mercury sealed connection, in order to prevent loss of moisture or ammonia during the long periods required for saturation. Great care was exercised to eliminate errors of manipulation. Large volumes of the saturated solutions were used for analysis. In the cases where equilibrium was approached from above (designated by *, in table below) the mixtures were heated to about 90° for ½ hour, and then cooled while being continually stirred for 4–5 hours at 50°, and then in a thermostat at 25° for the remaining period shown.

Solvent.	t°.	Time for Saturation.	Gms per 100 Gms. Sat. Sol. Mg.	P_2O_5.	NH_3.	Solid Phase.
Water	25°	69 hrs.	0 0808	0.0965	...	Mixed Hydrates
"	25	9 days	0.0867	0.0992	...	"
"	25	14 "	0.1352	0 1333	0.1301	"
"	22.7	17 hrs.*	0.1076	0.1084	0.1040	Monohydrate
2 n NH_4Cl	25	20 days	0.3129	0.3057	...	Mixed Hydrates
$\frac{1}{3.2}$ n NH_4Cl+1 n NH_3	25 2	16 hrs.*	0.0249	0.02025	...	Monohydrate
0.2 Mol. $MgCl_2$ per liter H_2O	25	27 days	...	0.0206	...	Mixed Hydrates
0.2 " " " "	25.2	16 hrs.*	...	0.0512	...	Monohydrate
$\frac{1}{3.2}$ Mol. $(NH_4)_2HPO_4$ per liter H_2O	24.25	... *	0 1229	...	...	"

PO

SOLUBILITY OF AMMONIUM MAGNESIUM PHOSPHATE IN SEVERAL SOLVENTS.

(Wenger, 1911.)

t°	Gms. NH_4MgPO_4 per 100 Gms. Solvent in: Water.	Aq. 5% NH_4NO_3.	Aq. 5% NH_4Cl.	Mixture of 1 Pt. NH_3 (d = 0.96) +4 Pts H_2O.	Aq. 5% NH_4Cl+4 NH_3 per 100.	Aq. 10% NH_4Cl+4 NH_3 per 100.
0	0.023	0.110	0.060	0.0087	...	...
20	0.052	0.046	0.105	0.0098	0.0165	0.0541
30	...	0.054	0.113	...	...	...
40	0.036	0.064	0.071	0.0136	...	...
56	0.030	0.072	0.093	0.0153	...	...
60	0.040	0.085	0.173	0.0174	0.0274	0.0731
70	0.016	0.083	0.124	0.0178	...	...
80	0.019	0.101	0.191	0.0145	...	...

SOLUBILITY OF MAGNESIUM AMMONIUM PHOSPHATE IN AQUEOUS SALT SOLUTIONS AT ABOUT 18°.

(Maljaroff and Matakiewitsch, 1934.)

An excess of $MgNH_4PO_4.6H_2O$, made from $MgCl_2$, was shaken at room temperature with each of the salt solutions and from time to time the content of phosphate was determined. Equilibrium was reached after a short (?) time. The content of magnesium ammonium phosphate was determined by titration with 0.1 n HCl using methyl orange as indicator.

Conc. of Aq. Salt solution in gms. per 100 cc	Gms. $MgNH_4PO_4$ per liter sat. solution in aqueous: NaCl.	NH_4NO_3	Na_2SO_4	NH_4Cl	$(NH_4)_2SO_4$	$(NH_4)_2C_2O_4$
0.625	0.1067	---	0.1272	0.1092	--	0.1505
1.25	0.1191	0.1186	0.1512	0.1355	0.1415	0.3208
2.50	0.1459	0.1376	0.1774	0.1882	0.1876	0.4688
5.00	0.1552	0.1668	0.1894	0.2205	0.2493	0.7690
7.50	--	0.1919	--	0.2515	--	--
10.00	0.1625	0.2042	0.2482	0.2725	0.3535	--

MAGNESIUM SULFITE $MgSO_3.6H_2O$.

SOLUBILITY OF MAGNESIUM SULFITE IN WATER.

(Hagisawa,' 1934.)

t°	Gms. $MgSO_3$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $MgSO_3$ per 100 gms. sat. sol.	Solid Phase
0	0.338	$MgSO_3.6H_2O$	65	0.720	$MgSO_3.3H_2O$
15	0.497	"	75	0.664	"
25	0.646	"	85	0.623	"
35	0.846	"	98	0.615	"
40 tr.pt.	—	" + $MgSO_3.3H_2O$	45	1.116*	$MgSO_3.6H_2O$
42	0.937	$MgSO_4.3H_2O$	55	1.465*	"
46	0.897	"	57.5	1.688*	"
50	0.844	"	62.5	1.950*	"
55	0.817	"	38	1.034*	$MgSO_3.3H_2O$

* Metastable

MAGNESIUM SULFATE $MgSO_4.7\ H_2O$.

SO

SOLUBILITY OF MAGNESIUM SULFATE IN WATER.

This system is complicated by the great range of temperature over which the hexa and penta(?) hydrates exist in metastable equilibrium Of the large number of determinations which have been made, those of de Coppet, 1872 (ice curve); Cottreil et.al. 1901 (Eutectic); Küpper, 1927; Schroder, 1929; Ting and McCabe, 1934; Robson, 1927; Froehlich, 1929; and Smits, Rinse and Lowwe-Kooymans, 1928 were plotted and the following values read from the average curve.

t°	Gms. $MgSO_4$ per 100 gms. sat. sol.	per Solid Phase	t°	Gms. $MgSO_4$ per 100 gms. sat. sol.	Solid Phase
-2.5	12.0	Ice	69 tr.pt.	37.1	$MgSO_4.6H_2O$ + $MgSO_4.H_2O$
-3.5 Eutec.	17.0 (?)	" + $MgSO_4.7H_2O$	70	37.3*	$MgSO_4.6H_2O$
-4.0 "	19.0*	" + $MgSO_4.6H_2O$	80 tr.pt.	39.3*	" + $MgSO_4.5$(or 4?)H_2O
0	18.0 (?)	$MgSO_4.7H_2O$	85	40.2*	$MgSO_4.6H_2O$
0	20.5*	$MgSO_4.6H_2O$	90	41.2*	"
10	22.0 (?)	$MgSO_4.7H_2O$	95	42.0*	"
10	23.6*	$MgSO_4.6H_2O$	100	42.9*	"
20	25.2	$MgSO_4.7H_2O$	85	39.3*	$MgSO_4.5$(or 4?)H_2O
20	28.3*	$MgSO_4.6H_2O$	90	39.6*	"
25	26.7	$MgSO_4.7H_2O$	95	40.0*	"
25	27.6*	$MgSO_4.6H_2O$	100	40.5*	"
30	28.0	$MgSO_4.7H_2O$	80	35.8	$MgSO_4.H_2O$
30	28.8*	$MgSO_4.6H_2O$	90	34.6	"
35	29.3	$MgSO_4.7H_2O$	100	33.5	"
35	30.0*	$MgSO_4.6H_2O$	120	30.0	"
40	30.8	$MgSO_4.7H_2O$	140	24.0	"
40	31.2*	$MgSO_4.6H_2O$	160	13.0	"
45	32.3	$MgSO_4.7H_2O$	170	8.0	"
48 tr.pt.	33.0	" + $MgSO_4.6H_2O$	180	5.0	"
50	33.4	$MgSO_4.6H_2O$	190	2.5	"
55	34.3		200	1.5	"
60	35.3	"	220	0.8	"
65	36.3	"	240	0.5	"

* Metastable

MAGNESIUM Oxy SULFATE $MgSO_4.3MgO.11H_2O$.

(Delyon, 1936.)

Aqueous solutions of $MgSO_4$ containing more than 500 gms. per liter dissolve MgO with formation of the oxy sulfate, $MgSO_4.3MgO.11H_2O$. The author studied the influence of the mode of preparation of the MgO, the concentration of $MgSO_4$ and the temperature upon this reaction. The results show the amount of MgO dissolved under given conditions. For example it was found that one liter of an aqueous solution containing 500 gms. $MgSO_4$, dissolves 4.2 gms. MgO at 60°.

MAGNESIUM SULFATE $MgSO_4.7H_2O$.

SOLUBILITY OF MAGNESIUM SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 12.6°.

(Montemartini and Losana, 1928.)

SO

d. of sat. sol.	Gms. per 100 gms. sat. sol. H_2SO_4	Gms. per 100 gms. sat. sol. $MgSO_4$	Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol H_2SO_{44}	Gms. per 100 gms. sat. sol $MgSO_4$	Solid Phase
1.2666	0.0	24.33	$MgSO_4.7H_2O$	1.4390	33.74	15.16	1.1.3
1.2729	8.64	19.25	"	1.4431	40.94	11.12	"+1.3
1.2861	15.78	16.05	"	1.4906	53.01	4.25	1.3
1.3267	24.28	12.23	"+$MgSO_4.H_2O$	1.5688	59.10	1.50	"+1.1.3(T)
1.3440	27.20	8.68	$MgSO_4.H_2O$	1.6553	66.49	0.38	1.3
1.3592	28.95	11.92	" + 1.1.3	1.7780	82.31	0.21	"
1.3641	29.81	12.37	1.1.3	1.8455	98.56	0.14	"

1.1.3 = $MgSO_4.H_2SO_4.3H_2O$; 1.3 = $MgSO_4.3H_2SO_4$.

Results for this system at 0°, 19° and 35.5° are given by Arditti, 1933, in the form of a diagram but without the numerical values. The author reported the solid phases to be $MgSO_4.7H_2O$, $MgSO_4.H_2SO_4.3H_2O$, $MgSO_4.H_2SO_4$, $3MgSO_4.2H_2SO_4$ and $3MgSO_4.H_2SO_4$.

SOLUBILITY OF MAGNESIUM SULFATE IN AQUEOUS SOLUTIONS OF MAGNESIUM CHLORIDE.

(Froehlich, 1929.)

The authors results were plotted and the following values taken from the average curves

Results for Aqueous Solutions Containning:

t° in each case	50 gms. $MgCl_4$ per liter Gms. per 100 gms. sat. sol. $MgSO_4$	50 gms. $MgCl_4$ per liter Gms. per 100 gms. sat. sol. $MgCl_2$	100 gms. $MgCl_2$ per liter Gms. per 100 gms. sat. sol. $MgSO_4$	100 gms. $MgCl_2$ per liter Gms. per 100 gms. sat. sol. $MgCl_2$	500 gms. $MgCl_2$ per liter Gms. per 100 gms. sat. sol. $MgSO_4$	500 gms. $MgCl_2$ per liter Gms. per 100 gms. sat. sol. $MgCl_2$
20	21.0	3.8	14.0	8.5	5.0	24.0
40	25.5	3.7	21.0	8.0	10.0	22.2
60	30.5	3.6	26.5	7.7	13.0	21.3
80	34.0	3.5	30.5	7.4	14.5	21.2
100	36.0	3.4	30.5	7.1	7.5	23.0
120	30.0	3.4	23.0	7.1	3.8	24.0
140	20.0	3.5	15.5	7.5	3.0	24.0
160	12.0	3.6	8.2	8.2	2.5	23.3
180	5.0	3.7	2.5	10.0	--	--

EQUILIBRIUM IN THE SYSTEM MAGNESIUM SULFATE, MANGANESE SULFATE AND WATER.

(Benrath and Blankenstein, 1934.)

Results at 0°

Gms. per 100 gms. sat. sol. $MnSO_4$	$MgSO_4$	Solid Phase
3.56	18.19	$MgSO_4.7H_2O$
6.17	17.68	"
10.66	14.61	"
14.21	12.77	"
17.83	11.0	"
23.1	8.37	M.C.Mg7 + Mn7
25.11	6.91	$MnSO_4.7H_2O$
29.25	3.97	"
32.0	1.88	"

Results at 23°

Gms. per 100 gms. sat. sol. $MnSO_4$	$MgSO_4$	Solid Phase
1.10	25.4	$MgSO_4.7H_2O$
1.83	25.3	"
8.65	21.16	"
14.27	17.86	"
20.4	14.50	"
26.3	11.88	"
28.1	10.36	"
28.5	9.36	M.C.Mg7 + Mn5 M.C.Mg6 + Mn5
30.0	8.43	$MnSO_4.5H_2O$
33.7	5.00	"
35.2	3.06	"
37.7	1.04	"

Results at 50°

Gms. per 100 gms. sat. sol. $MnSO_4$	$MgSO_4$	Solid Phase
2.24	32.0	$MgSO_4.6H_2O$
3.15	31.3	"
8.43	27.6	"
12.40	25.5	"
13.04	24.8	M.C.Mn1 + Mg6
13.33	24.4	$MnSO_4.H_2O$
16.00	21.2	"
19.30	17.08	"
26.00	10.46	"
30.70	6.00	"
33.8	2.36	"

Results at 90°

Gms. per 100 gms. sat. sol. $MnSO_4$	$MgSO_4$	Solid Phase
0.30	34.8	M.C.Mg1 + Mn1
1.64	33.6	" "
3.41	31.3	" "
5.72	29.5	" "
7.55	27.2	" "
10.55	23.5	" "
13.68	20.4	" "
17.86	13.45	" "
20.1	9.43	" "
25.9	2.39	" "

Mg7 = $MgSO_4.7H_2O$; Mg6 = $MgSO_4.6H_2O$; Mg1 = $MgSO_4.H_2O$.
Mn7 = $MnSO_4.7H_2O$; Mn5 = $MnSO_4.5H_2O$; Mn1 = $MnSO_4.H_2O$.

The authors also give results for the temperatures 17.5°, 27°, 37°, 45°, and 70° as well as the composition of the solid phases and the values calculated to the Janecke x-m method of expressing the equilibrium.

EQUILIBRIUM IN THE SYSTEM AMMONIUM SULFATE + MAGNESIUM SULFATE + WATER.

(Woston, 1922.)

t°.	Gms. per 100 gms. sat. sol. $MgSO_4$	$(NH_4)_2SO_4$	Solid Phase.	t°.	Gms. per 100 gms. sat. sol. $MgSO_4$	$(NH_4)_2SO_4$	Solid Phase.
30.	0.00	43.60	$(NH_4)_2SO_4$	60.	0.0	46.8	$(NH_4)_2SO_4$
30.	0.30	41.20	$(NH_4)_2SO_4.MgSO_4.6H_2O$	60.	4 68	26.77	$(NH_4)_2SO_4.MgSO_4.6H_2O$
30.	1.25	26.15	»	60.	11.92	14.27	»
30.	7.30	10.55	»	60.	15.04	11 91	»
30.	16 53	6.31	»	60.	26.85	5.85	»
30.	27.60	2.98	»	60.	31.10	3.98	»

EQUILIBRIUM IN THE SYSTEM MAGNESIUM SULFATE, AMMONIUM SULFATE AND WATER AT SEVERAL TEMPERATURES.

(Benrath and Thiemann, 1932.)

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms. sat. sol.		Solid Phase
	$MgSO_4$	$(NH_4)_2SO_4$			$MgSO_4$	$(NH_4)_2SO_4$	
0	42.77	2.31	Mg7 + 1.1.6	62.4	34.64	3.27	1.1.6 + Mg6
25	26.44	2.29	" + "	65	0.73	46.04	" + $(NH_4)_2SO_4$
"	22.55	3.02	1.1.6	67.5	36.7	3.38	" + Mg6 + Mg1
"	12.0	5.96	"	75.0	1.74	46.43	" + $(NH_4)_2SO_3$
"	8.43	7.83	"	96	34.14	5.17	" + Mg1
"	3.02	15.0	"	"	29.33	10.87	" + "
"	1.3	23.32	"	"	27.14	12.28	1.1.6
"	0.56	31.94	"	"	24.26	14.21	"
"	0.0	43.22	"	"	17.35	19.08	"
45	31.22	3.0	" + Mg7	"	17.19	21.36	"
45.6	31.45	2.96	" + Mg7 + Mg6	"	14.27	24.94	"
46.2	31.69	2.89	" + Mg6	"	8.12	36.35	"
50	32.13	3.0	" "	"	4.75	46.73	" + $(NH_4)_2SO_4$

Mg7 = $MgSO_4.7H_2O$; Mg6 = $MgSO_4.6H_2O$; Mg1 = $MgSO_4.H_2O$;
1.1.6 = $MgSO_4.(NH_4)_2SO_4.6H_2O$.

SO **MAGNESIUM** Ammonium **SULFATE** $Mg(NH_4)_2(SO_4)_2$..

SOLUBILITY OF AMMONIUM MAGNESIUM SULFATE IN WATER.

(Porlezza, 1914.)

t°.	Gms. per 100 Gms.		Solid Phase.	t°.	Gms. per 100 Gms.		Solid Phase.
	Sat. Sol.	Water.			Sat. Sol.	Water.	
−0.34	1.01	1.02	Ice	20	15.23	17.96	$(NH_4)_2Mg(SO_4)_2$
−0.80	2.98	3.07	"	25	16.45	19.69	"
−1.23	4.92	5.17	"	30	17.84	21.71	"
−1.60	6.56	7.02	"	40	20.51	25.86	"
−2.02	8.34	9.10	"	50	23.18	30.17	"
−2.34 Eutec.	...	...	Ice + $(NH_4)_2Mg(SO_4)_2$	60	26.02	35.17	"
0	10.58	11.83	$(NH_4)MgSO_4$	80	32.58	48.32	"
10	12.75	14.61	"	100	39.66	65.72	"

EQUILIBRIUM IN THE SYSTEM MAGNESIUM SULFATE, SODIUM NITRATE AND WATER.

(Schröder, 1930a.)

The authors present the complete data as determined by himself and others for the reciprocal salt pair $MgSO_4 + Na_2(NO_3)_2 + H_2O$, in the form of diagrams showing the fields of existance of the various components of the system at temperatures between 0° and 100°.

SOLUBILITY OF MAGNESIUM SULFATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATI AT 25° AND VICE VERSA. (Takegami, 1921.)

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
$MgSO_4$.	Na_2SO_4.		$MgSO_4$.	Na_2SO_4.	
26.68	0.00	$MgSO_4.7H_2O$	16.14	18.16	1.1.4
23.77	6.69	»	14.14	20.50	»
20.06	10.80	»	15.63	18.63	» + $Na_2SO_4.10H_2$
19.84	26.54		17.67	18.16	$Na_2SO_4.10H_2O$
21.60	12.45	» + 1.1.4	10.93	19.17	»
19.46	14.13	1.1.4	10.78	18.85	»
18.28	15.89	»	3.34	20.88	»
16.31	18.22	»	0.00	21.54	»

1.1.4 = Astrakanite, $MgSO_4.Na_2SO_4.4H_2O$.

SOLUBILITY OF MAGNESIUM SULFATE OCTAHYDRATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE AT 25° AND AT 30°. (Takegami, 1921 *a*, 1922.)

Results at 25°.

Gms. per 100 gms. sat. sol. $MgSO_4$.	Gms. per 100 gms. sat. sol. Na_2SO_4.	Solid Phase.
26.68	0.00	$MgSO_4.8H_2O$
25.48	2.73	»
25.04	3.54	»
24.49	5.20	»
23.49	7.50	»
22.32	10.10	»
21.27	12.76	»

Results at 30°.

Gms. per 100 gms. sat. sol. $MgSO_4$.	Gms. per 100 gms. sat. sol. Na_2SO_4.	Solid Phase.
29.00	0.00	$MgSO_4.8H_2O$
26.35	3.96	»
24.35	8.43	»
22.89	11.80	»
23.00	12.49	» $+MgSO_4.7H_2O$
22.33	13.71	$MgSO_4.7H_2O$
21.92	14.47	»

The tr. temp. of the 8 H_2O to 7 H_2O is at 45°.5-46°.1 in sodium sulfate solutions of 7 to 9 per cent concentration.

SOLUBILITY OF MAGNESIUM SULFATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE AND VICE VERSA AT SEVERAL TEMPERATURES.

(Benrath, 1928.)

Results at 15°

d. of sat. sol.	Gms. per 100 gms. sat. sol. $MgSO_4$	Gms. per 100 gms. sat. sol. Na_2SO_4	Solid Phase
1.204	25.13	0.0	Mg7
—	24.92	0.26	"
1.291	24.75	0.75	"
1.292	24.33	1.68	"
1.286	23.81	3.97	"
1.301	22.29	7.88	"
—	21.59	10.93	"
1.319	20.88	11.72	"+Na10
1.271	13.89	9.92	Na10
—	8.09	9.90	"
1.185	3.63	10.07	"
1.132	1.21	10.92	"
1.105	0.0	11.72	"

Results at 25°

d. of sat. sol.	Gms. per 100 gms. sat. sol. $MgSO_4$	Gms. per 100 gms. sat. sol. Na_2SO_4	Solid Phase
1.304	26.68	0.0	Mg7
1.320	25.66	2.42	"
1.364	23.53	7.96	
1.389	21.53	12.47	"+1.1.4
1.383	18.33	15.70	1.1.4
1.384	15.90	18.47	"+Na10
1.320	10.89	18.87	Na10
1.276	6.00	20.42	"
1.251	3.73	20.79	"
1.210	0.0	21.75	"

Results at 50°

d. of sat. sol.	Gms. per 100 gms. sat. sol. $MgSO_4$	Gms. per 100 gms. sat. sol. Na_2SO_4	Solid Phase
1.401	33.50	0.0	Mg6
1.410	32.50	1.96	"
1.426	31.60	3.95	"
1.428	31.32	4.74	"+1.1.4
1.414	27.49	7.55	1.1.4
1.380	20.16	13.86	"
1.374	15.75	18.62	"
1.381	11.98	23.25	"+Na_2SO_4
1.364	9.80	24.77	Na_2SO_4
1.329	3.52	29.42	"
1.310	0.0	31.70	"

Results at 97°

d. of sat. sol.	Gms. per 100 gms. sat. sol. $MgSO_4$	Gms. per 100 gms. sat. sol. Na_2SO_4	Solid Phase
1.400	35.60	0.0	Mg1
1.401	33.89	2.01	"
1.422	32.20	5.55	"+1.1
1.367	27.95	7.28	1.1
1.308	18.28	14.83	"
1.328	14.40	19.15	"+1.3
1.308	12.42	21.01	1.3
1.298	8.74	24.20	"
1.284	5.88	26.90	"+Na_2SO_4
1.280	4.91	27.49	Na_2SO_4
—	2.47	28.50	"
1.237	0.0	29.85	"

Mg7 = $MgSO_4.7H_2O$; Mg6 = $MgSO_4.6H_2O$; Mg1 = $MgSO_4.H_2O$; Na10 = $Na_2SO_4.10H_2O$; 1.1.4 = Astrakanite, $MgSO_4.Na_2SO_4.4H_2O$; 1.1 = $MgSO_4.Na_2SO_4$; 1.3 = Vanthoffite, $MgSO_4.3Na_2SO_4$. The author also gives results for the reciprocal salt pair $MgSO_4 + Na_2(NO_3)_2 + H_2O$ at the above temperatures.

EQUILIBRIUM IN THE SYSTEM MAGNESIUM SULFATE, SODIUM SULFATE AND WATER AT VARIOUS TEMPERATURES. (Archibald and Gale, 1924.)

t°.	Gms. per 100 gms. sat. sol.		Solid Phase.
	$MgSO_4$.	Na_2SO_4.	
0..	(20.63)	0.0	$MgSO_4.7H_2O$
0..	20.0	0.0	$MgSO_4.12H_2O$
0..	20.0	4.3	» (?)
0..	20.0	4.63	$MgSO_4.7H_2O+Na_2SO_4.10H_2O$
0..	(19.66)	(3.92)	»
0..	11.25	4.69	$Na_2SO_4.10H_2O$
0..	9.65	4.89	»
10..	20.9	7.46	$MgSO_4.7H_2O+Na_2SO_4.10H_2O$
10..	19.4	7.4	$Na_2SO_4.10H_2O$
10..	0.75	8.3	»
18.7.	25.7	0.5	$MgSO_4.7H_2O$
18.7.	24.4	3.4	»
18.7.	20.60	11.48	»
18.7.	20.57	11.80	»$+Na_2SO_4.10H_2O$
18.7.	15.70	12.30	$Na_2SO_4.10H_2O$
18.7.	11.30	13.50	»
18.7.	8.92	13.90	»
18.7.	1.48	14.68	»
25..	(28.04)	0.00	$MgSO_4.7H_2O$
25..	22.6	10.8	»
25..	19.8	16.9	»$+Na_2SO_4.10H_2O$*
25..	21.15	13.0	» + 1.1.4
25..	(19.86)	(14.54)	» »
25..	16.6	17.8	$Na_2SO_4.10H_2O$+1.1.4
25..	(15.88)	(18.52)	» »
25..	0.25	21.2	$Na_2SO_4.10H_2O$
25..	0.0	(21.87)	»
30..	24.55	8.75	$MgSO_4.7H_2O$
30..	24.5	9.27	»
30..	23.25	12.35	» + 1.1.4
30..	15.8	18.6	1.1.4
30..	12.3	23.25	» $+Na_2SO_4.10H_2O$
30..	6.48	26.08	$Na_2SO_4.10H_2O$
40..	28.0	8.5	$MgSO_4.7H_2O$+1.1.4
40..	25.1	9.6	1.1.4
40..	24.1	10.8	»
40..	20.95	13.8	»
40..	15.35	19.15	»
40..	13.15	22.80	»
40..	12.2	23.2	»
40..	11.6	24.5	» $+Na_2SO_4$
40..	11.0	24.7	Na_2SO_4
40..	3.61	30.7	»
40..	2.54.	30.70	»
50..	32.8	2.51	$MgSO_4.6H_2O$
50..	31.3	5.7	» + 1.1.4
50..	30.45	6.15	1.1.4
50..	27.8	9.75	»
50..	18.2	16.0	»
50..	16.0	18.3	»
50..	14.1	21.8	»
50..	13.7	23.8	» $+MgSO_4.3Na_2SO_4$
50..	12.7	25.0	» $+Na_2SO_4$
50..	9.65	26.85	Na_2SO_4
50..	2.6	30.0	»
60..	34.5	1.92	$MgSO_4.6H_2O$
60..	33.8	3.55	»
60..	33.8	4.6	» + 1.1.4
60..	30.0	6.5	1.1.4
60..	23.1	12.0	»
60..	18.2	15.8	»
60..	14.0	21.8	»
60..	9.9	24.85	Na_2SO_4
60..	6.05	27.85	»
80..	38.4	2.8	$MgSO_4.H_2O$
80..	36.3	4.9	$MgSO_4.Na_2SO_4.{}^5/_2H_2O$
80..	33.25	6.35	»
80..	24.06	12.6	»
80..	18.1	17.85	»
80..	16.4	19.7	»
80..	15.4	21.4	»
80..	14.7	22.0	»
80..	14.55	22.3	» $+MgSO_4.3Na_2SO_4$
80..	14.2	22.25	$MgSO_4.3Na_2SO_4$
80..	13.85	22.55	»
80..	4.29	28.1	» (?) $+Na_2SO_4$
80..	0.0	30.4	Na_2SO_4
100..	42.5	0.0	$MgSO_4.6H_2O$*
100..	40.6	0.0	$MgSO_4.H_2O$
100..	32.0	6.07	$MgSO_4.Na_2SO_4.{}^5/_2H_2O$
100..	31.1	6.5	»
100..	23.2	12.55	»
100..	16.9	19.4	» (?) $+MgSO_4.3Na_2SO_4$
100..	13.75	20.6	$MgSO_4.3Na_2SO_4$
100..	13.7	20.5	»
100..	0.0	29.8	Na_2SO_4

* Indicates unstable equilibrium.

1.1.4 = Astrakanite $MgSO_4.Na_2SO_4.4H_2O$.

The results in parentheses are by Kournakow and Zemcuznyj, 1919, 1924.

Determinations of the solubilities of the single salts and miscellaneous determinations at other temperatures were taken by the authors from the literature. They will be found under their respective headings in the present compilation.

Freezing-point data for mixtures of magnesium sulfate and sulfuric acid are given by Kendall and Davison, 1921.

EQUILIBRIUM IN THE SYSTEM MAGNESIUM SULFATE, SODIUM SULFATE AND WATER AT VARIOUS TEMPERATURES.

(Blasdale and Robson, 1928.)

t°	Gms. per 100 gms. H_2O		Solid Phase	t°	Gms. per 100 gms. H_2O		Solid Phase
	$MgSO_4$	Na_2SO_4			$MgSO_4$	Na_2SO_4	
0	25.6	5.1	Mg7 + Na10	130	2.3	41.7	Na_2SO_4 + 1.3
25	32.1	19.7	Mg7 + 1.1.4	150	1.4	41.8	" "
30 (R)	35.3	18.2	Mg7 + 1.1.4	175	0.7	41.7	" "
25	25.4	27.1	Na10 + 1.1.4	70	50.4	7.6	1.1.2/5 + $MgSO_4.H_2O$
55 (D'A)	50.2	8.3	Mg6 + 1.1.4	75	49.2	7.7	" "
30 (R)	19.1	36.1	Na_2SO_4 + 1.1.4	85	47.3	8.0	" "
65 (D'A)	21.0	36.2	" "	95	43.6	10.0	" "
75	20.0	36.2	" "	100	41.8	10.9	" "
86.5	18.0	36.7	" "	130	33.2	16.4	" "
90 (D'A)	17.7	37.5	" "	148	27.9	18.1	" "
67	22.1	34.4	1.3 + "	180	15.2	18.5	" "
67	16.0	37.5	Na_2SO_4 + 1.3	75	23.4	29.7	" + 1.3
70	15.0	37.8	" "	85	23.0	28.5	" "
75	12.8	38.4	" "	95	21.7	28.0	" "
76.5	12.0	38.6	" "	100	21.0	27.9	" "
85	9.3	39.2	" "	130	19.0	27.7	" "
86.5	8.8	39.4	" "	150	17.3	25.4	" "
95	6.7	40.0	" "	180	15.7	23.2	" "
100	5.8	40.2	" "	210	8.5	19.5	$MgSO_4.H_2O$ + 1.3

SO

(R) = Roozeboom, 1887, 1888; (D'A) = D'Ans, 1915.
Mg7 = $MgSO_4.7H_2O$; Mg6 = $MgSO_4.6H_2O$; Na10 = $Na_2SO_4.10H_2O$; 1.1.4 = Astrakanite, $MgSO_4.Na_2SO_4.4H_2O$; 1.3 = Vantoffite, $MgSO_4.3Na_2SO_4$; 1.1.2/5 = Löweite, $MgSO_4.Na_2SO_4.2/5\ H_2O$.

The authors give a diagram composed of the isotherms constructed from their own and other results. From this the composition of any stable solution in equilibrium with one or more solid phases can be found for any temperature between 0 and 210°.

A similar presentation of all available determinations upon this system, calculated to both the weight percent and gram molecular basis, is given by Froelisch, 1929.

SOLUBILITY OF MIXTURES OF SODIUM SULFATE AND MAGNESIUM SULFATE IN WATER (ASTRAKANITE) $Na_2Mg(SO_4)_2.4H_2O$.

(Roozeboom, 1887, 1888.)

t°.	Mols. per 100 Mols. H_2O.		Grams per 100 Grams H_2O		Solid Phase.
	Na_2SO_4.	$MgSO_4$.	Na_2SO_4.	$MgSO_4$.	
22	2.95	4.70	23.3	31.4	Astrakanite
24.5	3.45	3.68	27.2	24.6	"
30	3.59	3.59	28.4	24.1	"
35	3.71	3.71	29.4	24.8	"
47	3.6	3.6	28.4	24.1	"
22	2.95	4.70	23.3	31.4	Astrakanite + Na_2SO_4
24.5	3.45	3.62	27.2	24.2	"
30	4.58	2.91	36.1	19.1	"
35	4.3	2.76	33.9	18.44	"
18.5	3.41	4.27	43.0	45.5	Astrakanite + $MgSO_4$
22	2.85	4.63	35.2	48.9	"
24.5	2.68	4.76	32.5	50.3	"
30	2.3	5.31	25.9	55.0	"
35	1.73	5.88	23.5	59.4	

EQUILIBRIUM IN THE SYSTEM MAGNESIUM SULFATE, SODIUM SULFATE AND WATER AT 63°.

(Schroder, 1929.)

At this temperature the three double salts astrakanite, $MgSO_4.Na_2SO_4.4H_2O$ (1.1.4) Löweite, $MgSO_4.Na_2SO_4.2/5H_2O$ (1.1.2/5) and Vanthoffite, $MgSO_4.3Na_2SO_4$ (1.3) exist, and there are certain regions of metastability. Great care is required to reach equilibrium and periods of constant shaking from 142 to 1,800 hours were employed.

d. of sat. sol.	Gms. per 100 gms. sat. sol. $MgSO_4$	Gms. per 100 gms. sat. sol. Na_2SO_4	Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol. $MgSO_4$	Gms. per 100 gms. sat. sol. Na_2SO_4	Solid Phase
1.4114	35.33	0.0	$MgSO_4.6H_2O$	1.3729	20.48	13.90	1.1.4
1.4182	34.86	1.04	"	1.3728	19.94	14.46	"
1.4365	33.86	3.55	"	1.3706	19.08	15.37	"
1.4377	33.70	3.98	"+1.1.2/5	1.3651	14.19	20.65	"
1.4212	30.92	5.48	1.1.2/5	1.3687	12.34	22.89	"+Na_2SO_4
1.4092	29.06	6.90	"	1.3697	13.82	21.40	1.3
1.4045	28.15	7.75	"+1.1.4	1.3651	13.12	21.91	"+1.1.4
1.3926	25.44	9.84	1.1.2/5	1.3634	12.35	22.64	1.3
1.3725	16.18	19.34	"	1.3642	11.70	23.33	"+Na_2SO_4
1.4120	29.49	6.80	1.1.4	1.3635	11.34	23.68	1.3
1.4035	27.89	7.80	"	1.3695	12.69	22.59	Na_2SO_4
1.3982	26.81	8.53	"	1.3419	8.35	25.43	"
1.3868	24.31	10.57	"	1.3215	4.96	27.59	"
1.3829	23.53	11.20	"	1.2908	0.0	30.70	"
1.3795	22.86	11.82	"				

EQUILIBRIUM IN THE SYSTEM MAGNESIUM SULFATE THALLIUM SULFATE AND WATER AT SEVERAL TEMPERATURES.

(Benrath, 1931.)

t°	Gms. per 100 gms. sat. sol. Tl_2SO_4	Gms. per 100 gms. sat. sol. $MgSO_4$	Solid Phase	t°	Gms. per 100 gms. sat. sol. Tl_2SO_4	Gms. per 100 gms. sat. sol. $MgSO_4$	Solid Phase
0	2.39	22.37	Mg7 + 1.1.6	40.5	10.98	15.13	Tl_2SO_4
"	3.02	12.66	1.1.6	"	8.36	3.77	"
"	3.76	7.42	" + Tl_2SO_4	"	7.74	1.92	"
17.6	3.36	24.64	Mg7 + 1.1.6	64.5	4.70	35.08	Mg6
"	4.88	17.52	1.1.6	"	6.47	34.53	" + 1.1.6
"	5.75	13.76	"	"	12.22	26.98	1.1.6
"	6.40	12.0	" + Tl_2SO_4	"	15.20	22.65	" + Tl_2SO_4
40.5	2.59	31.0	Mg7	"	15.91	18.40	Tl_2SO_4
"	5.06	30.05	" + 1.1.6	"	12.52	4.67	"
"	6.86	25.12	1.1.6	100	9.41	30.34	$MgSO_4.H_2O$
"	9.42	19.66	"	"	24.7	25.4	" + Tl_2SO_4
"	10.78	15.62	" +Tl_2SO_4	"	23.65	18.55	Tl_2SO_4

1.1.6 = $MgSO_4.Tl_2SO_4.6H_2O$; Mg6 = $MgSO_4.6H_2O$; Mg7 = $MgSO_4.7H_2O$.

SOLUBILITY OF MAGNESIUM SULFATE IN METHYL AND ETHYL ALCOHOLS

(de Bruyn, 1892.)

Solvent.	t°.	Per 100 Gms. Solvent.	Solvent.	t°.	Per 100 Gms. Solvent.
Abs. CH_3OH	18	1.18 gms. $MgSO_4$	93% Methyl Alc.	17	9.7 gms. $MgSO_4.7H_2O$
"	17	41 " $MgSO_4.7H_2O$	50% " "	3-4	4.1 " "
"	3-4	29 " "	Abs. C_2H_5OH	3	1.3 " "

MAGNESIUM SULFATE

SOLUBILITY OF MAGNESIUM SULFATE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 25° AND AT 50°.

(Tarassenkow and Rets, 1937.)

Results at 25°

Gms. per 100 gms. sat. sol.		Solid Phase
C_2H_5OH	$MgSO_4$	
0.0	26.70	$MgSO_4 \cdot 7H_2O$
13.20	15.09	"
28.70	4.84	"
39.72	1.07	"
63.54	0.04	"
71.61	0.02	"

Results at 50°

Gms. per 100 gms. sat. sol.				Solid Phase
Upper Layer		Lower Layer		
C_2H_5OH	$MgSO_4$	C_2H_5OH	$MgSO_4$	
No separation		0.0	33.44	$MgSO_4 \cdot 6H_2O$
"	"	2.69	32.12	"
"	"	3.10	31.10	"
60.38	0.32	4.10	30.74	"
50.75	1.02	6.10	26.78	"
41.76	1.94	7.64	23.85	"
39.11	2.99	10.41	21.17	"
34.12	5.11	11.69	19.16	"
32.26	5.61	13.95	16.74	"
64.79	0.15	No separation		"

At 50° a separation into two liquid layers occurs between 3 and 65 weight percent ethyl alcohol.

SO

SOLUBILITY OF ANHYDROUS MAGNESIUM SULFATE IN METHYL ALCOHOL AND IN ETHYL ALCOHOL.

(Gibson, Driscoll and Jones, 1929.)

Results for Methyl Alcohol

t°	Gms. $MgSO_4$ per 100 gms. CH_3OH	Solid Phase
15	0.276	$MgSO_4 \cdot 3\frac{1}{2}CH_3OH$
25	0.224	"
35	0.180	"
45	0.153	"
55	0.123	"

Results for Ethyl Alcohol

t°	Gms. $MgSO_4$ per 100 gms. C_2H_5OH	Solid Phase
15	0.025	$MgSO_4$
35	0.020	"
55	0.016	"

SOLUBILITY OF MAGNESIUM SULFATE IN SEVERAL SOLVENTS.

t°	Solvent	Gms. $MgSO_4$ per 100 gms. sat. sol.	Authority
19	95% Formic acid	0.34	(Aschan, 1933.)
25	Pure Glycerol ($d\frac{25}{4} = 1.246$)	20.8	(Schnellbach and Rosin, 1929.)
31.25	Aq. 46.5 Wt. Percent Cane Sugar Solution	14.0	(Köhler, 1897.)

SOLUBILITY OF MAGNESIUM SULFATE IN AQUEOUS SOLUTIONS OF ISO PROPYL ALCOHOL AT 25°.

(Ginnings and Chen, 1931.)

The results locate the binodal curve of the system, including a tie line,* , which shows the composition of two liquid layers in contact with each other, and the plait point, PP, at which the two liquid layers became homogeneous.

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.	
Iso C_3H_5OH	$MgSO_4$		Iso C_3H_5OH	$MgSO_4$
39.30	1.43*		12.10	11.80
32.80	2.77		9.40	14.00
28.40	4.20		7.10	16.40
23.70	5.90		5.00	19.40
21.4	7.3 PP		3.00	22.50*

The composition of the homogeneous mixture, Plait point PP, of the system $MgSO_4$ + Tertiary Butyl Alcohol + H_2O at 25° was found by Ginnings, Herring and Webb, 1933 to be,

3.3 percent $MgSO_4$ + 27.2 percent ter. $(CH_3)_3COH$ + 69.5 percent H_2O The original results for the remaining points on the binodal curve are not given but only the values of constants calculated from empirical equations. SO

The binodal curve of the system $MgSO_4$ + Allyl Alcohol + H_2O at 25° has been determined by Ginnings and Dees, 1935; and that for the system $MgSO_4$ + Pyridine + H_2O at 25° has been determined by Ginnings, Webb and Hinohara, 1933. The authors do not give their experimental results but only the values of a series of arbitrary constants calculated from them by means of empirical equations. The results showed that allyl alcohol is more difficult to salt out than iso propyl or normal propyl alcohol.

EQUILIBRIUM IN THE SYSTEM MAGNESIUM SULFATE, UREA AND WATER AT 30°.

(Whittaker, Lundstrom and Shimp, 1936.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$MgSO_4$	$CO(NH_2)_2$		$MgSO_4$	$CO(NH_2)_2$	
28.42	0.0	$MgSO_4.7H_2O$	21.14	46.04	1.1.3
28.16	4.13	"	20.79	50.35	"
28.00	11.15	"	20.96	53.09	"+$CO(NH_2)_2$
28.32	20.80	"+1.1.3	21.08	53.39	$CO(NH_2)_2$
28.19	22.84	1.1.3	17.63	52.15	"
25.96	27.36	"	14.18	52.93	"
25.16	32.57	"	9.21	54.79	"
23.84	36.66	"	4.47	55.42	"
21.64	43.00	"	0.0	57.00	"

EQUILIBRIUM IN THE SYSTEM MAGNESIUM SULFATE, URETHAN AND WATER AT 25°.

(Palitzsch, 1928, 1929.)

Gm. Mols. per 1000 gms. H_2O		Solid Phase
$MgSO_4$	$NH_2COOC_2H_5$	
3.029	0.0	$MgSO_4.7H_2O$
0.0	35.69	Upper liquid layer
2.854	0.3704	Lower liquid layer
0.0	53.09	$NH_2COOC_2H_5$

Data for the system magnesium sulfate, phenol, and water are given by Timmermans, 1907.

Fusion-point data for mixtures of $MgSO_4 + K_2SO_4$ are given by Ginsberg, 1906; Nacken, 1907a and Grahmann, 1913. Results for $MgSO_4 + Na_2SO_4$ are given by Nacken 1907b.

MAGNESIUM Di THIONATE $MgS_2O_6.6H_2O$.

SOLUBILITY OF MAGNESIUM DITHIONATE IN WATER. (de Baat, 1926.)

t°..............................	0°.	12°.	20°.	30°.
Gms. MgS_2O_6 per 100 gms. sat. sol.....	31.94	33.30	33.91	35.24

MAGNESIUM SELENATE $MgSeO_4$ $6H_2O$.

SOLUBILITY OF MAGNESIUM SELENATE IN WATER.
(Meyer and Aulich, 1928.)

SeO

t°	Gms. $MgSeO_4$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $MgSeO_4$ per 100 gms. sat. sol.	Solid Phase
7.5	9.2	Ice + $MgSeO_4.7H_2O$	25	27.5	$MgSeO_4.6H_2O$
0	16.7	$MgSeO_4.7H_2O$	30	31.2	"
4.7	31.2*	$MgSeO_4.6H_2O$	40	32.3	"
7.5	32.1*	"	40	33.8*	"
8.0	23.0	" + MgSeO .7H O	50	34.9	"
20.	27.2	$MgSeO_4.6H_2O$	60	35.8	"

* Metastable

The mixtures were shaken for periods of 4 to 6 hours.

EQUILIBRIUM IN THE SYSTEM MAGNESIUM SELENATE, AMMONIUM SELENATE AND WATER AT 30°.
(Lawrence and King, 1938.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$(NH_4)_2SeO_4$	$MgSeO_4$		$(NH_4)_2SeO_4$	$MgSeO_4$	
0.0	36.60	$MgSeO_4.6H_2O$	20.24	5.63	1.1.6
1.25	36.66	"	26.20	3.24	"
2.26	36.76	" + 1.1.6	33.60	1.55	"
2.53	36.08	1.1.6	36.40	1.17	"
5.03	27.60	"	40.50	0.70	"
9.73	17.48	"	52.26	0.22	"
16.60	8.95	"	55.15	0.21	" + $(NH_4)_2SeO_4$
			54.16	0.0	$(NH_4)_2SeO_4$

1.1.6 = $MgSeO_4.(NH_4)_2SeO_4.6H_2O$.

The mixtures were shaken for at least 12 hours. The authors give no explanation of the difference between their result in water alone and that of Meyer and Aulich, at 30°.

EQUILIBRIUM IN THE SYSTEM MAGNESIUM SELENATE, SODIUM SELENATE AND WATER AT 25°.

(Meyer and Aulich, 1928.)

Gms. per 100 gms. sat. sol. Na_2SeO_4	Gms. per 100 gms. sat. sol. $MgSeO_4$	Solid Phase	Gms. per 100 gms. sat. sol. Na_2SeO_4	Gms. per 100 gms. sat. sol. $MgSeO_4$	Solid Phase
0.0	27.5	$MgSeO_4.6H_2O$	24.32	14.36	$MgSeO_4.6H_2O$
12.32	20.20	"	28.76	15.18(?)	"
14.36	19.90	"	31.22	10.66	"+$Na_2SeO_4.10H_2O$
17.20	18.30	"	33.24	8.22	$Na_2SeO_4.10H_2O$
20.11	16.98	"	36.4	0.0	"

The mixtures were shaken for periods of 24-36 hours.

MAGNESIUM SILICATE $MgSiO_3$.

Fusion-point data for mixtures of $MgSiO_3 + MnSiO_3$ are given by Lebedew (1914). Results for $MgSiO_3 + Na_2SiO_3$ are given by Wallace (1909).

MANGANESE Mn

SOLUBILITY OF MANGANESE IN MERCURY AT 20°.

(Irvin and Russell, 1932.)

An amalagam of 1 gm. Mn in 200 gms. Hg was passed through a sintered glass filter and the manganese in the weighed filtrate found to correspondto a solubility of 0.001 percent with an error of 10%. A determination by Tammann, Kollmann and Hinnüber, 1927, by the electrometric method, gave 0.00025 gm. Mn per 100 gm. Hg.

BO **MANGANESE BORATE** $MnH_4(BO_3)_2$.

SOLUBILITY IN WATER AND IN AQUEOUS SALT SOLUTIONS.

(Hartley and Ramage — J. Ch. Soc. 63, 137, '03.)

t°.	Grams $MnH_4(BO_3)_2$ per Liter in Solutions of: H_2O + trace Na_2SO_4.	Na_2SO_4 (0 2 Gms. per Liter).	Na_2SO_4 (20 Gms. per Liter).	NaCl (20 Gms. per Liter).	$CaCl_2$ (20 Gms. per Liter).
14	0.94	1.7	...	...	...
18	...	...	0 77	1.31	2.91
40	0.50	0.69 (52°)	0 65	...	2.44
60	...	...	0 36	0.60	2.25
80	0.08	...	0.12	0.29	1.35

MANGANESE BROMIDE $MnBr_2$.

SOLUBILITY IN WATER.

(Etard, 1894.)

Br

t°.	Gms. $MnBr_2$ per 100 Gms. Solution.	Solid Phase.	t°.	Gms. $MnBr_2$ per 100 Gms. Solution.	Solid Phase.
−20	52.3	$MnBr_2.4H_2O$	40	62.8	$MnBr_2.4H_2O$
−10	54.2	"	50	64.5	"
0	56.0	"	60	66 3	"
10	57.6	"	70	68.0	"
20	59.5	"	80	69 2	$MnBr_2.2H_2O$
25	60.2	"	90	69.3	"
30	61.1	"	100	69.5	"

MANGANESE ACETATE $Mn(CH_3COO)_2.4H_2O$.

100 gms. H_2O dissolve 64.5 gms. $Mn(CH_3COO)_2.4H_2O$ at 5°. The determination was made by adding water gradually to a weighed amount of the pure compound untill the last few remaining fragments of crystals just disappeared.

(Cadenhead and Vining, 1924.)

100 gms. Methyl Alcohol, sat. with anhydrous Mn Acetate, dissolve 4.76 gms. $Mn(CH_3COO)_2$ at 15° and 12.30 gm. at 66.2° (b.pt.). (Henstock, 1934.)

MANGANESE GLUCONATE $Mn(C_6H_{11}O_7)_2$.

100 gms. sat. solution of manganese gluconate in water contain 16.8 gms. $Mn(C_6H_{11}O_7)_2$ at 25°. (May, Weisberg and Herrick, 1929.)

MANGANESE BENZOATE $Mn(C_6H_5COO)_2.2H_2O$.

MANGANESE Chlor, Oxy, etc. BENZOATES.

CH

Solubility of Each Separately in Water at 20°.

(Ephraim and Pfister, 1925.)

Compound.	Formula.	Gms. anhydrous cmpd. per 100 cc. sat. sol.
Manganese Benzoate..........	$Mn(C_6H_5COO)_2.2H_2O$	4.82
» -4 Chlor Benzoate..	$Mn(C_6H_4.Cl.COO)_2.2H_2O$	1.157
» -4 Oxy » ..	$Mn(C_6H_4.OH.COO)_2.8H_2O$	3.324
» -4 Methoxy » ..	$Mn(C_6H_4.OCH_3.COO)_2.3H_2O$	1.452
» -4 Nitro » ..	$Mn(C_6H_4.NO_2.COO)_2.6H_2O$	1.341

MANGANESE CINNAMATE $MnC_{18}H_{14}O_4.2H_2O$.

100 cc. sat. sol. of manganese cinnamate in water contain 0.214 gm. $MnC_{18}H_{14}O_4$ at 20°. (Ephraim and Pfister, 1925.)

100 gms. H_2O dissolve 0.26 gm. $MnC_{18}H_{14}O_4$ at 26°. (DeJong, 1909.)

MANGANESE FUMARATE $MnC_4H_2O_4$.

100 gms. H_2O dissolve 0.14 gm. $MnC_4H_2O_4$ at 30°. (Weiss and Downs, 1923.)

MANGANESE HELIANTHATE $(C_{14}H_{14}N_3SO_3)_2.4H_2O$.

1000 cc. H_2O dissolve 0.06 gm. of the salt at 20-25°. (Stark and Dehn, 1918.)

MANGANESE Anthracene, Benzene and Naphthalene SULFONATES.

SOLUBILITY OF EACH SEPARATELY IN WATER.
(Ephraim and Pfister, 1925, 1925 a; Ephraim and Seger, 1925.)

Compound.	Formula.	t°.	Gms. anhydrous cmpd. per 100 cc. sat. sol.
Manganese Anthracene-1-sulfonate	$Mn(C_{14}H_9SO_3)_2.6H_2O$	20	0.0477
» » -2- »	$Mn(C_{14}H_9SO_3)_2.6H_2O$	20	0.00575
» Benzene sulfonate	$Mn(C_6H_5SO_3)_2.6H_2O$	18	13.998
» » »	»	20	16.348
» » »	»	34	18.840
» » »	»	49.5	24.696
» » »	»	64.5	32.215
» » »	»	80.5	42.924
» Naphthalene-1-sulfonate	$Mn(C_{10}H_7SO_3)_2.6H_2O$	17.0	0.479
» » -2- »	$Mn(C_{10}H_7SO_3)_2.6H_2O$	16.5	0.334
» » » »	»	20	0.384
» » » »	»	32	0.532
» » » »	»	45	0.816
» » » »	»	59	1.359
» » » »	»	70.5	1.946
» » » »	»	74	2.186
» » » »	»	77	2.382
» » » »	»	81.5	2.859
» » -5-chlor-1-sulfonate	$Mn(C_{10}H_6SO_3Cl)_2.H_2O$	20	0.742
» » -6- oxy -2- »	$Mn(C_{10}H_7SO_4)_2.8H_2O$	20	1.200

CO

MANGANESE CARBONATE $MnCO_3$.

One liter water dissolves $5.659.10^{-4}$ mols. $MnCO_3$ = 0.065 gm. at 25°.
(Ageno and Valla, 1911.)

100 gms. of a sat. solution of $Mn\,CO_3$ in water at 18° and in contact with CO_2 at a pressure of 1 atmosphere contain 0.04 gm. $Mn\,CO_3$. At a pressure of 56 atmospheres 0.080 gm. is dissolved. (Haehnel, 1924.)

MANGANESE Campho CARBONATE $Mg(C_{10}H_{15}O.COO)_2$.

1000 cc. sat. solution of Manganese Campho Carbonate in Methyl Alcohol contain 10.5 gms. $Mg(C_{10}H_{15}O.COO)_2$ at 10.5°.

1000 cc. sat. solution of Manganese Campho Carbonate in Ethyl Alcohol contain 0.36 gm. $Mg(C_{10}H_{15}O.COO)_2$ at 9°. (Picon, 1931.)

MANGANESE OXALATE $MnC_2O_4.2H_2O$ and $3H_2O$.

SOLUBILITY OF EACH OF THE HYDRATES SEPARATELY IN WATER.
(Chamberlain, Hume and Topley, 1926.)

COO

Saturation was secured by constant stirring in a thermostat. The trihydrate changes gradually to the dihydrate. The error due to this change was very slight. The results in parentheses are by Chatterjee and Dhar, 1924.

Results for the Dihydrate.			Results for the Trihydrate.		
t°.	Gms. MnC_2O_4 per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. MnC_2O_4 per 100 gms. sat. sol.	Solid Phase.
0.0	0.0198	$MnC_2O_4.2H_2O$	0.0	0.0326	$MnC_2O_4.3H_2O$
6.3	0.0225	»	6.3	0.0388	»
12.8	0.0256	»	12.8	0.0476	»
20.1	0.0285	»	20.1	0.0582	»
25.0	0.0308	»	25.0	0.0669	»
30.3	0.0335	»	30.0	0.0769	»
36.0	0.0369 (0.0375)	»	93.0	(0.0780)	$MnC_2O_4.2H_2O$

More recent determinations gave the following results.

t°	Gms. MnC_2O_4 per liter sat. solution	Solid Phase	Authority
18	0.2697	$MnC_2O_4.2H_2O$	(Scholder, 1930.)
25	0.3087	"	(Money and Davies, 1934.)
18	0.5368	$MnC_2O_4.3H_2O$	(Scholder, 1930.)

MANGANESE OXALATE $MnC_2O_4.2H_2O$.

SOLUBILITY IN AQUEOUS SOLUTIONS AT 25°.

(Hauser and Wirth, 1909.)

COO

In Oxalic Acid Solutions. Per 1000 Gms. Sat. Sol. G. Mols. $(COOH)_2$.	In Oxalic Acid Solutions. Per 1000 Gms. Sat. Sol. Gms. $Mn(COO)_2$.	In Ammonium Oxalate Solutions. Per 1000 Gms. Sat. Sol. G. Mols. $(NH_4)_2(COO)_2$.	In Ammonium Oxalate Solutions. Per 1000 Gms. Sat. Sol. Gms. $Mn(COO)_2$.	In Sulfuric Acid Solutions, Per 1000 Gms. Sat. Sol. Normality H_2SO_4.	In Sulfuric Acid Solutions, Per 1000 Gms. Sat. Sol. Gms. $Mn(COO)_2$.	Solid Phase.
0	0.312	0.005	0.338	0.025	1.825	$MnC_2O_4.2H_2O$
0.0125	0.759	0.025	0.479	0.24	8.850	"
0.025	0.930	0.050	0.761	1	25.955	"
0.050	1.080	0.125	1.789	2.389	51.080	"
0.125	1.396	0.245	3.970	2.987	60.109	$MnC_2O_4.2H_2O+(COOH)_2$
0.25	1.708	0.245	4.005	3.952	73.200	"
0.49	2.081	0.281	4.650	4.500	82.401	"

Results are also given for the solubility of $MnC_2O_4.2H_2O$ in aq. solutions of H_2SO_4 containing also about 0.25 gm. mols. free oxalic acid per liter at 25°

SOLUBILITY OF MANGANESE OXALATE IN AQUEOUS SALT SOLUTIONS AT 25°.

(Money and Davies, 1934.)

Results for Aqueous Solutions of:

Manganese Chloride. Gm. Mols. per liter sat. sol. $MnCl_2$	Manganese Chloride. Gm. Mols. per liter sat. sol. MnC_2O_4	Potassium Oxalate. Gm. Mols. per liter sat. sol. $K_2C_2O_4$	Potassium Oxalate. Gm. Mols. per liter sat. sol. MnC_2O_4	Sodium Oxalate. Gm. Mols. per liter sat. sol. $Na_2C_2O_4$	Sodium Oxalate. Gm. Mols. per liter sat. sol. MnC_2O_4
0.0	0.00216	0.0405	0.002869	0.07806	0.004624
0.005	0.001672	0.1198	0.006065	0.1600	0.007708
0.05	0.0016	0.1994	0.009529	0.2411	0.01097

MANGANESE CHLORIDE $MnCl_2$.

SOLUBILITY IN WATER.

(Etard; Dawson and Williams — Z. physik. Chem. 31, 63, '99.)

t°.	Sp. Gr. of Solutions.	Grams $MnCl_2$ per 100 Grams Water.	Grams $MnCl_2$ per 100 Grams Solution.	Mols. $MnCl_2$ per 100 Mols. H_2O.	Solid Phase.
−20	...	53.8	35.0	...	$MnCl_2.4H_2O$.
−10	...	58.7	37.0	...	"
0	...	63.4	38.8	...	"
+10	...	68.1	40.5	...	"
20	...	73.9	42.5	...	"
25	1.4991	77.18	43.55	11.08	"
30	1.5049	80.71	44.68	11.55	"
40	1.5348	88.59	46.96	12.69	"
50	1.5744	98.15	49.53	14.05	"
57.65	1.6097	105.4	51.33	15.10	"
60	1.6108	108.6	52.06	15.55	$MnCl_2.2H_2O$
70	1.6134	110.6	52.52	15.85	"
80	...	112.7	52.98	16.14	"
90	...	114.1	53.2	...	"
100	...	115.3	53.5	...	"
120	...	118.8	54.3	...	"
140	...	119.5	55.0	...	"

More recent results for the solubility of $MnCl_2$ in Water, in fairly close agreement with the above, are given by Benrath, 1934.

One liter of water dissolves 87.0 grams $MnCl_2$. One liter of sat. HCl dissolves 19.0 grams $MnCl_2$ at 12°. (Ditte — Compt. rend. 92, 242, '81.)

EQUILIBRIUM IN THE SYSTEM MANGANESE CHLORIDE, POTASSIUM CHLORIDE AND WATER. (Süss, 1913.)

t°.	Gms per 100 Gms. Sat. Sol. $MnCl_2$.	Gms per 100 Gms. Sat. Sol. KCl.	Solid Phase.	t°.	Gms. per 100 Gms. Sat. Sol. $MnCl_2$.	Gms. per 100 Gms. Sat. Sol. KCl.	Solid Phase.
6	40.23	...	$MnCl_2.4H_2O$	52.8	50.14	6.01	$MnCl_2.4H_2O+MnCl_2.2H_2O+$1.1.2
6	35.94	9.41	" +1.1.2+KCl	58.3	51.72	...	$MnCl_2.4H_2O+MnCl_2.2H_2O$
6	...	23.06	KCl	62.6	51.86	...	$MnCl_2.2H_2O$
28.4	44.46	...	$MnCl_2.4H_2O$	62.6	49.95	6.67	" +1.1.2
28.4	43.28	8.66	" +1.1.2	62.6	44.05	12.49	1.1.2+$MnCl_2.2KCl.2H_2O$
28.4	38.65	13.79	" +1.2.2+KCl	62.6	36.85	18.77	$MnCl_2.2KCl.2H_2O+MnCl_2.4KCl$
28.4	...	26.91	KCl	62.6	...	31.57	KCl

1.1.2 = $MnCl_2.KCl.2H_2O$. 1.2.2 = $MnCl_2 2KCl.2H_2O$

SOLUBILITY OF MIXTURES OF AMMONIUM AND MANGANESE CHLORIDES IN WATER AT 25°.

(Foote and Saxton, 1914.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
NH_4Cl.	$MnCl_2$.		NH_4Cl.	$MnCl_2$.	
23.97	7.97	α mixed crystals	17.09	18.76	β mixed crystals or double salt $2NH_4Cl.MnCl_2.2H_2O$
22.94	9.65		15.05	22.44	
21.44	12.31		13.17	24.52	
21.18	13.38		9.15	29.24	
20.10	15.19		5.90	34.78	
19.70	15.92	α and β mixed crystals	3.77	39.48	
19.75	16.02		2.98	43.71	$2NH_4Cl.MnCl_2.2H_2O + MnCl_2.2H_2O$
19.67	15.47		2.94	43.44	

α mixed crystals consist of NH_4Cl with varying amounts of $MnCl_2.2H_2O$; β mixed crystals consist of the double salt $2NH_4Cl.MnCl_2.2H_2O$ with excess of NH_4Cl.

This case represents a very rare type of solid solution "in which a single salt and a double salt are each capable of taking up very considerable quantities of the other to form homogeneous mixed crystals."

THE SYSTEM AMMONIUM CHLORIDE + MANGANOUS CHLORIDE + WATER AT 60°.

(Clendinnen and Rivett, 1921.)

C1

d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase.	d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase.
	NH_4Cl.	$MnCl_2$.			NH_4Cl.	$MnCl_2$.	
1.105	33.52	2.91	Mixed crystals Series AF	1.365	10.52	32.80	Mixed crystals Series GH
1.129	31.93	5.84		1.426	7.55	38.02	
1.183	29.50	10.16		1.482	5.44	43.10	
1.192	27.81	12.95		1.543	3.95	47.20	
1.200	27.07	13.79	F and G	1.575	2.94	49.33	
1.210	25.28	15.91	Mixed crystals Series GH	1.581	2.45	50.22	H and K
1.239	22.51	18.81		1.583	2.21	50.68	Mixed crystals Series KD
1.267	19.04	22.42		1.592	1.61	51.16	
1.317	14.33	27.74		1.619	0.91	51.47	

The solid phases lie on the line connecting the compositions of pure ammonium chloride and the dihydrate of manganous chloride. The system is of a somewhat uncommon type. There are three very well-defined series of mixed crystals, namely, AF, GH, and KD with two gaps, FG and HK. The composition of the alleged compound $2 NH_4 Cl.Mn Cl_2.2 H_2 O$ is well within the second series GH. The authors also give a very complete series of determinations at 25° which supplement those of Foote and Saxton, published in 1914.

In a later paper Clendinnen and Rivett, 1923, give results upon a critical solution temperature for solids in the binary system ammonium chloride-manganous chloride dihydrate. Eight isotherms between 10° and 60° were studied and the results of the analyses of the solutions and wet solid phases are given. The percentage of ammonium chloride in the solution and solid phases were plotted and the isothermal distribution curves thus obtained. These show regions of homogeneous single-phase mixed crystals and also a heterogeneous region. This latter was studied in considerable detail.

More recent determinations on this system of 25° by Benrath and Schackmann, 1935, show that the product which separates from the supersaturated mixture does not reach equilibrium with the solution but decomposes with time into NH_4Cl and $MnCl_2$.

MANGANESE CHLORIDE $MnCl_2$.

100 gms. sat. solution of manganese chloride in selenium oxychloride ($SeOCl_2$) contain 0.16 gm. $MnCl_2$ at 25°. (Wise, 1923.)

100 gms. pyridine dissolve 1.28 gms. $MnCl_2$ at 0° and 1.06 gms. at 25°. (Müller, R., 1924.)

100 cc anhydrous hydrazine dissolve 13 gms. $MnCl_2$ at about 20°. Welsh and Broderson, 1915.)

Fusion-point data are given for:

$MnCl_2$ + $PbCl_2$ (Sandonnini, 1911, 1914.)
" + $SnCl_2$ (Sandonnini, 1911; Sandonnini and Scarpa, 1911.)
" + $ZnCl_2$ (Sandonnini, 1912, 1914.)

MANGANESE Per CHLORATE $Mn(ClO_4)_2.6H_2O$.

SOLUBILITY OF MANGANESE PERCHLORATE IN SEVERAL SOLVENTS AT ABOUT 20°.

(Chaney and Mann, 1931.)

The determinations were made by adding, at room temperature, successive small amounts of solvent to a weighed amount of the salt until, upon vigorous shaking, the last trace of perchlorate just disappeared. C10

Solvent	Gms. $Mn(ClO_4)_2.6H_2O(?)$ per 100 cc solvent	
Water	268	(Salvadori, 1912.)
Furfural (C_4H_3OCHO of $d\frac{25}{4} = 1.1550$)	90	
Cellosolve (Monoethyl ether of ethylene glycol)	130	

MANGANESE Hexa Antipyrine Per CHLORATE $Mn(COC_{10}H_{12}N_2)_6.(ClO_4)_2$.

100 cc sat. solution of the salt in water contain 3.63 gm. $Mn(COC_{10}H_{12}N_2)_6.(ClO_4)_2$ at 20°. (Wilke-Dörfurt and Schliephake, 1929.)

MANGANESE FLUORIDE $MnF_2(.4H_2O?)$.

SOLUBILITY OF MANGANESE FLUORIDE IN WATER.

(Nuka, 1929.)

F

t°	Gms. MnF_2 per 100 gms. sat. sol.	Solid Phase
20	1.05	$MnF_2.4H_2O$
40	0.66	?
60	0.44	?
100	0.48	?
25	0.186 gm. per 100cc sat. sol. (Carter, 1928.)	

SOLUBILITY OF MANGANESE FLUORIDE IN AQUEOUS SOLUTIONS OF HYDROFLUORIC ACID AT 20°.

(Kurtenacker, Finger and Hey, 1933.)

Gms. per 100 gms. sat. sol.		Solid Phase
HF	MnF_2	
5.28	2.88	MnF_2
17.05	3.73	"
36.42	0.72	"

MANGANESE Hexa Antipyrine Boro **FLUORIDE** $[Mn(COC_{10}H_{12}N_2)_6](BF_4)_2$.

100 cc. sat. solution of Manganese Hexa Antipyrine Boro Fluoride in water contain 5.4 gms. $[Mn(COC_{10}H_{12}N_2)_6](BF_4)_2$ at 20°.
(Wilke-Dörfurt and Mureck, 1929.)

MANGANESE Ammonium **FLUORIDE** $MnNH_4F_3$.

100 gms. sat. solution of Manganese Ammonium Fluoride in Water contain 1.2 gm. $MnNH_4F_3$ at 20°. (Nuka, 1929.)

MANGANESE Silico **FLUORIDE** $MnSiF_6.6H_2O$. F

100 gms. H_2O dissolve 140 gms. of the salt at 17.5°. Sp. Gr. of the solution = 1.448. (Stolba, 1883.)

MANGANESE Pyridine etc. **FLUORIDES**.

SOLUBILITY OF EACH SEPARATELY IN ETHYL ALCOHOL AND IN ACETIC ACID AT 20°.

(Olsson, 1930.)

An excess of each compound was shaken with the solvent and the saturated solution analyzed for manganese by reduction with SO_2 and precipitating as manganese ammonium phosphate and weighing as the pyrophosphate.

Compound	Formula	Gms. Compound (?H_2O of Cryst.) per 100 cc sat. solution in: C_2H_5OH	CH_3COOH
Manganese:			
Pyridine Tetra Fluoride	$C_5H_5NHMnF_4.H_2O$	0.729	3.926
Quinoline " "	$C_9H_7NHMnF_4.3H_2O$	1.560	15.456
Tetra methyl ammonium "	$(CH_3)_4NMnF_4.2H_2O$	0.289	4.326
Ethylene di amine penta"	$C_2H_4(NH_2)_2H_2MnF_5.(H_2O?)$	0.003	0.102
Guanidine tetra "	$CNH(NH_2)_2H\ MnF_4.3H_2O$	0.029	0.449
" penta "	$[CNH(NH_2)_2H]_2MnF_5$	0.013	0.053

MANGANESE IODIDE MnI_2. I

100 gms. Liquid Ammonia dissolve 0.02 gm. MnI_2 at 0°. (Hunt and Boncyk, 1933.)

MANGANESE Mercuric **IODIDE** $3MnI_2.5HgI_2.20H_2O$.

A saturated solution of the salt in water at 17° has the composition 1.4 $MnI_2.HgI_2.10.22H_2O$ and density 2.98. (Dubois, 1906.)

MANGANESE Ammonium **MOLYBDATE** $Mn_2(Mo_2O_7)_3.5(NH_4)_2MoO_4.12H_2O$.

100 gms. H_2O dissolve 0.98 gms. of the salt at 17°. (Struve, 1854.)

MANGANESE NITRATE $Mn(NO_3)_2$.

SOLUBILITY IN WATER.

(Funk — Wiss. Abh. p. t. Reichanstalt 3, 438, '00.)

t°.	Gms. $Mn(NO_3)_2$ per 100 Gms. Sol.	Mols. $Mn(NO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Mn(NO_3)_2$ per 100 Gms. Sol.	Mols. $Mn(NO_3)_2$ per 100 Mols. H_2O.	Solid Phase.
−29	42.29	7.37	$Mn(NO_3)_2.6H_2O$.	18	57.33	13.5	$Mn(NO_3)_2.6H_2O$.
−26	43.15	7.63	"	25	62.37	16.7	"
−21	44.30	8.0	"	27	65.66	19.2	$Mn(NO_3)_2.3H_2O$.
−16	45.52	8.4	"	29	66.99	20.4	"
− 5	48.88	9.61	"	30	67.38	20.7	"
0	50.49	10.2	"	34	71.31	24.9	"
+11	54.50	12.0	"	35.5	76.82	33.3	"

NO

Sp. Gr. of solution saturated at 18° = 1.624.
The Eutec is at −36° and 40.5 gms. $Mn(NO_3)_2$ per 100 gms. Sat. Sol.

100 gms. sat. solution of $Mn(NO_3)_2.6H_2O$ in water contain 56.81 gms. $Mg(NO_3)_2$ at 20°. (di Capua, 1929.)

MANGANESE OXIDE MnO.

Fusion-point data for mixtures of manganese oxide and silicic acid are given by Doernickel, 1907.

MANGANESE HYDROXIDE $Mn(OH)_2$.

One liter H_2O dissolves $2.15.10^{-4}$ gms. mols. $Mn(OH)_2$ at 18°. (Sackur and Fritzmann, 1909.)

One liter H_2O dissolves $2.10.10^{-4}$ gms. mols. $Mn(OH_2)$ at 18°. (Tamm, 1910.)

The determination of S. & F. was made by the neutralization method of Kuster, that is, by determining the conductivity minimum on adding $Ba(OH)_2$ to $MnSO_4$ solution and calculating the $Mn(OH)_2$ remaining in solution.

OH

SOLUBILITY OF MANGANESE HYDROXIDE IN AQUEOUS SOLUTIONS OF ORGANIC SALTS.

(Tamm, 1910.)

(25 cc. of the neutral salt solution + 25 cc. of aqueous suspension of $Mn(OH)_2$ were shaken different lengths of time. Temp. not stated.)

100 cc. sat. solution in 1 *n* sodium tartrate solution contain 0.052 gm. Mn_3O_4.
100 cc. sat. solution in 1 *n* sodium malate solution contain 0.032 gm. Mn_3O_4.
100 cc. sat. solution in 1 *n* sodium citrate solution contain 0.095 gm. Mn_3O_4.

MANGANESE HYDROXIDE $MnO(OH)_2$.

One liter ordinary distilled water containing a little CO_2 dissolves 0.00043 gm. $MnO(OH)_2$ at about 22°. (Almkvist, 1918.)

MANGANESE (Hypo) PHOSPHITE $Mn(PH_2O_2)_2H_2O$.

100 gms. H_2O dissolve 15.15 gms. salt at 25°, and 16.6 gms. at b. pt. (U. S. P.)

EQUILIBRIUM IN THE SYSTEM MANGANESE PHOSPHATE, PHOSPHORIC ACID AND WATER.

(Grube and Staesche, 1927.)

Results at 25°

Normality of Aq. H_3PO_4 solvent	Gms. per 100 gms. sat. solution H_3PO_4	Gms. per 100 gms. sat. solution $Mn_3(PO_4)_2$	Solid Phase
1.0	2.61	1.36	$Mn_3(PO_4)_2$
2.0	5.23	3.72	"
2.98	7.60	5.37	"
3.54	8.56	5.88	$MnHPO_4$
6.09	14.02	10.36	"
9.00	19.98	13.74	"
9.29	21.07	14.59	"
11.00	25.32	17.33	"
15.25	28.02	19.55	$H_4[Mn(PO_4)_2]$
17.96	29.90	17.21	" $\cdot 3H_2O$
20.95	42.78	11.07	"
24.07	49.76	8.43	"
29.42	56.29	6.07	"
34.78	64.51	3.97	"
39.93	74.62	2.46	"
44.79	82.05	2.38	"
50.00	85.95	0.0	H_3PO_4

Results at 55°

Normality of Aq. H_3PO_4 solvent	Gms. per 100 gms. sat. solution H_3PO_3	Gms. per 100 gms. sat. solution $Mn_3(PO_4)_2$	Solid Phase
3.0	8.92	7.14	$Mn_3(PO_4)_2$
4.5	13.35	10.50	"
6.0	16.75	14.16	"
9.0	21.67	18.10	"
12.0	27.30	24.50	$MnHPO_4$
13.5	31.30	27.13	"
15.0	32.40	28.70	"
18.0	36.00	30.90	"
21.0	41.40	24.60	$H_4[Mn(PO_4)_2]$
27.0	57.30	13.30	" $.3H_2O$
36.0	69.00	7.70	"
45.0	83.30	7.30	"

PO

MANGANESE Ammonium PHOSPHATE $MnNH_4PO_4 \cdot 7H_2O$.

1000 cc. sat. solution of Manganese Ammonium Phosphate in Water contain 0.00042 gm. $MnNH_4PO_4.H_2O$. (? temp.) (Breuner, 1920, 1922.)

SOLUBILITY OF MANGANESE AMMONIUM PHOSPHATE IN SEVERAL SOLVENTS.

(Wenger, 1911.)

t°.	Gms. NH_4MnPO_4 per 100 Gms. Solvent in: Water.	Aq. 5% NH_4NO_3.	Aq. 5% NH_4Cl.	Mixture of 1 Pt. NH_3 (d = 0.96) + 4 parts H_2O.
0	...	0.021	0.002	0.0116
20	0	0.020	0.025	0.0122
30	...	0.023	0.034	...
40	0	0.021	0.039	0.0118
50	...	0.023	0.035	0.0132
60	0	0.027	0.038	0.0194
70	0.005	0.028	0.041	0.0191
80	0.007	0.033	0.045	0.0197

MANGANESE SULFIDE MnS. S

One liter sat. solution in water contains $71.6.10^{-6}$ mols. MnS = 0.00623 gm. per liter at 18° by conductivity method. (Weigel, 1907; see also Bruner and Zawadzki, 1909.)

Purified manganese sulfide was agitated in 0.01 $n\,H_2SO_4$ containing H_2S for 10 hours at 20°. The determination was repeated after another period of 10 hours. The sat. solution contained 0.4874 gm. Mn S, corresponding to $5.6.10^{-3}$ gm. mols. MnS, per 1000 cc. (Moser and Behr, 1924.)

Attention is called by Kolthoff, 1931, to the incorrectness of the results of Weigel. From a critical study of the available determinations of the solubility of metal sulfides in water, it is concluded that these results are of doubtful value, and it is recommended that the relation between the solubility and the hydrogen ion and hydrogen sulfide concentrations be expressed as the reaction constant.

MANGANESE SULFATE $MnSO_4$.

SOLUBILITY IN WATER.

(Cottrell — J. Physic. Ch. 4, 651, '01; Richards and Fraprie — Am. Ch. J. 26, 77, '01. The results of Linebarger — Am. Ch. J. 15, 225, '93, were shown to be incorrect by Cottrell, and this conclusion was confirmed by R. and F.)

t°.	Grams $MnSO_4$ per 100 Gms. Water.	Grams $MnSO_4$ per 100 Gms. Solution.	Solid Phase.	t°.	Grams $MnSO_4$ per 100 Gms. Water.	Grams $MnSO_4$ per 100 Gms. Solution.	Solid Phase.
−10	47.96	32.40	$MnSO_4.7H_2O$	16	63.94	38.99	$MnSO_4.4H_2O$
0	53.23	34.73	"	18.5	64.19	39.10	"
5	56.24	35.99	"	25	65.32	39.53	"
9	59.33	37.24	"	30	66.44	39.93	"
12	61.77	38.19	"	39.9	68.81	40.77	"
14.3	63.93	39.00	"	49.9	72.63	42.08	"
5	58.06	36.69	$MnSO_4.5H_2O$	41.4	60.87	37.84	$MnSO_4.H_2O$
9	59.19	37.18	"	50	58.17	36.76	"
15	61.08	37.91	"	60	55.0	35.49	"
25	64.78	39.31	"	70	52.0	34.22	"
30	67.76	40.38	"	80	48.0	32.43	"
35.5	71.61	41.74	"	90	42.5	29.83	"
				100	34.0	24.24	"

SO

More recent very careful determinations of the Solubility of Manganese Sulfate in Water by Krepelka and Rejha, 1933, gave the following values. differing in certain details from the above.

t°	Gms. $MnSO_4$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $MnSO_4$ per 100 gms. sat. sol.	Solid Phase
− 5	23.3	Ice	20	39.1*	$MnSO_4.4H_2O$
−10	31.3	"	23.5 tr.pt.	39.4*	" + $MnSO_4.H_2O$
−11.4 Eutec	32.2	" + $MnSO_4.7H_2O$	30	39.7*	"
− 5	33.4	$MnSO_4.7H_2O$	35	40.3*	"
0	34.6	"	45	41.4*	"
+ 5	36.1	"	10	40.6*	$MnSO_4.H_2O$
8.6 tr.pt.	37.2	" + $MnSO_4.5H_2O$	20	39.7*	"
10	37.8*	"	25	39.2	"
5	36.8*	$MnSO_4.5H_2O$	30	38.6	"
15(1.4772)	38.0	"	40	37.5	"
20(1.4866)	38.6	"	50	36.3	"
24.5	39.3	" + $MnSO_4.H_2O$	60	34.9	"
25(1.4993)	39.4*	" + $MnSO_4.4H_2O$	70	38.2	"
30	40.4*	"	80	31.3	"
35	41.5*	"	90	29.0	"
15	38.8*	$MnSO_4.4H_2O$	100.7 b. pt.	26.1	"

* Metastable.

The figures in parentheses are densities of the saturated solutions, determined by Plöttmann, 1928.

MANGANESE SULFATE

SOLUBILITY OF MANGANESE SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 12.6°.

(Montemartini and Losana, 1928.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	H_2SO_4	$MnSO_4$			H_2SO_4	$MnSO_4$	
1.4817	0.0	36.98	$MnSO_4.5H_2O$	1.3782	47.64	2.10	$MnSO_4.H_2O$+$MnSO_4$
1.4312	10.06	29.65	$MnSO_4.4H_2O$	1.4640	52.21	0.61	$MnSO_4$
1.4181	17.45	24.93	"	1.4618	67.42	0.41	$MnSO_4.H_2SO_4.H_2O$
1.3862	23.82	18.07	"	1.6579	75.76	0.21	"
1.3628	32.21	8.03	"+$MnSO_4.H_2O$	1.7748	85.52	0.11	$MnSO_4.H_2SO_4$
1.3561	40.51	4.20	$MnSO_4.H_2O$	1.8442	99.12	0.05	$MnSO_4.3H_2O$

SOLUBILITY OF MANGANESE SULFATE IN AQUEOUS SOLUTIONS OF AMMONIUM SULFATE AT 25° AND 50° AND VICE VERSA.

(Schreinemakers, 1909.)

Results at 25°.			Results at 50°.		
Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
$MnSO_4$.	$(NH_4)_2SO_4$		$MnSO_4$.	$(NH_4)_2SO_4$.	
39.3	0	$MnSO_4.5H_2O$	36.26	0	$MnSO_4.H_2O$
38.49	3.64	" +D_6	35.35	2.95	" +$D_{2.1}$
33.44	4.91	D_6	30.57	5.14	$D_{2.1}$
22.06	9.65	"	16.86	17.62	"
9.02	20.36	"	6.92	35.98	"
2.91	37.42	"	6.29	39.71	"
1.75	42.58	" +$(NH_4)_2SO_4$	5.70	43.24	" +$(NH_4)_2SO_4$
1.77	43.24	$(NH_4)_2SO_4$	3.49	44.02	$(NH_4)_2SO_4$
0	43.4	"	0	45.7	"

$D_6 = MnSO_4.(NH_4)_2SO_4.6H_2O$.

$D_{2.1} = (MnSO_4)_2(NH_4)_2SO_4$.

SOLUBILITY OF MANGANESE SULFATE IN AQUEOUS SOLUTIONS OF AMMONIUM SULFATE AND VICE VERSA AT 0°.

(Caven and Johnston, 1927.)

Gm. Mols. per 1000 gms. H_2O		Solid Phase	Gm. Mols. per 1000 gms. H_2O		Solid Phase
$(NH_4)_2SO_4$	$MnSO_4$		$(NH_4)_2SO_4$	$MnSO_4$	
0.0	3.533	$MnSO_4.7H_2O$	1.864	0.377	1.1.6
0.168	3.623	"	3.551	0.167	"
0.251	3.665	" + 1.1.6	3.993	0.138	"
0.260	3.565	1.1.6	5.135	0.075	"
0.531	1.868	"	5.229	0.081	" + $(NH_4)_2SO_4$
1.069	0.769	"	5.254	0,017	$(NH_4)_2SO_4$
1.315	0.531	"	5.327	0.0	"

1.1.6 = $MnSO_4.(NH_4)_2SO_4.6H_2O$.

SOLUBILITY OF MANGANESE SULFATE IN AQUEOUS SOLUTIONS OF AMMONIUM SULFATE AND VICE VERSA.

(Benrath, 1931a.)

Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$	Gms. per 100 gms. sat. sol. $MnSO_4$	Solid Phase
Results at 12.5°		
3.17	36.9	$MnSO_4.5H_2O$ + 1.1.6
3.24	34.91	1.1.6
21.23	3.29	"
41.75	1.2	" + $(NH_4)_2SO_4$
Results at 40°		
1.76	37.39	$MnSO_4.H_2O$
4.84	35.23	2.1
7.6	31.32	"
10.33	28.61	"
17.8	17.89	1.1.6
19.98	14.77	"
Results at 40° (con.)		
29.7	7.99	1.1.6
40.75	4.26	"
41.81	3.80	" + $(NH_4)_2SO_4$
Results at 100°		
3.45	25.96	$MnSO_4.H_2O$ + 2.1
3.91	23.81	2.1
5.49	18.47	"
10.62	10.04	"
25.35	5.15	"
39.19	2.83	"
50.15	1.66	" + $(NH_4)_2SO_4$

1.1.6 = $MnSO_4.(NH_4)_2SO_4.6H_2O$; 2.1 = $2MnSO_4.(NH_4)_2SO_4$.

MANGANESE Ammonium SULFATE $MnSO_4.(NH_4)_2SO_4.6H_2O$.

SO

100 cc Water dissolve 37.2 gms. $MnSO_4.(NH_4)_2SO_4$, at 25°. (Locke, 1901.)

100 cc sat. solution of manganese ammonium sulfate in water contain 38.28 gms. $MnSO_4.(NH_4)_2SO_4.6H_2O$ at 7°. (Bertisch, 1926.)

SOLUBILITY OF MANGANESE SULFATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE AT 35° AND VICE VERSA.

(Schreinemakers and Provije, 1913)

Gms. per 100 Gms. Sat. Sol. $MnSO_4$	Gms. per 100 Gms. Sat. Sol. Na_2SO_4	Solid Phase.
39.45	0	$MnSO_4.H_2O$
33.92	5.23	"
33.06	7.97	" + $(MnSO_4)_9.(Na_2SO_4)_{10}$
32.92	7.42	" "
31.05	9.20	$(MnSO_4)_9.(Na_2SO_4)_{10}$
27.67	10.76	"
22.14	14.28	"
14.58	20.01	"
13.96	21.91	$(MnSO_4)_9.(Na_2SO_4)_{10}$ " + $MnSO_4(Na_2SO_4)_3$
12.19	22.49	$MnSO_4.(NaSO_4)_3$
10.45	23.41	"
7.43	26.58	"
5.69	29.31	"
5.11	30.52	" + Na_2SO_4
2.96	31.33	
0	33	

Data for the solubility of mix crystals of manganese and zinc sulfates between 0° and 39° are given by Sahmen, 1905–06.

MANGANESE SULFATE

SOLUBILITY OF MANGANESE SULFATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE AND VICE VERSA AT 0°.

(Caven and Johnston, 1928.)

Gm. Mols. per 1000 gms. H_2O		Solid Phase	Gm. Mols. per 1000 gms. H_2O		Solid Phase
$MnSO_4$	Na_2SO_4		$MnSO_4$	Na_2SO_4	
3.533	0.0	$MnSO_4.7H_2O$	1.650	0.445	$Na_2SO_4.10H_2O$
3.499	0.158	"	0.897	0.383	"
3.424	0.509	"	0.773	0.389	"
3.413	0.566	" + $Na_2SO_4.10H_2O$	0.254	0.369	"
2.818	0.520	$Na_2SO_4.10H_2O$	0.0	0.331	"

SOLUBILITY OF MANGANESE SULFATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE AND VICE VERSA AT 25° AND AT 35°.

(Caven and Johnston, 1928.)

SO

Results at 25°			Results at 35°		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$MnSO_4$	Na_2SO_4		$MnSO_4$	Na_2SO_4	
39.10	0.0	$MnSO_4.4H_2O$	39.56	0.0	$MnSO_4.\ H_2O$
38.43	1.66	"	37.12	3.05	"
36.94	5.09	" + 1.1.2	34.46	6.62	" + 1.1.2
34.69	6.23	1.1.2	30.43	8.49	1.1.2
29.52	8.78	"	26.56	11.12	"
22.88	13.51	"	15.64	19.79	"
18.62	17.42	"	12.54	22.96	"
17.15	19.26	" + $Na_2SO_4.10H_2O$	10.21	25.75	"
15.15	19.55	$Na_2SO_4.10H_2O$	9.35	27.49	" + Na_2SO_4
9.14	20.53	"	6.55	29.05	Na_2SO_4
5.44	21.16	"	4.25	30.49	"
2.81	21.54	"	0.0	32.83	"
0.0	21.89	"			

1.1.2 = $MnSO_4.Na_2SO_4.2H_2O$

The above results at 35° fail to confirm the existance of the double salts. $MnSO_4.3Na_2SO_4$ and $9MnSO_4.10Na_2SO_4$ previously reported by Schreinemakers and Provije, 1913, or of $MnSO_4.Na_2SO_4.4H_2O$.

MANGANESE SULFATE

SOLUBILITY OF MANGANESE SULFATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE AT SEVERAL TEMPERATURES.

(Benrath, 1929a.)

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms. sat. sol.		Solid Phase
	Na_2SO_4	$MnSO_4$			Na_2SO_4	$MnSO_4$	
11	7.52	33.50	$MnSO_4.5H_2O$+1.1.2	50	9.95	29.25	1.1.2
"	10.45	29.0	$Na_2SO_4.10H_2O$+	"	12.45	24.89	"
			1.1.2	"	13.59	22.42	"
25	28.64	8.62*	1.3	"	16.42	18.33	"
30	27.64	6.40	"+$Na_2SO_4.10H_2O$	"	17.17	17.53	"+1.3
41	7.52	32.28	$MnSO_4.H_2O$+1.1.2	"	18.62	14.91	1.3
"	18.09	17.13	1.3 + 1.1.2	"	20.78	11.59	"
"	24.73	7.93	"	"	23.04	7.84	"
"	34.38	2.50	" + Na_2SO_4	"	25.99	5.16	"
50	0.0	37.3	$MnSO_4.H_2O$	"	27.76	3.09	"
"	4.70	33.22	"	"	30.2	2.68	" + Na_2SO_4
"	7.09	31.60	"	"	31.8	0.0	Na_2SO_4
"	8.57	30.95	"				

SO

1.1.2 = $MnSO_4.Na_2SO_4.2H_2O$; 1.3 = $MnSO_4.3Na_2SO_4$.

The author considers that Caven and Johnston, 1928, failed to find the 1.3 salt on account of the slowness with which it is formed in the vicinity of its transformation points.

SOLUBILITY OF MANGANESE SULFATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE AT 97°.

(Benrath and Benrath, 1929.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	Na_2SO_4	$MnSO_4$			Na_2SO_4	$MnSO_4$	
1.216	0.0	28.49	$MnSO_4.H_2O$	1.304	14.89	18.54	1.3
1.244	2.16	26.48	"	1.263	15.93	14.77	"
1.275	4.91	24.60	"	1.249	16.87	12.48	"
—	11.42	22.84	"	1.241	17.90	10.42	"
—	11.94	22.81	" + 1.1.2	1.216	19.43	6.79	"
1.326	12.64	22.09	" + "	1.215	23.53	2.58	"
1.317	13.13	21.41	1.1.2	—	25.38	1.41	"
1.329	13.70	20.49	"	1.230	29.54	0.69	"+Na_2SO_4
1.339	14.72	19.25	" + 1.3	1.237	29.85	0.0	Na_2SO_4

1.1.2 = $MnSO_4.Na_2SO_4.2H_2O$; 1.3 = $MnSO_4.3Na_2SO_4$.

MANGANESE SULFATE

SOLUBILITY OF MANGANESE SULFATE IN AQUEOUS SOLUTIONS OF RUBIDIUM SULFATE AND VICE VERSA.

(Benrath, 1931a.)

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms. sat. sol.		Solid Phase
	Rb_2SO_4	$MnSO_4$			Rb_2SO_4	$MnSO_4$	
0	4.8	33.4	$MnSO_4.7H_2O$ + 1.1.6	55	3.58	29.0	2.1
"	8.95	9.3	1.1.6	"	5.77	20.56	"
"	10.83	6.32	"	"	10.55	11.60	"
"	26.51	1.69	" + Rb_2SO_4	"	23.95	5.72	"
25	3.3	37.5	$MnSO_4.H_2O$ + 1.1.6	"	30.75	4.08	"
"	10.67	26.93	1.1.6	75	2.97	30.8	$MnSO_4.H_2O$+ 2.1
"	32.73	3.77	" + Rb_2SO_4	"	2.81	29.25	2.1
"	33.47	3.03	" + "	"	9.61	7.59	"
40	5.50	32.05	2.1	"	26.48	2.31	"
"	6.17	24.02	"	"	45.56	2.12	"
"	13.21	14.8	"	100	2.26	22.65	"
"	25.34	7.72	"	"	9.09	3.91	"
"	33.49	5.11	"	"	20.74	1.76	"
60	39.75	3.17	" + Rb_2SO_4	"	31.96	1.34	"

1.1.6 = $MnSO_4.Rb_2SO_4.6H_2O$; 2.1 = $2MnSO_4.Rb_2SO_4$.

SO

SOLUBILITY OF MANGANESE SULFATE IN AQUEOUS SOLUTIONS OF THORIUM SULFATE AND VICE VERSA AT 30°.

(Caven, 1932.)

Gms. per 100 gms. H_2O		Solid Phase	Gms. per 100 gms. H_2O		Solid Phase
$Th(SO_4)_2$	$MnSO_4$		$Th(SO_4)_2$	$MnSO_4$	
0.0	66.41	$MnSO_4.5H_2O$	7.91	13.79	1.1.7 + $Th(SO_4)_2.8H_2O$
0.135	65.67	" + 1.1.7	8.66	17.68•	$Th(SO_4)_2.8H_2O$
0.50	54.59	1.1.7	8.23	15.49•	"
1.38	45.27	"	7.75	13.54	"
1.87	36.78	"	6.64	9.33	"
3.11	29.75	"	4.69	4.54	"
5.82	19.86	"	3.94	2.93	"
6.65	16.94	"	3.03	1.41	"
			2.14	0.0	"

• = Metastable

1.1.7 = $MnSO_4.Th(SO_4)_2.7H_2O$. This double salt forms very slowly

rated solution

or a long

MANGANESE SULFATE

SOLUBILITY OF MANGANESE SULFATE IN AQUEOUS SOLUTIONS OF THALLIUM SULFATE.

(Benrath, 1931a.)

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms. sat. sol.		Solid Phase
	Tl_2SO_4	$MnSO_4$			Tl_2SO_4	$MnSO_4$	
0	3.26	34.4	$MnSO_4.7H_2O$+1.1.6	40	3.62	36.78	$MnSO_4.H_2O$+2.1
"	9.85	3.88	Tl_2SO_4 + "	"	5.43	27.92	2.1
8	6.0	14.2	" + "	"	13.05	21.85	"+Tl_2SO_4
25	3.2	38.6	$MnSO_4.5H_2O$+2.1	66	2.06	34.57	$MnSO_4.H_2O$+2.1
30	2.52	38.42	$MnSO_4.H_2O$ + "	"	5.84	20.24	2.1
"	7.39	28.91	2.1	"	7.65	15.01	"
"	9.32	31.21*	1.1.6	"	11.81	9.07	"
"	11.08	27.14	2.1 + $TlSO_4$	"	14.75	8.85	"+Tl_2SO_4
50	2.83	35.41	$MnSO_4.H_2O$+2.1	"	12.80	7.23	Tl_2SO_4
"	4.58	30.14	2.1	100	2.33	24.17	$MnSO_4.H_2O$+2.1
"	9.07	22.45	"	"	4.75	7.56	2.1
"	13.38	13.77	"+Tl SO	"	7.25	4.29	"
"	11.37	8.50	Tl SO	"	16.06	2.49	"
"	10.08	4.38	"	"	17.28	2.14	" + Tl_2SO_4

SO 1.1.6 = $MnSO_4.Tl_2SO_4.6H_2O$; 2.1 = $2MnSO_4.Tl_2SO_4$.

EQUILIBRIUM IN THE SYSTEM MANGANESE SULFATE, ZINC SULFATE AND WATER AT 35°.

(Benrath and Blankenstein, 1934a.)

The results are expressed in the Jänecke System in terms of the gm. mols. H_2O to dissolve 1.0 gm. mol. anhydrous salt mixture containing the reported percentage of $MnSO_4$. Results for the isotherms 0°, 20°, 23°, 27.2°, 30°, 35°, 45° and 60° are given. Both the saturated solutions and moist solids were analyzed and the composition of the solid phase deduced from the results. The solid phases of mixed crystals over considerable regions and the limiting percentage of the constituents in these are shown. The following values at 35° are typical of the entire series.

Percent $MnSO_4$ in 1 mol. dissolved salt mixture	Mols. H_2O to dissolve 1 mol. salt mixture	Crystalline Phase	Percent $MnSO_4$ in mol. dissolved salt mixture	Mols. H_2O to dissolve 1 mol. salt mixture	Crystalline Phase
100.0	13.53	$MnSO_4.H_2O$	41.8	11.5	$MnSO_4.5H_2O$
93.6 (98.1)	13.2 (1.0)	"	38.0	11.4	"+$ZnSO_4.6H_2O$
81.6	12.5	"	37.8 (15.0)	12.0 (6.0)	$ZnSO_4.6H_2O$
70	12.1	"	34.0	11.8	"
59.6	11.63	"+$MnSO_4.5H_2O$	22.2 (5.5)	12.4 (7.0)	$ZnSO_4.7H_2O$
49.9	11.5	$MnSO_4.5H_2O$	15.9	12.9	"
43.3 (61.0)	11.3 (5.0)	"	5.69	13.3	"
			0.0	13.5	"

The figures in parentheses are the limiting values respectively for $MnSO_4.H_2O$, $MnSO_4.5H_2O$, $ZnSO_4.6H_2O$ and $ZnSO_4.7H_2O$ in the mixed crystals composing the moist solid phases.

SOLUBILITY OF MANGANESE SULFATE IN AQUEOUS ETHYL ALCOHOL.

(Schreinemakers, 1909; Schreinemakers and Deuse, 1912.)

Results at 25°.

Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	Gms. per 100 Gms. Sat. Sol. $MnSO_4$.	Solid Phase.
0	39.3	$MnSO_4.5H_2O$
6.81	33.72	"
liquid layers separate here		
53.00	1.23	"
57.39	0.56	"
76.70	0	$MnSO_4.H_2O$

Results at 50°.

Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	Gms. per 100 Gms. Sat. Sol. $MnSO_4$.	Solid Phase.
0	36.26	$MnSO_4.H_2O$
6.67	28.12	"
16.02	18.75	"
22.63	12.54	"
36.47	4.12	"

Composition of the liquid layers.

Water rich Layer.		C_2H_5OH rich Layer.	
%C_2H_5OH.	%$MnSO_4$.	%C_2H_5OH.	%$MnSO_4$.
6.81	33.72*	53.09	1.23*
8.48	31.51	49.76	1.83
15.02	22.61	32.75	8.01

The following reciprocally saturated metastable solutions were obtained at 50°.

Water rich Layer.		C_2H_5OH rich Layer.	
% C_2H_5OH.	% $MnSO_4$.	% C_2H_5OH.	% $MnSO_4$.
5.68	34.95	53.64	0.97
7.69	30.99	45.83	2.19
8.70	29.20	41.93	3.11
11.85	24.84	35.15	5.95

* These liquids in contact with $MnSO_4.5H_2O$.

Similar data are also given for 30° and for 35°. Both stable and metastable liquid pairs were obtained at these intermediate temperatures.

Additional data for this system are also given by Cuno, 1908. SO

SOLUBILITY OF MANGANESE SULFATE IN AQUEOUS ETHYL ALCOHOL (CON.).

Composition of the conjugated liquids in contact with excess of solid salt.

t°.	C_2H_5OH rich Layer.		Aqueous rich Layer.		Solid Phase.
	% C_2H_5OH.	% $MnSO_4$.	% C_2H_5OH.	% $MnSO_4$.	
10	37.06	5.44	13.78	25.25	$MnSO_4.5H_2O$
15	44.56	2.79	9.25	29.79	"
17	47.11	2.22	8.53	30.88	"
21	53.55	1.10	6.10	35.05	"
25	53.00	1.23	6.81	33.72	"
30	45.20	2.49	8.69	30.15	$MnSO_4.H_2O$
31	43.90	2.74	8.47	30.10	"
35	41.71	3.44	9.24	28.61	"
37	38.26	4.84	11.03	26.47	"
41	34.01	5.86	11.93	24.97	"
42	32.37	6.89	13.57	23.09	"
43	31.42	8.51	14.33	22.01	"

Data for the solubility of manganese sulfate and potassium iodate in methyl alcohol are given by Karplus, 1907.

SOLUBILITY OF MANGANESE SULFATE IN AQUEOUS ETHYL AND PROPYL ALCOHOL SOLUTIONS AT 20°.

(Linebarger, 1892; Snell, 1898.)

Conc. of Alcohol in Wt. per cent.	Gms. $MnSO_4$ per 100 Gms. Aq. Ethyl Alc.	Gms. $MnSO_4$ per 100 Gms. Aq. Propyl Alc.	Conc. of Alcohol in Wt. per cent.	Gms. $MnSO_4$ per 100 Gms. Aq. Ethyl Alc.	Gms. $MnSO_4$ per 100 Gms. Aq. Propyl Alc.
34	9.5	6	44	3.3	1.9
36	7.2	4.6	48	2.2	1.4
38	5.8	3.5	52	1.4	1.1
40	4.7	2.8			

100 cc. anhydrous hydrazine dissolve about 1 gm. $MnSO_4$ at room temp.

(Welsh and Broderson, 1915.)

100 gms. sat. solution of Manganese Sulfate in Gycol contain 0.5 gm. $MnSO_4$. (de Connick, 1905.)

SOLUBILITY OF ANHYDROUS MANGANESE SULFATE IN METHYL AND ETHYL ALCOHOLS.

(Gibson, Driscoll and Jones, 1929.)

Results for Methyl Alcohol

t°	Gms. $MnSO_4$ per 100 gms. CH_3OH	Solid Phase
15	0.190	$MnSO_4$
25	0.114	"
35	0.064	"
45	0.043	"
55	0.029	

Results for Ethyl Alcohol

t°	Gms. $MnSO_4$ per 100 gms. C_2H_5OH	Solid Phase
15	0.012	$MnSO_4$
35	0.014	"
35	0.021	"

EQUILIBRIUM IN THE SYSTEM MANGANESE SULFATE, URETHAN AND WATER AT 25°.

(Palitsch, 1928, 1929.)

SO

Gm. Mols. per 1000 gms. H_2O		Solid Phase
$MnSO_4$	$NH_2COOC_2H_5$	
4.306	0.0	$MnSO_4 \cdot ?H_2O$
4.108	0.228	$MnSO_4 \cdot ?H_2O + NH_2COOC_2H_5$
0.007	52.16	Upper Liquid Layer
3.817	0.317	Lower Liquid Layer
0.0	53.07	$NH_2COOC_2H_5$

Fusion-point data for mixtures of $MnSO_4 + K_2SO_4$ and $MnSO_4 + Na_2SO_4$ are given by Calcaqui and Marotta, 1914.

MANGANESE Potassium **VANADATE** $MnKV_5O_{14}.8H_2O$.

100 gms. H_2O dissolve 1.7 gms. salt at 18°. (Radau, 1889.)

MOLYBDENUM Mo

SOLUBILITY OF MOLYBDENUM IN MERCURY.

(Irvin and Russell, 1932.)

An amalgam containing approximately 0.2 gm. of Mo per 200 gms. of Hg was prepared by electrolysis and allowed to stand two days. This was filtered and the molybdenum in the filtrate found to be less than 0.00002 percent.

MOLYBDENUM TRIOXIDE (Molybdic acid dihydrate) $MoO_3.2H_2O$.

SOLUBILITY IN WATER. (Rosenheim and Bertheim, 1903.)

t°.	Gms. MoO_3 per 1000 Gms. Sat. Solution.	Gms. MoO_3 per 1000 Gms. H_2O.	t°.	Gms. MoO_3 per 1000 Gms. Sat. Solution.	Gms. MoO_3 per 1000 Gms. H_2O.
18	1.065	1.066	59	10.117	11.258
23	1.822	1.856	60	10.760	12.057
30	2.570	2.638	66	14.730	17.274
40	4.541	4.761	70	17.048	20.550
48	5.980	6.360	74.4	17.290	20.904
50.2	6.431	6.873	75	17.300	20.920
54	7.283	7.855	79	17.400	21.064

When a solution of the dihydrate is held at 40–50°, considerable amounts of crystals, designated by the authors as α molybdic acid monohydrate, separate. They differ from the β molybdic acid monohydrate obtained by direct conversion of the dihydrate at 70°, in being better crystals and in yielding solutions which can be filtered.

SOLUBILITY OF α MOLYBDIC ACID MONOHYDRATE IN WATER.
(Rosenheim and Davidsohn, 1903.)

t°.	Gms. MoO_3 per 1000 Gms. Sat. Solution.	Gms. MoO_3 per 1000 Gms. H_2O.	t°.	Gms. MoO_3 per 1000 Gms. Sat. Solution.	Gms. MoO_3 per 1000 Gms. H_2O.
14.8	2.112	2.117	45	3.648	3.661
24.6	2.612	2.619	52	4.167	4.184
30.3	2.964	2.973	60	4.665	4.685
36.8	3.284	3.295	70	4.213	4.231
42	3.434	3.446	80	5.185	5.212

SOLUBILITY OF MOLYBDIC ACID DIHYDRATE IN AQ. AMMONIUM SALT SOLUTIONS. (R. and D., 1903.)

t°.	Solvent	Gms MoO_3 per 1000 Gms. Sat. Solution.	Gms MoO_3 per 1000 Gms. Solvent.
29.6	10% $(NH_4)_2SO_4$	18.91	19.27
31.5	10% NH_4HSO_4	26.79	27.53
41.8	"	33.22	34.36
49.7	"	36.32	37.69

Fusion-point data for $MoO_3 + Na_2MoO_4$ are given by Groschuff (1908).

Experiments upon the formation of complexes in the system MoO • H_2O are reported by Nowosselowa, 1931.

NITROGEN N_2.

SOLUBILITY IN WATER.

(Winkler — Ber. 24, 3606, '91; Braun — Z. physik. Chem. 33, 732, '00; Bohr and Bock — Wied. Ann 44, 318, '91.)

t.°	"Coefficient of Absorption" β.			"Solubility" B'.	$\bar{q}$.
0	0.0235*	0.0239†	...‡	0.0233*	0.00239*
5	0.0208	0.0215	0.0217	0.0206	0.00259
10	0.0186	0.0196	0.0200	0.0183	0.00230
15	0.0168	0.0179	0.0179	0.0165	0.00208
20	0.0154	0.0164	0.0162	0.0151	0.00189
25	0.0143	0.0150	0.0143	0.0139	0.00174
30	0.0134	0.0138	...	0.0128	0.00161
35	0.0125	0.0127	...	0.0118	0.00148
40	0.0118	0.0118	...	0.0110	0.00139
50	0.0109	0.0106	...	0.0096	0.00121
60	0.0102	0.0100	...	0.0082	0.00105
80	0.0096	...	...	0.0051	0.00069
100	0.0095	0.0100	...	0.0000	0.00000

* W. † B. and B. ‡ B.

β = Absorption Coefficient (Bunsen) i.e. the volume of gas (reduced to 0° and 760 mm Hg pressure) absorbed by 1 volume of the solvent when the pressure of the gas itself, minus the vapor tension of the solvent, amounts to 760 mm.

β' = Solubility i.e. the volume of gas (reduced to 0 and 760mm) which is absorbed by one volume of the liquid when the barometer indicates 760 mm. pressure.

q = The weight of gas in grams which is taken up by 100 gms. of the pure solvent at the indicated temperature and total pressure (that is, the partial pressure of the gas plus the vapor pressure of the liquid at the absorption temperature) of 760 mm.

Single determinations of the solubility of nitrogen in water reported by Hüfner (1906–07), Bohr (1910), Müller (1912–13) and von Hammel (1915), are, on the average, about 2–3 units in the fourth place higher than the above figures of Winkler for the absorption coefficient β. Drucker and Moles (1910), give an extensive review of the literature and present results which, they state, are in very satisfactory agreement with previous determinations. A critical review of the literature of the solubility of nitrogen in water and in sea water is given by Coste (1917).

Data for the solubility of the nitrogen of air in water are given by Fox (1909a). The oxygen was removed from air and the solubility of the residual N + 1.185% argon was determined. After making correction for the argon, the following formula for the solubility of pure nitrogen in water was deduced:

$$1000 \times \text{coef. of abs. } \beta = 22.998 - 0.5298\,t + 0.009196\,t^2 - 0.00006779\,t^3.$$

Data for the solubility of nitrogen in water at pressures up to 10 atmospheres are given by Cassuto (1913). The solubility was found to increase at a somewhat slower rate than proportional to the pressure.

The solubility of N_2 in water at 25°, in terms of the Bunsen absorption coefficient (β above), was found by Orcutt and Geevers, 1936, to be 0.0149. These authors made use of the Van Slyke-Neill, 1924, manometric apparatus which is based upon the principle of extracting the gas from the saturated solvent and measuring its pressure. By means of a special technique and method of calculating the correction for unextracted gas, this becomes a simple method of determining the solubility of any gas in any liquid without the aid of previously determined constants.

NITROGEN

SOLUBILITY OF NITROGEN IN WATER AT 25° AND AT PRESSURES UP TO 200° ATMOSPHERES.

(Frolich, Tauch, Hogan and Peer, 1931.)

The determinations were made by shaking water and nitrogen at various pressures in a steel cylinder maintained at 25° and, after attainment of equilibrium, withdrawing a sample of the saturated solution over mercury, in one of three burets so designed that the volumes could be measured with the same degree of accuracy at any ratio of gas to liquid. The results are given only in the form of a diagram from which the following approximate values were read.

Pressure in Atmospheres	cc N_2 (measured at 25° and 1 Atmosphere) per 1.0 cc H_2O	Pressure in Atmospheres	cc N_2 (measured at 25° and 1 Atmosphere) per 1.0 cc H_2O
20	0.27	100	1.40
40	0.55	140	1.95
60	0.82	180	2.50
80	1.10	200	2.80

SOLUBILITY OF NITROGEN IN WATER AT 25°, 50°, 75°, AND 100° AND UNDER PRESSURES UP TO 1000 ATMOSPHERES.

(Wiebe, Gaddy and Heins Jr., 1932, 1933.)

The apparatus consisted of two steel cylinders respectively of 1000 cc and 300 cc capacity. They were filled with water to three fourths capacity and N_2 bubbled through at the desired temperature and pressure. Equilibrium was approached from pressures above and below that for the particular determination, and gas bubbled through at the final pressure for three hours and the saturated solutions allowed to stand 2-14 hours before samples were removed for analysis. The nitrogen was 99.9% pure, the impurities being argon and a trace of oxygen.

N_2 Pressure in Atmospheres	cc N_2 (reduced to 0° and 760mm) dissolved by 1.0 gm. H_2O at:			
	25°	50°	75°	100°
25	0.348	0.273	0.254	0.266
50	0.674	0.533	0.494	0.516
100	1.264	1.011	0.946	0.986
200	2.257	1.830	1.732	1.822
300	3.061	2.534	2.413	2.546
500	4.441	3.720	3.583	3.799
800	6.134	5.221	5.062	5.365
1000	7.15	6.123	5.934	6.250

The results show that it is not possible to predict with certainty the solubility of nitrogen in water at high pressures from determinations made at low pressures.

SOLUBILITY OF NITROGEN IN WATER AT 0° TO 170° AND AT PRESSURES FROM 100 TO 300 ATMOSPHERES.

(Goodman and Krase, 1931.)

The saturated solutions were prepared by stirring in a solubility pipet, by means of a magnetic stirrer, mixtures of water and nitrogen maintained at the desired pressures. The sample was removed through a needle valve at the bottom of the solubility vessel and separated into its gaseous and liquid constituents by means of a cooled trap.

t°	cc N_2 (reduced to 0° and 760mm) dissolved by 1 gm. H_2O under pressure of: 100 Atmospheres	125 Atmospheres	200 Atmospheres	300 Atmospheres
0	1.46	1.76	3.19	3.62
25	1.07	1.44	2.76	3.25
50	1.003	1.24	2.49	2.99
80	0.934	1.15	2.27	2.86
100	0.954	1.17	2.25	2.91
144	1.025	1.30	2.68	3.45
169	1.08	1.52	3.29	3.83

SOLUBILITY OF NITROGEN IN WATER AT 50° TO 240° AND AT PRESSURES FROM 100 TO 300 ATMOSPHERES.

(Saddington and Krase, 1934.)

It is pointed out that a quantitative solution of the problem requires density measurements of both the liquid and vapor phase in these systems at high temperatures and pressures, as well as a knowledge of the compressibility coefficient of the liquid. The highly perfected apparatus permitted saturation of the water with N_2 at the desired temperatures and pressures and subsequent removal of samples of the liquid and gas phases for analysis.

N

Liquid Phase t°	cc N_2 (reduced to 0° and 760mm) to saturate 1.0 gm. H_2O	Gas Phase t°	Gms. H_2O per liter gas phase	Gms. per 1.0 gm. Gas Phase H_2O	N_2	Density of Gas Phase gms. per liter
Results at 100 Atmospheres Pressure						
65	0.981	50	0.1236	0.00118	0.9988	—
80	0.777	80	0.3817	0.00403	0.9960	94.2
125	1.198	100	0.6474	0.00726	0.9927	88.0
180	1.644	150	2.710	0.0341	0.9659	76.8
210	1.817	190	5.880	0.0828	0.9172	68.5(210°)
240	2.027	230	13.300	0.1958	0.8042	67.7
Results at 200 Atmospheres Pressure						
50	1.806	50	0.1463	0.00085	0.9992	196.8
80	1.748	85	0.5116	0.00290	0.9971	176.7(80°)
100	1.825	150	2.960	0.0203	0.9797	145.8
150	2.172	190	7.550	0.0564	0.9436	132.6(200°)
200	3.287	225	14.840	0.1180	0.8820	122.0(240°)
240	4.378					
Results at 300 Atmospheres Pressure						
50	2.572	50	0.1975	0.00073	0.9993	273.1
70	2.425	75	0.4607	0.00262	0.9974	256.3(70°)
105	2.598	100	0.9126	0.00372	0.9963	237.2
135	3.128	115	1.450	0.00629	0.9937	225.0
165	3.905	145	3.240	0.0155	0.9835	212.1(140°)
230	6.062	165	5.320	0.0259	0.9741	198.3(170°)
		230	16.400	0.0933	0.9067	173.0(240°)

Calculated results for the compressibility factors of the gas phase are also given.

SOLUBILITY OF NITROGEN IN WATER AT 18° AND UNDER VERY HIGH PRESSURES.

(Basset and Dode, 1936.)

The apparatus permitted the gradual introduction of the liquid by bubbling until the desired pressure was attained. The gas was then allowed to remain in contact with the liquid at constant pressure until two succeeding determinations after a sufficient interval of time showed no further change. This period was approximately 80 hours. The difference between the present results and those of Wiebe and co-workers is considered probably due to small quantities of oil carried in during compression of the gas. The N_2 was of 99.7% purity and previously compressed to 1000 Kgs. per sq. cm. in four stages. Above about 3000 Kgs. pressure the solubility diminished.

Pressure in Kgs. per sq. cm.	cc N_2 (reduced to 0° and 760mm) per 1cc. H_2O	Pressure in Kgs. per sq. cm.	cc N_2 (reduced to 0° and 760mm) per 1cc. H_2O
500	4.3	3000	7.0
1000	6.1	4000	6.4
2000	6.9	4500	6.0

NITROGEN (Atmospheric) AIR

SOLUBILITY IN WATER.

(Winkler — Ber. 34, 1409, '01; see also Peterson and Sondern — Ber. 22, 1439, '89.)

t°.	*B.*	*B′.*	cc * of atmospheric O and N per liter of: Dist. H_2O (at 760 mm.) Oxygen.	Dist. H_2O (at 760 mm.) Nitrogen.	Sea Water (at 760 mm.). Oxygen.	Sea Water (at 760 mm.). Nitrogen.
0	0 02881	0.02864	10.19	18.45	7.77	14.85
5	.02543	.02521	8.91	16 30	6.93	13.32
10	02264	.02237	7.87	14.50	6.29	12.06
15	.02045	.02011	7.04	13.07	5.70	11.05
20	01869	.01826	6.35	11.91	...	10.25
25	01724	01671	5.75	10 96	...	9.62
30	01606	.01539	5.24	10 15		
40	.01418	.01315	4.48	8.67		
50	01297	.01140	3.85	7.55		
60	.01216	.00978	3.28	6.50		
80	01126	.00600	1.97	4.03		
100	.01105	.00000	0 00	0.00		

B = "Coefficient of Absorption," *i.e.*, the amount of gas dissolved by the liquid when the pressure of the gas itself without the tension of the liquid amounts to 760 mm.

B′ = "Solubility," *i.e.*, the amount of gas, reduced to 0° and 760 mm., which is absorbed by one volume of the liquid when the barometer indicates 760 mm. pressure.

* Reduced to 0° and 760 mm.

SOLUBILITY OF AIR IN AQUEOUS SULPHURIC ACID AT 18° AND 760 MM.

(Tower — Z anorg. Ch. 50, 382, '06.)

Wt. % H_2SO_4	98	90	80	70	60	50
Solubility Coef.	0.0173	0.0069	0.0069	0 0055	0.0059	0.0076

SOLUBILITY OF AIR IN ALCOHOL, ETC.

(Robinet, 1864.)

Solvent.	Vols. Air per 100 Vols. Solvent.	Solvent.	Vols. Air per 100 Vols. Solvent.
Alcohol (95 1%)	14.1	Oil of Lavender	6.9
Petroleum	6.8	Oil of Turpentine	24.2
Benzene	14.0		

SOLUBILITY OF NITROGEN IN SEA WATER.

(Fox, 1909a).

Before using the sample of sea water for the solubility determinations it was found necessary to add acid, otherwise the CO_2 could not be boiled out or the precipitation of neutral carbonates prevented. The very small amount of acid was titrated back, using phenolphthaleine as indicator.

The results are in terms of number of cc. of nitrogen (containing argon) absorbed by 1000 cc. of sea water from a free dry atmosphere of 760 mm. pressure. The calculated formula expressing the solubility is:

$$1000\,a = 18.639 - 0.4304\,t + 0.007453\,t^2 - 0.0000549\,t^3 - \mathrm{Cl}\,(0.2172 - 0.007187\,t + 0.0000952\,t^2).$$

Parts Chlorine per 1000.	t° = 0°.	4°.	8°.	12°.	16°.	20°.	24°.	28°.
0	18.64	17.02	15.63	14.45	13.45	12.59	11.86	11.25
4	17.74	16.27	14.98	13.88	12.94	12.15	11.46	10.89
8	16.90	15.51	14.32	13.30	12.44	11.70	11.07	10.52
12	16.03	14.75	13.66	12.72	11.93	11.25	10.67	10.16
16	15.18	14	13	12.15	11.73	10.81	10.27	9.80
20	14.31	13.27	12.34	11.57	10.92	10.36	9.87	9.44

A recalculation of Fox's determinations to parts per million, with correction for vapor pressure, is published by Whipple and Whipple (1911).

SOLUBILITY OF NITROGEN IN AQUEOUS SOLUTIONS OF SULFURIC ACID

Results at 21°. (Bohr, 1910.)				Results at 20°. (Christoff, 1906.)	
Normality of Aq. H_2SO_4.	Absorption Coef. β (Bunsen).	Normality of Aq. H_2SO_4.	Absorp. Coef. β (Bunsen).	Per cent H_2SO_4.	Ostwald Solubility Expression l_{20}.
0	0.0156	24.8	0.0048	0	0.01537
4.9	0.0091	29.6	0.0051	35.82	0.008447
8.9	0.0072	34.3	0.0100	61.62	0.006144
10.7	0.0066	35.8*	0.0129	95.6	0.01672
20.3	0.0049				

* = about 96%.

For definitions of Absorption Coef. (Bunsen) and Solubility Expression (Ostwald), see p. 1186.

SOLUBILITY OF NITROGEN IN AQUEOUS SALT SOLUTIONS.

(Braun.)

t°.	Coefficient of Absorption of N in Barium Chloride Solutions of:				
	13.83 Per cent	11.92 Per cent.	6.90 Per cent.	3.87 Per cent.	3.33 Per cent.
5	0.0127	0.0137	0.0160	0.0180	0.0183
10	0.0117	0.0125	0.0147	0.0166	0.0168
15	0.0104	0.0114	0.0132	0.0148	0.0150
20	0.0092	0.0098	0.0118	0.0132	0.0135
25	0.0078	0.0086	0.0104	0.0114	0.0119

t°.	Coefficient of Absorption of N in Sodium Chloride Solutions of:				
	11.73 Per cent.	8.14 Per cent.	6.4 Per cent.	2.12 Per cent.	0.67 Per cent.
5	0.0102	0.0127	0.0138	0.0179	0.0200
10	0.0093	0.0113	0.0126	0.0164	0.0185
15	0.0081	0.0101	0.0113	0.0147	0.0164
20	0.0066	0.0087	0.0098	0.0131	0.0148
25	0.0047	0.0075	0.0083	0.0113	0.0130

SOLUBILITY OF NITROGEN IN ALCOHOL.

(Bunsen.)

t°.	0°.	5°.	10°.	15°.	20°.	24°.
Vols. N * dissolved by 1 Vol. Alcohol.	0.1263	0.1244	0.1228	0.1214	0.1204	0.1198

* At 0° and 760 mm.

SOLUBILITY OF ATMOSPHERIC NITROGEN AND OXYGEN IN AQUEOUS AMMONIUM CHLORIDE SOLUTIONS. (Coste and Andrews, 1921.)

In attempting to explain the unexpected results of Mac Arthur (*J. Phys. Chem.*, **20**, 495, 1916) upon the solubility of atmospheric air in ammonium chloride solutions, the authors found that the trouble was with the method of analysis. New determinations were made as follows.

Solutions of ammonium chloride in distilled water were subjected to a stream of air for some hours and then examined (1) by the Winkler manganous process and (2) by the Winkler gasometric process (*Z. anal. Chem.*, **40**, 523, 1901) in which the oxygen and nitrogen dissolved in the water are evolved by a current of CO_2 generated in the water from calcite by means of hydrochloric acid. The following results were obtained :

Molar conc. of the NH_4Cl solution.	t° of saturation with air.	Dissolved gases in cc. per liter		
		Gasometric process		Manganous process
		Nitrogen + Argon.	Oxygen.	Oxygen.
0.5	20	10.65	5.48	5.46 (18 hrs.)
1.0	20	10.29	5.08	–
1.0	19	10.15	5.70	2.6 (20 hrs.)
2.0	22	7.79	3.93	1.6 (over night)

Although highest accuracy is not claimed for the results they show} that the solubility of air in aqueous ammonium chloride is very different from that given by Mac Arthur. They also demonstrate the inapplicability of the manganous process in presence of large amounts of ammonium salts.

Extensive data upon the rate of solution of atmospheric nitrogen and oxygen in water are given in a series of papers by Adeney and Becker, 1916-1920, 1919, 1920 and 1921. One of the methods of experimenting consisted in inclosing a large bubble of air, of known volume, in a narrow tube containing deaerated water, and allowing the bubble to pass up through the water repeatedly untill saturation was reached. From the figures given it is possible to calculate the rate of solution for any condition of area exposed, depth, or degree of saturation.

A critical examination of the available data upon the Solubility of Nitrogen in pure water and in sea water has been made by Coste, 1927. It is concluded that "When proper allowances have been made for the effect of argon in the solubility of atmospheric nitrogen, considerable uncertainty exists as to the absorption coefficients of both this mixed gas and pure nitrogen in distilled Water. A similar uncertainty exists in the case of sea water.

SOLUBILITY OF NITROGEN IN MIXTURES OF ETHYL ALCOHOL AND WATER AT 25°.

(Just, 1901.)

Results in terms of the Ostwald solubility expression, see p. 1136

Vol. % H_2O in Mixture.	Vol. % Alcohol in Mixture.	Dissolved N (l_{25}).
100	0	0.01634
80	20	0.01536
67	33	0.01719
0	100 (99.8% Alcohol)	0.1432

SOLUBILITY OF NITROGEN IN AQUEOUS PROPIONIC ACID AND UREA SOLUTIONS.

(Braun.)

t°.	Coefficient of Absorption of N in C_2H_5COOH Solutions of:				
	11.22 per cent.	9.54 per cent.	6.07 per cent.	4.08 per cent.	3.82 per cent.
5	0.0195	0.0204	0.0208	0.0210	0.0209
10	0.0178	0.0182	0.0186	0.0192	0.0191
15	0.0159	0.0163	0.0164	0.0169	0.0167
20	0.0146	0.0147	0.0148	0.0154	0.0155
25	0.0130	0.0134	0.0134	0.0137	0.0137

t°.	Coefficient of Absorption of N in $CO(NH_2)_2$ Solutions of:					
	15.65 per cent.	11.9 per cent	9.42 per cent.	6.90 per cent.	5.15 per cent.	2.28 per cent.
5	0.0175	0.0179	0.0190	0.0198	0.0197	0.0199
10	0.0162	0.0167	0.0176	0.0183	0.0182	0.0184
15	0.0150	0.0149	0.0158	0.0165	0.0165	0.0171
20	0.0140	0.0139	0.0146	0.0151	0.0151	0.0155
25	0.0130	0.0130	0.0133	0.0137	0.0135	0.0139

SOLUBILITY OF NITROGEN IN AQUEOUS SOLUTIONS OF CHLORAL HYDRATE AT 15°.

N

Results by Müller, C (1912-13.)			Results by von Hammel (1915).		
Gms. $CCl_3.CH(OH)_2$ per 100 Gms. Aq. Sol.	d_{20} of Aq. Sol.	Absorp. Coef. β at 15°.	Gms. $CCl_3CH(OH)_2$ per 100 Gms. Aq. Sol.	Abs. Coef. β at 15°.	Solubility l_{15} (Ostwald).
0	1	0.0170	0	0.0170	0.01796
15.8	1.0738	0.0158	15	0.0152	0.0160
28.2	1.1422	0.01422	26.1	0.0141	0.0149
37.25	1.1946	0.01300	37.6	0.0123	0.0130
47	1.2535	0.01275	48.9	0.0115	0.0121
56.52	1.3225	0.01245	61.3	0.0114	0.0120
71.5	1.441	0.01420	70.9	0.0131	0.0138
78.8	1.503	0.01492	79.1	0.0156	0.0165

SOLUBILITY OF NITROGEN IN AQUEOUS SOLUTIONS OF GLYCEROL.

Results of Müller, C. (1912-13).			Results of von Hammel (1915).		Results of Drucker and Moles (1910).		
Gms. $(CH_2OH)_2$-CHOH per 100 Gms. Aq. Sol.	d_{16} of Aq. Sol.	Abs. Coef. β at 15°.	Gms. $(CH_2OH)_2$-CHOH per 100 Gms. Aq. Sol.	Abs. Coef. β at 15°.	Gms. $(CH_2OH)_2$-CHOH per 100 Gms. Aq. Sol.	d_{25} of Aq. Sol.	Solubility l_{25} (Ostwald).
25	1.061	0.01266	15.7	0.01400	0	0	0.0156
42.2	1.108	0.00976	29.9	0.01087	16	1.0392	0.0103
51.5	1.133	0.00759	46.6	0.00840	29.7	1.0744	0.0067
58	1.151	0.00703	57.6	0.00698	48.9	1.1263	0.0052
80.25	1.212	0.00530	67.1	0.00635	74.5	1.1931	0.0025
90	1.240	0.00583	77	0.00527	84.1	1.2213	0.0024
95	1.249	0.00716	88.5	0.00536			
			99.25	0.00524			

Solubility of N_2 in pure isobutyric acid of d_{25} = 0.9481, l_{25} (Ostwald) = 0.1651. (Drucker and Moles, 1910)

Solubility of N_2 in aq. 37.5% isobutyric acid of d_{25} = 0.9985, l_{25} (Ostwald) = 0.0396. (Drucker and Moles, 1910.)

Solubility of N_2 in aq. 37.5% isobutyric acid of d_{25} = 0.9985, l_{29} (Ostwald) = 0.0384. (Drucker and Moles, 1910.)

SOLUBILITY OF NITROGEN IN AQUEOUS SOLUTIONS OF SEVERAL COMPOUNDS.

(Hüfner, 1906–07.)

Aq. Solution of:		Conc. of Aq. Solution. Normality.	Conc. of Aq. Solution. Gms. per Liter.	t°.	Abs. Coef. β.
Glucose		1	180	20.18	0.01215
"		0.5	90	20.21	0.01380
"		0.25	45	20.2	0.01480
Alanine	(α Aminopropionic Acid)	1	89	20.19	0.01213
Glycocol	(Aminoacetic Acid)	1	75	20.16	0.01212
Aribinose		1	150	20.21	0.01203
Levulose		1	180	20.25	0.01221
Erythritol		1	122	20.25	0.01321
Urea		1	60	20.18	0.01477
Acetamide		1	59	20.22	0.01475

SOLUBILITY OF NITROGEN IN AQUEOUS SOLUTIONS OF CANE SUGAR AT 15°.

(Müller, C., 1912–13.)

Gms $C_{12}H_{22}O_{11}$ per 100 Gms. Aq. Solution.	d_{15} of Aq. Sol.	Abs. Coef. β at 15°.	Gms. $C_{12}H_{22}O_{11}$ per 100 Gms. Aq. Solution.	d_{15} of Aq. Sol.	Abs. Coef. β at 15°.
11.38	1.050	0.01480	30.12	1.129	0.01090
20	1.082	0.01280	47.89	1.220	0.00785
29.93	1.128	0.01053	48.57	1.223	0.00700

Data for the solubility of nitrogen in defibrinated ox-blood and ox serum under pressures varying 760–1400 mm. Hg are given by Findlay and Creighton (1910–11).

N

Data for the solubility of nitrogen in liquid oxygen are given by Erdman and Bedford (1904) and Stock (1904.)

SOLUBILITY OF NITROGEN IN SERUM, PLASMA AND HAEMOGLOBIN SOLUTIONS.

Solvent	t°.	Cc N_2 per 100 cc. solvent.	Authority.	
Water	20	1.561	(Stoddard, 1927.)	
Plasma proteins, series 1	20	1.5168	"	
" " 2	20	1.5156	"	
Haemoglobin solutions	20	1.613	"	
Blood Plasma	15	1.7	(O'Brien and Parker, 1922;	
"	38	1.2		" quoted from Bohr, 1905.)
Whole Blood	15	1.6	"	"
"	38	1.1	"	"
Blood Corpuscles	15	1.4	"	"
"	38	1.0	"	"

100 cc. rubber dissolve 3.5 cc. nitrogen (reduced to 0° and 760 mm.) at 21°. The dissolved gas was pumped out with a Töpler pump and measured over mercury.

(Venable and Fuwa, 1922.)

SOLUBILITY OF NITROGEN IN PLASMA, BLOOD ETC. AT 38°.

(Van Slyke, Dillon and Margaria; 1934; Sendroy, Dillon and Van Slyke, 1934.)

Solvent	cc N_2* per 1 cc solvent	cc N_2* per 1 gm. H_2O of solvent
Water	0.01272	0.01281
0.155 Mol. Aq. NaCl	0.01220	0.01228
Plasma	0.117	0.0124
Cells	0.0146	0.0200
Blood (20 Vol.% O_2 cap.)	0.0130	0.0158
Haemoglobin	0.017 †	—

* reduced to 0° and 760mm; † is ccN_2 dissolved by 1 gm. dissolved Haemoglobin when the gas tension is 760mm.

SOLUBILITY OF NITROGEN IN WATER AND IN WHOLE BLOOD AT 38° AND UNDER PRESSURES UP TO 6 ATMOSPHERES.

(Hawkins, and Shilling, 1936.)

Calves and dogs blood oxalated to 0.02% was either used immediately or after being kept at 0° until next day. The Van Slyke and Neill (1920) manometric apparatus was used and the determinations made upon 5cc samples.

Results for Water

N_2 Pressure in Mm Hg	N_2 content of H_2O Vol. percent	Abs. Coef. α, cc N_2 per cc solution
714	1.21	0.01281
1486	2.55	0.01300
2980	4.97	0.01261
4592	7.67	0.01270

Results for Blood

N_2 Pressure in Mm Hg	N_2 content of Blood Vol. percent	Abs. Coef. α, cc N_2 per cc solution	Abs. Coef. α, cc N_2 per gm. H_2O in Blood
715	1.31	0.0138	0.0171
1481	2.68	0.0136	0.0169
3071	5.52	0.0136	0.0169
4508	8.04	0.0134	0.0166

α = the Bunsen Absorption Coefficient is the cc of N_2 (reduced to 0° and 760 mm) which are dissolved by 1cc of the saturated solution at a pressure of 760mm Hg.

9 samples of blood were used varying in O_2 capacity from 15.70 to 20.14 Vol. percent. The above results are for the sample having 20.14 O_2 capacity. The abs. coef. varied from 0.0138 to 0.0148 for dogs' blood and 0.0135 to 0.0140 for ox blood.

The Solubility of Nitrogen in Water and in aqueous suspensions of blood lipoids was determined by Grollman, 1929, with results showing that the lipoids increase the solubility of the nitrogen.

Determinations of the Solubility of Nitrogen in Azobacter Cells are given by Lineweaver, 1938.

SOLUBILITY OF NITROGEN IN METHYL ALCOHOL SOLUTIONS OF POTASSIUM IODIDE AND OF UREA.

(Levi, 1901.)

Solvent.		Solubility of N (in terms of the Ostwald Solubility Expression l).					
Gms. KI or of Urea per 100 Gms. CH_3OH Solution.		At 5°.		At 15°.		At 25°.	
		d_5 of Solvent.	l_5.	d_{15} of Solvent.	l_{15}.	d_{25} of Solvent.	l_{25}.
0	(= pure CH_3OH)	0.8080	0.2154	0.7980	0.1923	0.7937	0.1649
2.152	KI	0.8171	0.2028	0.8070	0.1802	0.8019	0.1524
3.053	"	0.8249	0.1966	0.8015	0.1756	0.8101	0.1466
10.939	"	0.8930	0.1676	0.8841	0.1464	0.8801	0.1258
2.738	Urea	0.8148	0.2030	0.8050	0.1823	0.7997	0.1561
4.841	"	0.8231	0.1951	0.8122	0.1750	0.8080	0.1491
7.377	"	0.8350	0.1878	0.8241	0.1690	0.8193	0.1444

SOLUBILITY OF NITROGEN IN ETHYL ETHER.

(Christoff, 1912.)

Results in terms of the Ostwald expression l, see p. 1136, $l_0 = 0.2580$, $l_{10} = 0.2561$.

SOLUBILITY OF NITROGEN IN SEVERAL SOLVENTS AT 20° AND 25°.

(Just.)

Solvent.	l_{25}.	l_{20}.	Solvent.	l_{25}.	l_{20}.
Water	0.01634	0.01705	Toluene	0.1235	0.1186
Aniline	0.03074	0.02992	Chloroform	0.1348	0.1282
Carbon Disulfide	0.05860	0.05290	Methyl Alcohol	0.1415	0.1348
Nitro Benzene	0.06255	0.06082	Ethyl Alcohol (99.8%)	0.1432	0.1400
Benzene	0.1159	0.1114	Acetone	0.1460	0.1383
Acetic Acid	0.1190	0.1172	Amyl Acetate	0.1542,	0.1512
Xylene	0.1217	0.1185	Ethyl Acetate	0.1727	0.1678
Amyl Alcohol	0.1225	0.1208	Isobutyl Acetate	0.1734	0.1701

SOLUBILITY OF NITROGEN IN SEVERAL SOLVENTS AT DIFFERENT TEMPERATURES.

(Horiuti, 1931; Horiuti, 1932.)

Results for:

Carbon Tetrachloride		Ethyl Ether		Benzene	
t^0	l	t^0	l	t^0	l
-19.7	0.1256	-77.7	0.2055	7.1	0.1063
0	0.1403	-60.6	0.2144	20	0.1162
20	0.1572	-41.1	0.2286	25	0.120
25	0.162	-20.5	0.2452	40	0.1355
40.1	0.1754	0	0.2672	60	0.1575
60.1	0.1953	20	0.2870		
		25	0.293		

Acetone		Methyl Acetate		Chlorobenzene	
t^0	l	t^0	l	t^0	l
-78.1	0.0967	-78.7	0.0900	-39.7	0.0695
-60.3	0.1081	-60.1	0.1032	-19.7	0.0778
-40.75	0.1211	-40.6	0.1190	0.0	0.0881
-20.2	0.1376	-20.3	0.1353	20.0	0.0994
0	0.1553	0.0	0.1551	25	0.102
20	0.1747	20	0.1748	40.1	0.1116
25	0.179	25	0.179	60.05	0.1259
40.1	0.1946	40.1	0.1957	80.3	0.1399

l = Ostwald Solubility Expression which is the ratio of the volume (v) of gas absorbed at any pressure and temperature, to the volume (V) of the absorbing liquid, that is $l = \frac{v}{V}$. The solubility l is therefore the volume of gas dissolved by unit volume of the solvent at the temperature of the experiment.

NITROGEN

SOLUBILITY OF NITROGEN IN SEVERAL SOLVENTS AT 25° AND UNDER PRESSURES UP TO 180 ATMOSPHERES.

(Frolich, Touch, Hogan and Peer, 1931.)

The determinations were made by shaking the solvents and nitrogen at various pressures in a steel cylinder maintained at 25° and, after attainment of equilibrium, withdrawing a sample of the saturated solution under mercury in one of three burets, so designed that the volumes could be measured with the same degree of accuracy at any ratio of gas to liquid. The results are given only in the form of a diagram from which the following approximate values were read.

Pressure in Atmospheres	cc N_2 (measured at 25° and 1 atmosphere) per 1.0 cc liquid in:					
	Butane $CH_3(CH_2)_2CH_3$	Carbon Tetra Chloride, CCl_4	Iso Propanol $CH_3CHOHCH_3$	Ethanol C_2H_5OH	Heavy Naphtha	Gas oil
20	10.6	3.0	2.5	2.0	2.1	2.0
40	22.0	6.25	5.0	4.25	4.5	4.5
60	32.8	9.3	7.5	6.25	6.3	6.3
80	44.0	12.5	10.0	8.1	8.1	8.1
100	55.0	15.6	12.5	10.2	10.0	9.8
120	62.5	18.75	15.0	12.0	11.5	11.2
140	76.0	22.0	17.5	13.75	13.0	12.75
160	88.0	—	20.0	15.5	—	—
180	99.0	—	—	—	—	—

The heavy naphtha had a sp. gr. of 0.8003 and vapor pressure of 80mm at 25°. The gas oil had a sp. gr. of 0.8319 and vapor pressure of 2mm at 25°.

Data for the Solubility of Nitrogen in Normal Heptane at 25°-115° and under 100.9 atmospheres pressure are given by Boomer, Johnson and Piercey, 1938.

SOLUBILITY OF NITROGEN IN PETROLEUM. COEFFICIENT OF ABSORPTION AT 10° = 0.135, AT 20° = 0.117.

(Gniewasz and Walfisz, 1887.)

The Coefficient of Absorption of Nitrogen in American Mineral Oil (d = 0.868 at 27 ; viscosity (saybolt = 285 at 100° F.; congealing point = 37°) was found by Kubie, 1927 (using the Van Slyke and Neil, 1924, apparatus) to be

0.071 ccN_2 (reduced to 0° and 760mm) per 1.0cc oil at 22°.

SOLUBILITY OF NITROGEN IN LIQUID AMMONIA AT 25° AND FROM 25 TO 1000 ATMOSPHERES PRESSURE.

(Wiebe and Tremearne, 1934.)

Liquid ammonia and Nitrogen were shaken together at given pressures in a steel cylinder of 1400cc. capacity. The sample removed for analysis was received in a vessel immersed in liquid air, and subsequently analyzed by appropriate methods. The vapor pressure of liquid ammonia at 25° is 9.8955 atmospheres.

Total Pressure in Atmospheres	cc N_2(at 0° and 760mm) dissolved per 1.0 gm. NH_3	Total Pressure in Atmospheres	cc N_2(at 0° and 760mm) dissolved per 1.0 gm. NH_3
25	2.22	400	37.02
50	5.73	600	45.43
100	12.04	800	51.10
200	22.48	1000	54.83

Results for the system Nitrogen + Hydrogen + Ammonia (Gas) + Ammonia (Liquid) at temperatures from -22.5 to +18.7° and pressures from 50 to 1000 atmospheres are given by Larson and Black, 1925. A discussion of these and similar results for other systems, in the concept that solubility effect is a change in activity of one component resulting from the presence of the other component, is given by Cupples, 1929.

N

SOLUBILITY OF NITROGEN IN LIQUID SULFUR DIOXIDE.

(Donte and Ferguson, 1939.)

The determinations were made in an apparatus which permitted measurements in the static system and in a circulating system. In addition the authors have calculated extrapolated values which are considered to be probably as reliable as the experimental determinations.

t°	ccN_2(at 0° and 760mm) dissolved in 1.0 gm. of the liquid when the partial pressure of the gas is 1 atmosphere		
	Static Experiments	Circulation Experiments	Calculated values
-60	2.86	2.15	—
-50	6.35	4.41	—
-40	12.3	7.88	—
-30	27.2	—	—
-20	56.6	26.7	47
-10	—	—	87
0	—	—	150
+10	—	—	260
20	—	—	435
30	—	—	600

SOLUBILITY OF NITROGEN IN METALS.

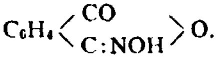
Results for Cobalt (Sieverts and Hagen, 1934.)
" " Ferrum (Jurisch, 1912; Martin, 1929; Sieverts, 1931; 1938.)
" " Molybdanum (Martin, 1929.)
" " Wolfram (Tungsten) (Martin, 1929.)

HYDROXYLAMINE $NH_2(OH)$.
HYDROXYLAMINE HYDROCHLORIDE $NH_2(OH).HCl$.

SOLUBILITY OF EACH IN SEVERAL SOLVENTS.
(de Bruyn, 1892.)

Solvent.	t°.	Gms. NH_2OH per 100 Gms. Solution.	t°.	Gms. $NH_2(OH).HCl$ per 100 Gms. Solvent.
Methyl Alcohol (abs.)	5	35	19.75	16.4
Ethyl Alcohol (abs.)	15	15	19.75	4.43
Ether (dry)	(b. pt.)	1.2	...	...
Ethyl Acetate	(b. pt.)	1.6	...	...

For densities of $NH_2(OH).HCl$ solutions, see Schiff and Monsacchi, 1896.

Phthalyl**HYDROXYLAMINE** 
$C_6H_4\left\langle\begin{matrix}CO\\C{:}NOH\end{matrix}\right\rangle O$.

One liter benzene dissolves 0.33 gm. of the A form of melting point 220°-226°.
(Sidgwick, 1915.)

HYDRAZINE $NH_2.NH_2$.

Fusion-point data are given for:

$NH_2.NH_2$ + C_2H_5OH (Epstein, 1939.)
" + $CO(NH_2)_2$(Urea) (Semisine, 1939.)
H$_2$
" + $N_2H_5N_3$ (Dresser, Browne, and Mason, 1933.)
" + $N_2H_5N_3$ + NH_3 (Howard, Jr., and Browne, 1934.)
$N_2H_5N_3$ + NH_3 " " "

HYDRAZINE $NH_2.NH_2$.

DISTRIBUTION OF HYDRAZINE BETWEEN WATER AND BENZENE.
(Georgievics, 1915.)

Gms $NH_2.NH_2$ per:		Gms $NH_2.NH_2$ per:	
25 cc. H_2O Layer.	75 cc. C_6H_6 Layer.	25 cc. H_2O Layer.	75 cc. C_6H_6 Layer.
0.4137	0.027	1.7601	0.0626
0.6676	0.0335	2.3336	0.1101
1.0862	0.0355	4.75	0.137

HYDRAZINE Per**CHLORATE** $N_2H_4(HClO_4)_2.3H_2O$.

SOLUBILITY IN WATER. (Carlson, 1910.)

t°.	Sp. Gr Sat Sol.	Gms. $N_2H_4(HClO_4)_2$ per 100 cc. Sat. Sol.
18	1.264	41.72
35	1.391	66.9

HYDRAZINE Mono**NITRATE** $N_2H_4.HNO_3$.

SOLUBILITY IN WATER. (Sommer, 1914.)

t°.	Gms $N_2H_4.HNO_3$ per 100 Gms.		t°.	Gms. $N_2H_4.HNO_3$ per 100 Gms.	
	Sat Sol.	Water.		Sat. Sol.	Water.
10	63.63	174.9	40.02	85.86	607.2
15	68.47	217.2	45.02	88.06	737.6
20.01	72.70	266.3	50.01	91.18	1034
25.01	76.61	327.5	55.01	93.58	1458
30.01	80.09	402.2	60.02	95.51	2127
35.01	83.06	490.3			

HYDRAZINE PICRATE $N_2H_5OC_6H_2(NO_2)_3.\frac{1}{2}H_2O$.

SOLUBILITY OF HYDRAZINE PICRATE IN AQUEOUS SOLUTIONS OF SALTS AT 20°.

(Gilbert, 1929.)

Gm. Mols. Salts per liter aqueous solvent	Gm. Mols. $N_2H_5OC_6H_2(NO_2)_3$ per liter sat. sol.
Water alone	0.01396
0.020 NH_4Cl	0.01499
0.050 "	0.01586
0.080 "	0.01655
0.100 "	0.01690
0.090 " + 0.01 NH_4 Pic.	0.01313
0.080 " + 0.02 "	0.01188
0.070 " + 0.03 "	0.01108
0.104 " + 0.005 "	0.01497
0.102 " + 0.003 "	0.01566
0.100 " + 0.012 "	0.01360
0.100 " + 0.01745 "	0.01387
0.05 " + 0.01 "	0.01209
0.100 " + 0.01 "	0.01388
0.100 " + 0.005 "	0.01495
0.100 $NaNO_3$	0.01611
0.100 NaPic.	0.04322
0.090 NH_4Cl + 0.009793 N_2H_5Cl	0.01231
0.080 " + 0.01950 "	0.00903
0.070 " + 0.02952 "	0.00690
0.100 NaPic.	0.00314 (15°)
0.050 " + 0.05 NaCl	0.00413 (15°)
0.100 NaCl	0.01176 (15°)

H_2

NH_4Pic. (Picrate) $NH_4OC_6H_2(NO_2)_3$; NaPic (Picrate), $NaOC_6H_2(NO_2)_3$.

The author also gives results for the Solubility of Croceo Dinitro Tetrammine Cobalti Picrate and Flavo Tetra Rhodano Diammine Chromiate in aqueous solutions of NaCl and Na Picrate. He also gives results for Tri ethyl amine Picrate and Tri propyl amine picrate in these salt solutions.

SOLUBILITY OF HYDRAZINE PICRATE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 20°.

(Gilbert and Huffman, 1932.)

Wt. Percent C_2H_5OH in Aq. Solvent	Gm. Mols. $N_2H_5OC_6H_2(NO_3)_3$ per liter sat. solution	Wt. Percent C_2H_5OH in Aq. Solvent	Gm. Mols. $N_2H_5OC_6H_2(NO_3)_3$ per liter sat. solution
0.0 (= H_2O)	0.01396	60	0.01901
10	0.01160	69.4	0.01616
15	0.01076	79.7	0.01176
25	0.01113	96.0	0.00525
34.5	0.01448	99.8 (Vol. Percent)	0.00694
51	0.01890		

Data for the Solubility of Hydrazine Picrate at 15° in dilute aqueous solutions of NaCl + HCl in presence of acetone were determined by Gilbert 1929(a), in connection with studies of the hydrolysis of hydrazine by acetone.

HYDRAZINE Tri Nitro Methyl CRESYLATE, $N_2H_5OC_6H(NO_2)_3CH_3.H_2O$

SOLUBILITY OF TRI NITRO METHYL CRESYLATE IN WATER AND IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL.

(Gilbert and Huffman, 1932.)

Results for Water		Results for Aq. Alcohol at 20°			
t°	Gm. Mols. $N_2H_5.OC_6H(NO_2)_3.CH_3$ Per liter sat. sol.	Wt. Percent C_2H_5OH in Aq. Solvent	Gm. Mols. Cresylate per liter sat. sol.	Wt. Percent C_2H_5OH in Aq. Solvent	Gm. Mols. Cresylate per liter sat. sol.
15	0.08473	5.0	0.1015	60.	0.2297
20	0.1158	15	0.08996	69.4	0.2189
25	0.1506	25	0.1089	79.70	0.1843
30	0.2053	34.5	0.1509	96.0	0.0710
		50	0.2170	99.8 (Vol%)	0.0517

H_2

HYDRAZINE SULFATES $(N_2H_5)_2SO_4$ (I), $N_2H_6SO_4$ (II).

SOLUBILITY OF THE TWO HYDRAZINE SULFATES IN WATER. (Sommer and Weise, 1916.)

Results for $(N_2H_5)_2SO_4$.				Results for $N_2H_6SO_4$.			
t°.	Gms $(N_2H_5)_2SO_4$ per 100 gms. sat. sol.	Mols. $(N_2H_5)_2SO_4$ per liter.	Solid Phase.	t°.	Gms. $N_2H_6SO_4$ per 100 gms. sat. sol.	Mols. $N_2H_6SO_4$ per liter.	Solid Phase.
25...	66.91	12.48	$(N_2H_5)_2SO_4.H_2O$	20...	2.794	0.220	$N_2H_6SO_4$
35...	71.28	15.32	»	25..	3.302	0.260	»
45...	78.54	22.59	»	30...	3.746	0.299	»
50...	82.33	28.76	»+$(N_2H_5)_2SO_4$	40...	3.987	0.404	»
55...	83.40	31.01	$(N_2H_5)_2SO_4$	50...	6.538	0.538	»
60...	84.72	34.22	»	60...	8.322	0.698	»
				70...	10.465	0.902	»
				80...	12.580	1.107	»

SOLUBILITY OF BIVALENT HYDRAZINE SULFATE (II) IN AQUEOUS SOLUTIONS OF ACIDS AT 25°. (Sommer and Weise, 1916.)

In aq. H_2SO_4		In aq. HCl.		In aq. CH_3COOH	
Gms. H_2SO_4 per liter.	Gms. $N_2H_6SO_4$ per 100 gms. sat. sol.	Gms. HCl per liter.	Gms. $N_2H_6SO_4$ per 100 gms. sat. sol.	Gms. CH_3COOH per liter.	Gms. $N_2H_6SO_4$ per 100 gms. sat. sol.
0.4897	3.143	0.00	3.302	0.5157	3.198
4.887	2.680	0.3645	3.156	6.8963	3.147
26.59	1.541	3.645	2.876	33.306	2.903
49.00	1.026	18.25	2.652	63.00	2.737
116.18	0.518	36.45	2.639	117.38	2.323
144.18	0.4318	66.08	2.615		

SOLUBILITY OF AMMONIA IN WATER.

(Roscoe and Dittmar — Liebig's Annalen, 112, 334, '59; Raoult — Ann. chim. [5] 1, 262, 74; Mallet — Am. Ch. J. 19, 807, '97.)

t°.	At 760 mm. Pressure. G. NH_3 per 100 g. H_2O.	At 760 mm. Pressure. Vol. NH_3 per 1 g. H_2O.	t°.	At 760 mm. Pressure. G. NH_3 per 100 g. H_2O.	At 760 mm. Pressure. Vol. NH_3 per 1 g. H_2O.
−40	294.6	...	20	52.6	710
−30	278.1	...	25	46.0	635
−20	176.8	...	30	40.3	595 (28°)
−10	111.5	...	35	35.5	...
0	87.5	1299	40	30.7	...
5	77.5	1019	45	27.0	...
10	67.9	910	50	22.9	...
15	60.0	802	56	18.5	...

SOLUBILITY OF AMMONIA IN WATER DETERMINED BY METHOD OF LOWERING OF FREEZING-POINT.

(Rupert, 1910.)

t°	Gms NH_3 per 100 Gms. Sol.	Solid Phase.	t°	Gms. NH_3 per 100 Gms. Sol.	Solid Phase.
0	0	Ice	−80.6	52	NH_3H_2O
−2	2	"	−82.8	54	"
−4.6	4	"	−85.8	56	"
−7.6	6	"	−87	Eutec. 56.5	$NH_3.H_2O+2NH_3.H_2O$
−10.6	8	"	−84.8	58	$2NH_3H_2O$
−13.9	10	"	−82.2	60	"
−17.6	12	"	−80.4	62	"
−21.4	14	"	−79.2	64	"
−25.8	16	"	−79.8	m. pt. 66	"
−31.3	18	"	−79.2	68	"
−37	20	"	−80.3	70	"
−43.6	22	"	−82.1	72	"
−50.7	24	"	−84.5	74	"
−60.3	26	"	−87.4	76	"
−72.2	28	"	−90.4	78	"
−87.2	30	"	−93.6	80	"
−102.3	32	"	−94	Eutec. 80.3	$2NH_3H_2O+NH_3$
−116.7	34	"	−91.7	82	NH_3
−120	Eutec. 34.5	Ice + NH_3H_2O	−89.4	84	"
−103.8	36	NH_3H_2O	−87.4	86	"
−92.9	38	"	−85.6	88	"
−86.7	40	"	−84.1	90	"
−83.5	42	"	−82.7	92	"
−81.4	44	"	−81.5	94	"
−80	46	"	−80.3	96	"
−79.3	48.7	"	−79.1	98	"
−79.4	50	"	−78	100	"

More recent data on the above system, by Smits and Postma (1914) agree quite closely with the above except in the region of the eutectic Ice + NH_3H_2O. These authors report a temperature of −100.3 instead of −120 for this point. Additional determinations are also given by Baumé and Tykociner (1914). Older data for the ice curve are given by Guthrie (1884) and Pickering (1893).

SOLUBILITY IN WATER DETERMINED BY THE METHOD OF LOWERING OF THE FREEZING-POINT. (Postma, 1920; Elliott, 1924.)

The closely agreeing determinations of these investigators were plotted on cross-section paper and the following results read from the curve.

t°.	Mole per cent NH_3.	Gms. NH_3 per 100 gms. solution.	Solid Phase.	t°.	Mole per cent NH_3.	Gms. NH_3 per 100 gms. solution.	Solid Phase.
0.0.....	0.0	0.0	Ice	−88.3 Eutec.	57.5	56.11	$NH_3.H_2O+2NH_3.H_2O$
− 10.0.....	9.2	8.75	»	−87.5.. ..	58.0	56.63	$2NH_3.H_2O$
− 20.0. ...	15.2	14.49	»	−85	59.2	57.84	»
− 40.0.....	22.2	21.22	»	−82.5.....	60.5	59.16	»
− 60.0.....	27.0	25.9	»	−80	63.0	61.69	»
− 80.0.....	31.0	29.8	»	−78.2 m. pt..	66.5	65.28	»
− 90.0.....	33.0	31.76	»	−80	70.5	60.36	»
−100.0 Eutec.	34.5	33.23	» + NH_3H_2O	−85	76.0	75.00	»
− 95.0.....	37.2	35.88	NH_3H_2O	−87.5.....	78.0	77.05	»
− 90.0.....	40.0	38.6	»	−90.0.....	79.7	78.83	»
− 85.0.....	43.0	41.61	»	−92.5 Eutec.	81.5	80.05	» + NH_3
− 80.0.....	46.5	45.1	»	−90	83.6	82.87	NH_3
− 79 m. pt..	49.5	48.08	»	−87.5.....	86.0	85.55	»
− 80	52.2	50.81	»	−85	88.5	87.92	»
− 82.5.....	54.6	53.20	»	−82.5.....	92.0	91.56	»
− 85.0.....	56.0	54.62	»	−80.0.....	95.7	95.45	»
− 87.5.....	57.2	55.82	»	−77.7.....	100.0	100.00	»

VAPOR PRESSURE OF AQUEOUS AMMONIA SOLUTIONS.

(Perman, 1903.)

Gms. NH_3 per 100 Gms. Sol.	Vapor Pressure in mm. of Mercury at: 0°	10°.	20°.	30°.	40°.	50°.	60°.
0	4.5	9	17.5	31.5	55	125	149.5
2.5	13	18	32.5	56.5	91	146	234
5	20	27	47.5	83	134.5	210	327
7.5	27.5	40	70	115	183.5	281	425
10	35	54	93	153.5	241.5	363.5	539.5
12.5	45	69	118	193.5	303.5	455	666
15	57.5	89	151	245	377.5	564	816.5
17.5	75	115	191	305.5	465.5	688.5	985
20	93	144	237	393	569.5	834.5	1191
22.5	117	180.5	291	455.5	690	1005	1432
25	144.5	226.5	360	561.5	830.5	1195	...
27.5	181	280	440	680	1007	...	...
30	222	346	537	817	1189.5	...	...

The apparatus (Perman, 1901) used for the above determinations, consisted of a pipet provided with a stop-cock at its upper end and connected with a Hg leveling tube at its lower end. For maintaining constant temperatures the vessel was surrounded by a glass jacket into which water or vapors of liquids boiling at various temperatures could be introduced. The aqueous ammonia solution was drawn in above the Hg and boiled to expel air. A portion of it was withdrawn for analysis through the stop-cock at the top, by elevating the level of Hg. The vapor pressures of the analyzed mixture at various constant temperatures were then read with the aid of an adjacent millimeter scale. Curves were plotted from the results and readings for regular intervals of concentration and temperature made.

By means of a modification of the above apparatus the author was also able to estimate the partial pressure of the ammonia and of the water of each mixture. Tables for these values are given. Data have also been calculated for the latent heat of evaporation of aqueous ammonia solutions.

More recent data for the Vapor Pressure of Aqueous Solutions of Ammonia at 0° are given by Klarmann, 1924, and at 25° by Scheffer and de Wijs, 1925 and Breitenbach, 1925.

INFLUENCE OF SALTS AND OTHER COMPOUNDS ON THE VAPOR PRESSURE OF AQUEOUS AMMONIA SOLUTIONS.

(E. G. Perman, J. Chem. Soc. (Lond.), 81, 480, 1902.)

Vapor pressure determinations were made as above described on aqueous solutions of the following compositions — (*a*) 10.43% Urea + 16.36% NH_3, (*b*) 5.29% Urea + 17.22% NH_3, (*c*) 4.55% Mannitol + 12.27% NH_3, (*d*) 3.05% K_2SO_4 + 7.49% NH_3, (*e*) 5.27% NH_4Cl + 16.85% NH_3, (*f*) 10.26% NH_4Cl + 12.9% NH_3, (*g*) 2.68% $CuSO_4$ + 14.65% NH_3, (*h*) 3.94% $CuSO_4$ + 6.54% NH_3.

The author's data were plotted on cross section paper and the following values read from the curves.

t°.	Vapor Pressure of Each Solution in mm. of Mercury.							
	(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)	(*g*)	(*h*)
20	204	200	120	...	193	130	155	...
30	325	325	198	...	302	220	235	87
40	485	500	311	200	471	345	365	145
50	715	727	465	304	695	522	545	223
60	1050	1060	705	453	975	770	...	344

In an earlier paper Perman (1901) gives data similar to the above for the vapor pressure of ammonia in aqueous solutions of sodium sulfate.

VAPOR PRESSURE OF AQUEOUS AMMONIA SOLUTIONS.

(Sherwood, 1925.)

This author collected the available data on the partial vapor pressure of ammonia in water and plotted the results on logarithmic paper to reduce the curvature and obtain constant percentage errors. The results of Raoult, Carius, Perman, Watts, Sims, Roscoe and Ditmar, Cragoe, Myers and Taylor, Mallet, Mollier, Smits and Postma, Doryer and Gaus were used.

Gms. NH_3 per 1000 gms H_2O	Partial Pressure of NH_3 in mm. Hg at						
	0°	10°.	20°.	30°.	40°.	50°.	60°.
1000	947	.....	.....	.....	.....	.....	.....
900	785	.....	.....	.....	.....	.....	.....
800	636	987	.....	.....	.....	.....	.....
700	500	780	.....	.....	.....	.....	.....
600	380	600	945	.....	.....	.....	.....
500	275	439	686	.....	.....	.....	.....
400	190	301	470	719	.....	.....	.....
300	119	190	298	454	692	.....	.....
250	89.5	144	227	352	534	825	.....
200	64	103.5	166	260	395	596	834
150	42.7	70.1	114	179	273	405	583
100	25.1	41.8	69.6	110	167	247	361
75	17.7	29.9	50.0	79.7	120	179	261
50	11.2	19.1	31.7	51	76.5	115	165
40	.....	16.1	24.9	40.1	60.8	91.1	129.2
30	.....	11.3	18.2	29.6	45	67.1	94.3
25	.....	.....	15	24.4	37.6	55.7	77
20	.....	.....	12	19.3	30	44.5	61
16	.....	.....	.....	15.3	24.1	35.5	48.7
12	.....	.....	.....	11.5	18.3	26.7	36.3
10	.....	.....	.....	.....	15.4	22.2	30.2

AMMONIA NH_3.

SOLUBILITY OF AMMONIA IN WATER. (Neuhausen and Patrick, 1921.)

The authors developed a static method for measuring the partial pressure of water and of ammonia over aqueous ammonia solutions. The apparatus consists of two recepticles connected respectively to each arm of a delicate manometer, in such a fashion that very small differences in pressure between the two can be very accurately measured. Into these two recepticles ammonia vapor at a certain pressure is introduced. Then into one, water vapor is successively added in small portions. The total pressure in this recepticle gradually increases untill the partial pressure of the water vapor equals that corresponding to the partial pressure of water vapor over a solution, whose partial pressure of ammonia at that temperature is such as at the start. Any further addition of water vapor will entail condensation of water with consequent solution of some of the ammonia and reduction in the total pressure. When, therefore, the total pressure in the recepticle to which water vapor is added reaches a maximum, and just begins to diminish, this point shows the partial pressure of water vapor corresponding to that of the ammonia at the temperature in question. A series of such determinations were made at 0°, 20° and 40°. A curve was plotted for each temperature taking the measured partial pressures of water as the ordinates and the total pressure of ammonia plus water as absissae. From these curves the following results, showing the partial pressure of water corresponding to regular intervals of total pressure above the aqueous solution of ammonia, were read.

H_3

Total pressure of $H_2O + NH_3$ in mm.	Partial pressure of H_2O in mm at 0°.	20°.	40°	Total pressure of $H_2O + NH_3$ in mm.	Partial pressure of H_2O in mm. at 20°	40°.
1000	1.06	8.8	34.2	2600	4.8	18.8
1200	0.92	8.2	31.7	2800	4.5	18.5
1400	0.78	7.6	29.2	3000	4.2	18.2
1600	0.65	7.0	26.5	3200	4.0	18.1
1800	0.53	6.6	24.0	3400	3.7	17.9
2000	0.41	6.1	22.0	3600	3.5	17.4
2200	0.29	5.7	20.5	3800	3.3	17.6
2400	0.19	5.2	19.5	4000	3.1	17.5

The determinations of the *Solubility of ammonia in water* were made by repeatedly introducing ammonia into a recepticle containing a given volume of water, untill no further diminution in pressure occurred after thorough shaking. By means of a special device a portion of the saturated solution was withdrawn without a material change in pressure, and thus without alteration in the content of ammonia. Successive samples were titrated and the following results were calculated from these titrations and the pressure readings.

t°.	Mole fraction per cent ammonia.	Partial pressure in mm. of Ammonia.	Water.	Density of solution.	Per cent contraction in volume
0......	51.676	915	1.25	0.842	7.50
0......	52.382	944	1.19	0.842	7.80
0......	54.735	1140	0.97	0.833	7.80
0......	61.206	1409	0.77	0.817	9.21
0......	62.765	1499	0.708	0.812	8.52
0......	65.076	1684	0.61	0.803	8.51
0......	65.711	1732	0.545	0.800	8.35
0.....	66.621	1865	0.46	0.795	8.12

SOLUBILITY OF AMMONIA IN WATER. (Neuhausen and Patrick, 1921.) (Con.)

20......	34.886	728	9.4	0.882	7.07
20......	36.508	798	9.25	0.878	7.25
20......	42.077	1140	8.6	0.864	8.30
20......	42.392	1165	8.55	0.862	8.17
20......	43.086	1226	8.4	0.854	8.16
20......	43.731	1281	8.3	0.848	7.37
20......	48.175	1677	7.05	0.845	8.96
20......	49.941	1938	6.33	0.835	8.36
20......	53.940	2655	5.1	0.825	9.47
20......	55.970	3076	4.45	0.817	9.47
20......	56.923	3277	4.15	0.815	9.65
40......	25.011	752	36.5	0.902	6.05
40......	25.366	774	36.2	0.9005	6.21
40......	30.690	1134	32.1	0.8833	7.21
40......	32.686	1335	29.5	0.817	7.68
40......	33.134	1376	29.0	0.8755	7.74
40......	36.326	1787	23.9	0.864	8.22
40......	39.026	2180	20.5	0.856	8.52
40......	41.133	2460	19.0	0.849	9.05
40......	42.925	2832	18.42	0.843	10.00
40......	44.624	3226	18.0	0.837	9.49
40.	44.557	3214	18.0	0.837	9.42
40......	46.335	3640	17.6	0.828	9.40

EQUILIBRIUM IN THE SYSTEM AMMONIA AND WATER AT TEMPERATURES UP TO 150° AND PRESSURES UP TO 10 ATMOSPHERES.

(Clifford and Hunter, 1933.)

A dynamic method was used to determine the vapor compositions between 60° and 100° and for pressures up to 1.5 atmospheres. At higher ranges of temperature and pressure a static method was used. Both total vapor pressures and vapor compositions were measured. The results were plotted together with those of Perman 1903, Mollier, 1908 and Smits and Postma, 1914 and from the curves so obtained, tables for the isobars and isotherms were constructed. The following are the values for the isobars.

Results at:

0.02 Atmospheres Pressure		0.2 Atmospheres Pressure			0.5 Atmospheres Pressure		
t°	Gms. NH_3 per 100 gms. Solution	t°	Gms. NH_3 per 100 gms.		t°	Gms. NH_3 per 100 gms.	
			Solution	Vapor		Solution	Vapor
-82.9	75.5	-61.0	100	100	-46.3	100	100
-79.8	62.8	-10	31.8	99.0	-40	75.3	—
-70	51.0	0	25.3	98.0	-30	60	—
-60	41.5	10	20.0	95.5	-20	51.2	—
-50	34.3	20	15.0	90.5	-10	43.1	—
-40	27.5	30	10.0	80.0	0	37.2	—
-30	21.0	40	5.5	65.5	20	26.0	97.5
-20	15.0	50	2.7	38.0	40	15.0	87.5
-10	9.5	60.4	0.	0.	60	6.2	63.6
0	5.0				80	0.3	4.5
10	1.7				81.7	0.	0.
17.7	0.0						

EQUILIBRIUM IN THE SYSTEM AMMONIA AND WATER AT TEMPERATURES UP TO 150° AND PRESSURES UP TO 10 ATMOSPHERES. (Continued)

(Clifford and Hunter, 1933.)

1.0 Atmosphere

t°	Gms. NH_3 per 100 gms.	
	Solution	Vapor
-33.2	100	100
-30	86.0	—
-20	65.4	—
-10	55.3	—
0	47.3	—
10	40.6	99.2
20	34.6	98.5
30	29.1	97.0
40	24.0	94.5
50	19.0	90.2
60	14.4	82.5
70	10.0	70.0
80	6.1	52.6
90	2.9	31.8
100	0	0

H3

2 Atmospheres

t°	Gms. NH_3 per 100 gms.	
	Solution	Vapor
-18.5	100	100
-10	75.0	—
0	61.4	—
10	52.6	—
20	45.6	—
30	39.3	—
40	33.7	98.4
50	28.5	97.5
60	23.4	94.8
70	18.5	89.2
80	14.0	80.3
90	10.0	67.5
100	6.2	50.6
110	2.9	29.0
120	0.15	1.5
120.6	0.	0.

4 Atmospheres

t°	Gms. NH_3 per 100 gms.	
	Solution	Vapor
-1.5	100	100
0	94.7	—
10	71.5	—
20	60.2	—
30	52.2	—
40	45.5	—
50	39.7	—
60	34.2	97.3
70	29.2	94.8
80	24.4	90.0
90	19.8	83.6
100	15.5	76.0
110	11.5	66.3
120	7.7	52.2
130	4.2	33.0
140	1.0	9.8
144.1	0.	0.

6 Atmospheres

t°	Gms. NH_3 per 100 gms.	
	Solution	Vapor
9.7	100	100
20	74.6	—
30	62.0	—
40	54.0	—
50	47.5	—
60	41.9	—
70	36.6	97.0
80	31.4	94.2
90	26.6	90.0
00	22.0	84.8
110	17.6	78.4
120	13.5	69.9
130	9.6	57.1
140	5.9	40.0
150	2.6	19.5
159.3	0.	0.

8 Atmospheres

t°	Gms. NH_3 per 100 gms.	
	Solution	Vapor
18.5	100	100
20	94.6	—
30	73.5	—
40	62.0	—
50	54.1	—
60	47.5	—
70	41.9	98.2
80	36.4	96.2
90	31.4	93.3
100	26.7	89.5
110	22.4	84.0
120	18.3	77.3
130	14.1	68.0
140	10.2	55.5
150	6.4	38.9
160	3.1	20.7
170	0.3	2.3
171	0.0	0.0

10 Atmospheres

t°	Gms. NH_3 per 100 gms.	
	Solution	Vapor
25.3	100	100
30.	87.0	—
40	70.2	—
50	60.0	—
60	52.2	—
70	46.0	98.8
80	40.6	97.4
90	35.6	95.1
100	30.8	91.7
110	26.3	87.0
120	22.0	81.1
130	18.0	74.2
140	14.0	64.8
150	10.1	51.5
160	6.6	36.3
170	3.4	20.5
180.5	0.	0.

MUTUAL SOLUBILITY OF AQUEOUS AMMONIA AND POTASSIUM CARBONATE SOLUTIONS.

(Newth — J. Chem. Soc. 77, 776, 1900.)

The solutions used were: Potassium Carbonate saturated at 15° (contained 57.2 grams K_2CO_3 per 100 cc.). Aqueous Ammonia of 0.885 Sp. Gr. (contained about 33 per cent ammonia). The determinations were made by adding successive small quantities of one of the solutions to a measured volume of the other, and observing the point at which opalescence appeared.

t°.	Saturated K_2CO_3 in Aq. Ammonia.		Aq. Ammonia in Saturated K_2CO_3.	
	cc. K_2CO_3 per 100 cc. Ammonia.	% K_2CO_3 Solution in Mixture.	cc. Ammonia in 100 cc. K_2CO_3.	% K_2CO_3 Solution in Mixture.
1	2.0	2.0	37.5	72.7
6	3.0	3.0	47.5	67.6
11	5.0	4.7	52.5	65.0
16	6.5	6.1	60.0	63.0
21	8.5	8.0	77.5	56.3
26	10.5	9.5	105.0	49.0
31	12.5	11.1	152.5	39.0
38	20.0	16.6	195.0	33.0
39	21.0	17.0	220.0	31.0
42	25.0	20.0	250.0	28.5
43	35.0	26.0	285.0	26.5

H_3

Above 43° the solutions are completely miscible. If 10 per cent of water is added to each solution the temperature of complete miscibility is lowered to 25°. The mutual solubilities are:

t°.	Per cent K_2CO_3 Solution in:	
	Ammonia Layer.	K_2CO_3 Sol. Layer.
0	8	62
10	11	52
20	15	38
25 (crit. pt.)	25	

With the addition of 12.9 per cent of water to each solution the temperature of complete miscibility (cr t. pt.) is lowered to 10°. With the addition of 18.1 per cent water this temperature becomes 0°.

SOLUBILITY OF AMMONIA IN AQUEOUS SALT SOLUTIONS.

(Raoult.)

t°.	In Calcium Nitrate Solutions Gms. NH_3 per 100 Gms. Solvent in:		In Potassium Hydroxide Solutions Gms. NH_3 per 100 Gms. Solvent in:	
	28.38% $Ca(NO_3)_2$	In 59.03% $Ca(NO_3)_2$.	11.25% KOH.	25.25% KOH.
0	96.25	104.5	72.0	49.5
8	78.50	84.75	57.0	37.5
16	65.00	70.5	46.0	28.5
24	...	...	37.3	21.8

SOLUBILITY OF AMMONIA IN AQUEOUS SALT SOLUTIONS AT 25°.

(Abegg and Riesenfeld, 1902.)

The determinations were made by the dynamic method of vapor pressure measurement previously used by Doyer (1890), Konowalow (1898), Gahl (1900), and Gaus (1900). It consists in passing an indifferent gas through an aqueous ammonia solution of known concentration and calculating the vapor pressure from the volume of indifferent gas required to remove a definite amount of ammonia from solution. The indifferent gas (H + O) was generated by an electric current and its volume measured by means of a voltmeter. The accompanying ammonia was removed by passing through 0.01 n. HCl and estimated by means of electrolytic conductivity. The molecular vapor pressure was obtained by dividing the absolute vapor pressure, calculated from above measurements, by the concentration (normality) of the ammonia. For 1 n. ammonia in water at 25° the molecular vapor pressure was 13.45 mm. Hg; for 0.5 n. solution it was 13.27 mm. Hg.

Since it has been shown by much experimental evidence, that Henry's Law of the proportionality of the concentration in the liquid and vapor phase applies very closely in the present case, see also Gaus (1900), it follows that the ammonia pressure relation of two solutions of equal ammonia content is reciprocally proportional to the solubility relation of the ammonia in them. Hence, to calculate the solubility from the vapor pressures, it is only necessary to divide the value for the molecular vapor pressure in H_2O by that for the salt solution. Thus the solubility of NH_3 in H_2O becomes unity. All determinations were made with 1 n. aqueous ammonia in salt solution of 0.5, 1 and 1.5 normality. The figures therefore show mols. NH_3 per liter of the particular salt solution at 25°. In a later paper by Riesenfeld (1903), additional determinations are given for 35°.

Salt Solution	Mols NH_3 per Liter Salt Sol of.			Salt Solution.	Mols NH_3 per Liter Salt Sol. of:		
	0.5 n	1 n	1.5 n.		0.5 n.	1 n.	1.5 n.
KCl	0.930	0.866	0.809	KCN	0.926	0.858	0.802
KBr	0.950	0.904	0.857	KCNS	0.932	0.868	0.814
KI	0.970	0.942	0.900	K_2SO_4	0.875	0.772	0.678
KOH	0.852	0.716	0.607	K_2SO_3	0.865	0.768	0.675
NaCl	0.938	0.889	0.843	K_2CO_3	0.788	0.650	0.554
NaBr	0.965	0.916	0.890	$K_2C_2O_4$	0.866	0.771	0.675
NaI	0.995	0.992	0.985	K_2CrO_4	0.866	0.771	0.675
NaOH	0.876	0.789	0.716	CH_3COOK	0.866	0.765	0.685
LiCl	0.980	1.008	1.045	HCOOK	0.868	0.760	0.678
LiBr	1.001	1.040	1.090	KBO_2	0.814	0.677	0.560
LiI	1.030	1.094	1.190	K_2HPO_4	0.860	0.749	0.664
LiOH	0.863	0.808	0.768	Na_2S	0.887	0.795	0.726
KF	0.839	0.722	0.626	*$KClO_3$	0.927	...	...
KNO_3	0.923	0.852	0.804	*$KBrO_3$	0.940	...	...
KNO_2	0.920	0.855	0.798	*KIO_3	0.951	...	...

* These salt solutions are 0.25 normal

Konowalow (1898) expressed the results of determinations of the solubility of ammonia in aqueous silver nitrate by the equation $H = 56.58\ (m - 2n)$ in which H = partial pressure of NH_3 in mm. of Hg., m = molecular concentrations of NH_3 and n = molecular concentration of $AgNO_3$. Similar results are given in later papers (Konowalow, 1899, *a*, *b*) for a large number of other salt solutions.

Gaus (1900) gives data for the vapor pressure of ammonia in aqueous 0.4 n solutions of about 20 salts, only a few of which occur in the above table.

Data for the Solubility of Ammonia in Aqueous Sodium Hydroxide Solutions at 15° are given by Miloslawskij, 1931.

SOLUBILITY OF AMMONIA IN HYDROGEN PEROXIDE DETERMINED BY THE FREEZING-POINT METHOD. (Maass and Hatcher, 1922.)

By means of a gas buret definite volumes of ammonia were added to weighed quantities of pure hydrogen peroxide, and the freezing-points of the resulting mixtures were accurately determined.

t° of f. pt.	Gms. NH_3 per 100 gms. mixture.	Solid Phase.	t° of f. pt.	Gms. NH_3 per 100 gms. mixture.	Solid Phase.
— 1.72.....	0.0	H_2O_2	9.6..	48.6	$NH_3.H_2O_2$
—13	3.41	»	1.5..	49.7	»
—18	4.31	»	0.0..	50.7	»
+48 Eutec.	8.0 approx.	»+$NH_3.H_2O_2$	— 6.0..	51.8	»
+ 5	18.0	$NH_3.H_2O_2$	— 9.5..	52.8	»
8	19.8	»	—32 .	56.7	»
15	21.1	»	—53.5..	59.5	»
20	23.9	»	below —78 ..	61.3	»
24.5 m. pt.	30.0 approx.	»	» » ..	68.7	»

100 cc. of *rubber* saturated with ammonia at 21° dissolve 930 cc. NH_3 (0° and 760^{mm}). The determination was made by pumping out the gas with a Töpler pump and measuring it over mercury. Results for the effect of pressure and temperature upon the solubility are also given. (Veneble and Fuwa, 1922.)

EQUILIBRIUM IN THE SYSTEM AMMONIA AND HYDROGEN SULFIDE. (Scheflan and McCrosky, 1932.)

H_3

The vapor pressure curve of NH_3 + H_2S was determined and also the freezing-points of their mixtures. The vapor pressure curve at 0° showed two regions of constant pressure, respectively at 80mm and 837mm. These correspond to the dissociation pressure of the compound NH_4HS and the pressure at which the solid compound is in equilibrium with solution and vapor at 0°. The vapor pressure temperature curve of the three phase system NH_4HS, (solid) solution and vapor was determined by two methods. The freezing-points of various mixtures of NH_3 + H_2S were also determined.

Vapor Pressures of the Three Phase System

t°	Vapor Pressure in mm.
-21	435.5
-12	548.5
-10	581.0
-7.8	604.5
-7.5	631.5
-5.9	664.0
-5	686.0
-4	708.5
-2.5	780.0
0	838.0
2.5	917.5
5	1002.0
6.5	1075.0
7.5	1120.0
9	1201.5
10	1246.5

Freezing Points of the system NH_3 + H_2S

t° of f. pt.	Mols. NH_3 per 100 Mols. NH_3 + H_2S	Solid Phase
-78.0	100	NH_3
-83.5	97.5	"
-88.0 Eutec.	95.0	" + H_2S
-72	92.5	$(NH_4)_2S$
-60	90	"
-48.3	87.5	"
-30	82.5	"
-22.5	80.0	"
-18.0	75.0	"
+11.0	72.5	NH_4HS
40	70	"
79	65	"
100.8	60	"
114.5	55	"
118.0 m. pt.	50	"
-83.5	0	H_2S

These results show that Ammonium Sulfide, $(NH_4)_2S$, is stable only below -18°. On heating at this temperature it decomposes into solid cryst. NH_4HS and melt.

SOLUBILITY OF AMMONIA IN ABSOLUTE ETHYL ALCOHOL.

(Delepine — J. pharm. chim. [5] 25, 496, 1892; de Bruyn — Rec. trav. chim. 11, 112, '92.)

t°.	Density.	Gms. NH$_3$ per 100 cc. Solution.	Gms. NH$_3$ per 100 Gms. Solution. (Delepine.)	Gms. NH$_3$ per 100 Gms. Solution. (de Bruyn.)	Gms. NH$_3$ per 100 Gms. Alcohol (Delepine.)	Gms. NH$_3$ per 100 Gms. Alcohol (de Bruyn.)
0	0.782	13.05	20.95	19.7	26.5	24.5
5	0.784	12.00	19.00	17.5	23.0	21.2
10	0.787	10.85	16.43	15.0	19.6	17.8
15	0.789	9.20	13.00	13.2	15.0	15.2
20	0.791	7.50	10.66	11.5	11.9	13.2
25	0.794	6.00	10.0	10.0	11.0	11.2
30	0.798	5.15	9.7	8.8	10.7	9.5

According to Müller (1891), one volume of alcohol absorbs 340 volumes of ammonia at 20° and 760 mm. pressure.

SOLUBILITY OF AMMONIA IN AQUEOUS ETHYL ALCOHOL.

(Delepine.)

t°.	In 96% Alcohol. Sp. Gr. Solution.	In 96% Alcohol. G. NH$_3$ per 100 Gms. Sol.	In 90% Alcohol. Sp. Gr. Solution.	In 90% Alcohol. G. NH$_3$ per 100 Gms. Sol.	In 80% Alcohol. Sp. Gr. Solution.	In 80% Alcohol. G. NH$_3$ per 100 Gms. Sol.
0	0.783	24.5	0.800	30.25	0.808	39.0
10	0.803	18.6	0.794	28.8	0.800	28.8
20	0.788	14.8	0.795	15.8	0.821	19.1
30	0.791	10.7	0.796	11.4	0.826	12.2

t°.	In 60% Alcohol. Sp. Gr. Solution.	In 60% Alcohol. G. NH$_3$ per 100 Gms. Sol.	In 50% Alcohol. Sp. Gr. Solution.	In 50% Alcohol. G. NH$_3$ per 100 Gms. Sol.
0	0.830	50.45	0.835	69.77
10	0.831	37.3	0.850	43.86
20	0.842	26.1	0.869	33.8
30	0.846	21.2	0.883	25.2

SOLUBILITY OF AMMONIA IN ABSOLUTE METHYL ALCOHOL.

(de Bruyn — Rec. trav. chim. 11, 112, '92.)

t°.	G. NH$_3$ per 100 Grams. Solution.	G. NH$_3$ per 100 Grams. Alcohol.	t°.	G. NH$_3$ per 100 Grams. Solution.	G. NH$_3$ per 100 Grams. Alcohol.
0	29.3	41.5	20	19.2	23.8
5	26.5	36.4	25	16.5	20.0
10	24.2	31.8	30	14.0	16.0
15	21.6	27.8			

SOLUBILITY OF AMMONIA IN ETHYL ETHER.

(Christoff, 1912.)

Results in terms of the Ostwald Solubility Expression (see page 1136), at 0° = 17.13, at 10° = 12.35, at 15° = 10.27.

SOLUBILITY OF AMMONIA IN HYDROXYLAMINE.

(de Bruyn, 1892.)

100 gms. of the sat. solution contain 26 gms. NH$_3$ at ±0° and 19-20 gms. at 15°-16°.

Data for the reciprocal Solubility of gaseous Ammonia and the vapors of Methyl Alcohol, Acetone, Ether and Chloroform, determined by measuring at 25° the changes in pressure produced by adding a weighed amount of the volatile compound to a given volume of ammonia gas, are given by MacFarlane and Wright, 1934.

SOLUBILITY OF AMMONIA IN CHLOROFORM AT 25°.

(Seward, 1932.)

A series of solutions of varying concentrations were prepared from $CHCl_3$ which had been saturated with NH_3, by successive dilutions with $CHCl_3$. These were each shaken in a closed vessel and after attainment of equilibrium, the NH_3 in both the liquid and vapor phase was determined by titration. The $CHCl_3$ contained 0.1 percent C_2H_5OH. The exact content of C_2H_5OH is important since the solubility of NH_3 increases with the proportion of C_2H_5OH. The presence of 1.0 percent C_2H_5OH was found to increase the solubility of NH_3 in $CHCl_3$ about 20 percent.

Gm. Mols. NH_3 per liter		Calc. Partial Pressure of NH_3 in mm. Hg
$CHCl_3$ phase	Vapor phase	
0.0393	0.000756	14.0
0.0888	0.001716	31.9
0.1157	0.002215	41.2
0.246	0.00474	88.1
0.392	0.00749	139.2
0.423	0.00814	151.3
0.661	0.0132	245.4
0.851	0.0175	325.4
1.105	0.0244	453.5

The partial pressures of NH_3 were calculated from the concentration of the NH_3 in the vapor phase, assuming Dalton's law to hold and neglecting the deviations of ammonia gas from the perfect gas law. The d. of the $CHCl_3$ was 1.480 at 25° and that of the solution containing 1.315 gm. mols. NH_3 per liter was 1.450. These figures were used in calculating the concentrations of NH_3 to volume of liquid phase.

SOLUBILITY OF AMMONIA IN SEVERAL SOLVENTS AT 20° AND 760mm. PRESSURE.

(Bell, 1931.)

The solvents were saturated with NH_3 and the amount of gas present in a known amount of the saturated solution determined by removing it with a current of air, absorbing in an excess of HCl and titrating.

Solvent	s	x
Hexane	4.16	0.0223
Octane	2.56	0.0170
Dodecane	2.13	0.0197
Cetane	1.84	0.0219
Carbon Tetrachloride	7.17	0.0281
Benzene	9.95	0.0474
Toluene	7.23	0.0313
Chloroform	69.8	0.1930
Bromobenzene	8.08	0.0340
Chlorobenzene	11.35	0.0423
Benzyl chloride	12.20	0.0556
Ethylene chloride	26.6	0.0797

s = the partition coefficient of NH_3 between the liquid and the vapor, that is, s = c(the gm. equiv. NH_3 per liter) ÷ 0.0417 and s/c = 22.4 x 293/273.

x = the mol. fraction (gm. mol. NH_3 per 1.0 gm. mol. NH_3 + solvent) calculated on the assumption that the densities of the solutions obey the ideal mixture law.

One liter of Cyclohexanol ($C_6H_{11}OH$) dissolve 28,166.7 cc Ammonia (NH_3) at 26° and 755 mm. pressure. (Cauquil, 1927.)

AMMONIA

The solubility of AMMONIA in NITROBENZENE, in terms of the Bunsen Absorption Coefficient, (see p. 1136) is 18.37 at 15°, 12.61 at 25° and 8.257 at 40° (Baars, 1927)

Freezing-point Data are given for:

NH_3 + CH_3OH (Baume and Perrot, 1910, 1914.)
" + $(CH_3)_2O$ " " " "
" + C_2H_5OH (Broderson, 1911.)
" + n $CH_3CH_2.CH_2OH$ (Cady and Jones, 1933.)
" + iso $(CH_3)_2CHOH$ " " "
" + n $CH_3(CH_2)_2CH_2OH$ " " "
" + iso $(CH_3)_2CHCH_2OH$ " " "
" + sec. $CH_3CH_2CHOHCH_3$ " " "
" + ter. $(CH_3)_3COH$ " " "
" + C_6H_5OH (Briner and Agathon, 1926.)
" + H_2S (Scheffer, 1912.)
" + NH_4Br (Kendall and Davidson, 1922.)
" + NH_4Cl " " "
" + NH_4I " " "
" + NH_4ClO_4 (Mazetti and Decarli, 1926.)
" + NH_4NO_3 (Kuriloff, 1898.)
" + NH_4CNS (Bradley and Alexander, 1912; Foote, 1920; Foote and Hunter, 1920.)
" + $(NH_2)_2CO$ (Jänecke and Rahlfo, 1930.)
" + $CS(NH_2)_2$ (Jänecke and Hoffmann, 1932.)
" + Li (Ruff and Geisel, 1906.)
" + K " " "
" + Na " " "
" + S (Ruff and Hecht, 1911.)

DISTRIBUTION OF AMMONIA BETWEEN CARBON TETRA CHLORIDE AND AIR AT 15°.

(Roederer, 1936.)

The experiments were made by shaking CCl_4 containing NH_3 with air or by shaking CCl_4 with air containing NH_3.

Gm. Mols. NH_3 per liter:		$\frac{(c)}{(a)}$	Gm. Mols. NH_3 per liter:		$\frac{(c)}{(a)}$
CCl_4 (c)	Air (a)		CCl_4 (c)	Air (a)	
0.0114	0.0016	7.13	0.0899	0.0123	7.31
0.0222	0.00325	6.83	0.1351	0.0188	7.19
0.0533	0.0072	7.40	0.1632	0.0222	7.35
0.0618	0.0087	7.11	0.1668	0.0229	7.28
0.0763	0.0106	7.20	0.1700	0.0228	7.45

One liter of CCl_4 saturated with ammonia at 15° and under 760mm partial pressure contains 0.306 gm. mols. NH_3.

DISTRIBUTION OF AMMONIA BETWEEN:

Water and Amyl Alcohol at 20°.

(Herz and Fischer — Ber 37, 4747, '04)

Gms NH_3 per 100 cc.		G M NH_3 per 100 cc.	
Aq. Layer	Alcoholic Layer.	Aq. Layer	Alcoholic Layer.
0.5	0.072	0.25	0.0035
1.0	0.147	0.50	0.0073
2.0	0.272	1.00	0.0148
3.0	0.438	2.00	0.0295
4.0	0.595	3.00	0.0460
5.0	0.756		

Water and Chloroform at 20°.

(Dawson and McCrae — J. Ch. Soc. 79, 496, '01; see also Hantsch and Sebaldt — Z. phys. Ch. 30, 258, '99.)

Gms. NH_3 per 100 cc.		G. M. NH_3 per 100 cc.	
Aq. Layer.	$CHCl_3$ Layer.	Aq. Layer.	$CHCl_3$ Layer.
0.2	0.007	0.01	0.00038
0.4	0.015	0.02	0.00073
0.6	0.023	0.03	0.00114
0.8	0.031	0.04	0.00152
1.0	0.039	0.05	0.00193
1.2	0.046	0.06	0.00232
1.4	0.055	0.08	0.00311
1.6	0.063	0.10	0.00396

Additional data for the distribution of ammonia between water and chloroform are given by Dawson and McCrae (1900), (1901*a*), (1901*b*); Dawson (1906), (1909); Abbott and Bray (1907); Sherrill and Russ (1907); Bell (1911), and by Moore and Winmill (1912). The results show that with increase of concentration of ammonia, the relative amount in the aqueous layer diminishes. Thus Bell found that at 25° the distribution ratio is 22.7 when the aqueous layer contains 1.02 gm. mols. NH_3 per liter and only 10 when 12.23 gm. mols. NH_3 are present in the aqueous layer. The influence of increase of temperature was also found to be in the direction of diminution of the relative amount in the aqueous layer

The influence of the presence of a large number of salts in the aqueous layer has been studied by several of the above-mentioned investigators. In the case of copper, zinc and cadmium salts (Dawson and McCrae, 1900), (Dawson, 1909), the distribution ratio varied with salt concentration in a manner indicating that metal ammonia compounds were formed.

Results for the effect of KOH, NaOH and $Ba(OH)_2$ on the distribution at 18° are given by Dawson (1909).

Results for the effect of ammonium chromate upon the distribution at 25° are given by Sherrill and Russ (1907).

Results for the distribution of ammonia between water and mixtures of chloroform and amyl alcohol at 25° are given by Herz and Kurzer (1910).

DISTRIBUTION OF AMMONIA BETWEEN TOLUENE AND AIR.

(Hantzsch and Vagt, 1901.)

t°.	Gms NH_3 per 1000 cc.		Mols. NH_3 per 1000 cc	
	$C_6H_5CH_3$ Layer.	Air.	$C_6H_5CH_3$ Layer.	Air.
0	0.366	0.0396	0.0215	0.00233
10	0.357	0.0435	0.0210	0.00256
20	0.326	0.0451	0.0192	0.00265
30	0.286	0.0462	0.0168	0.00272

DISTRIBUTION OF AMMONIA BETWEEN WATER AND CHLOROFORM AT 25°.

(Occleshaw, 1931.)		(Dietrick, 1929.)		(Matthews and Davies, 1933)		
Gm. Mols. NH_3 per liter		Gm. Mols. NH_3 per 1000 gms.		Gm. Mols. NH_3 per 1000 gms.		
Aqueous layer (a)	$CHCl_3$ layer (c)	Aqueous layer (a)	$CHCl_3$ layer (c)	Aqueous layer (a)	$CHCl_3$ layer (c)	$\frac{(a)}{(c)}$
0.1388	0.00579	0.02183	0.0005936	0.1289	0.003587	35.93
0.2330	0.00978	0.03203	0.0008735	0.4976	0.01408	35.33
0.3232	0.01360	0.04610	0.001263	0.7796	0.02220	34.98
0.3835	0.01624	0.04983	0.001301	1.0264	0.02957	34.71
0.4677	0.01993	0.05871	0.001611	2.2678	0.06762	33.54
0.4868	0.02074	0.1011	0.002772	3.0349	0.09233	32.87

$\frac{(a)}{(c)} = 23.64$ $\frac{(a)}{(c)} = 35.83$

Data for the distribution of Ammonia between Chloroform and aqueous solutions containing various concentrations of both ammonium chloride and magnesium chloride at 18° are given by Fredholm, 1934.

Data for the distribution of ammonia between toluene and aqueous silver ammonium chloride and hydroxide at 25° are given by (Randall and Halford, 1930.).

THE SYSTEM AMMONIA, ARSENIC TRIOXIDE AND WATER AT 30°.

(Schreinemakers and de Baat, 1915.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
NH_3.	As_2O_3.		NH_3.	As_2O_3.	
0	2.26	As_2O_3	3.13	12.30	NH_4AsO_2
1.41	10.98	"	3.91	7.63	"
2.78	20.49	"	6.95	4.72	"
2.86	21.17	"	9.93	3.20	"
2.88 •	18.43	NH_4AsO_2	4.28	2.16	"

Data are also given for the system $NH_4Cl + As_2O_3 + H_2O$ at 30°.

100 gms. H_2O dissolve 0.02 gm. $NH_4CaAsO_4.\frac{1}{2}H_2O$. (Field, 1873.)

" " " " 0.014 " $NH_4MgAsO_4.\frac{1}{2}H_2O$. "

SOLUBILITY OF AMMONIUM MAGNESIUM ARSENATE IN WATER AND IN AQUEOUS SOLUTIONS OF AMMONIUM SALTS.

(Wenger, 1911.)

t°.	Gms. NH_4MgAsO_4 per 100 Gms. of Each Solvent.						Solid Phase.
	Water.	Aq. 5% NH_4NO_3.	Aq. 5% NH_4Cl.	Aq.* NH_4OH.	Aq. NH_4OH † +5% H_4Cl.	Aq. NH_4OH † +10% NH_4Cl.	
0	0.0339	0.092	0.084	0.0087	...	...	$NH_4MgAsO_4.6H_2O$
20	0.0207	0.114	0.113	0.0096	0.013	0.032	"
30	...	0.118	0.113	...	...	...	"
40	0.0275	0.139	0.190	0.0117	...	...	"
50	0.0226	0.189	0.189	0.0100	...	...	"
60	0.0210	0.211	0.219	0.0090	0.047	0.054	"
70	0.0156	0.189	0.221	0.0095	...	...	"
80	0.0236	0.189	0.231	0.0091	...	...	"

* Composed of 1 part $NH_3(d = 0.96)$ + 4 parts H_2O.

† Contained 4 parts $NH_3(d = 0.96)$ per 100 parts NH_4Cl solution.

AMMONIUM ARSENATE $NH_4H_2AsO_4$.

SOLUBILITY OF MONO AMMONIUM ARSENATE IN WATER.

(de Passille, 1936.)

t°	d. of sat. sol.	Gms. $NH_4H_2AsO_4$ per 100 gms. H_2O	Solid Phase	t°	d. of sat. sol.	Gms. $NH_4H_2AsO_4$ per 100 gms. H_2O	Solid Phase
0	1.1814	33.74	$NH_4H_2AsO_4$	60	1.3464	83.05	$NH_4H_2AsO_4$
20	1.2280	48.67	"	80	1.4200	107.25	"
40	1.2821	63.83	"	90	1.4623	122.4	"

The author also prepared the Di and Tri Ammonium Arsenates but these decompose with loss of ammonia in aqueous solution.

AMMONIUM BORATES $(NH_4)_2O.2B_2O_3.4H_2O$, $(NH_4)_2O.5B_2O_3.8H_2O$.

BO

SOLUBILITY OF AMMONIUM DI BORATE IN WATER.

(Menzel, 1927.)

t°	Gms. $(NH_4)_2O.2B_2O_3$ per 100:		Solid Phase
	cc sat. solution	gms. sat. solution	
18	7.06	6.78	$(NH_4)_2O.2B_2O_3.4H_2O$
25	9.22	8.76	"

SOLUBILITY OF AMMONIUM PENTA BORATE IN WATER.

(Sborgi and Ferri, 1921; Menzel, 1927; Rollet and Andres, 1930.)

t°	Gms. $(NH_4)_2O.5B_2O_3$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $(NH_4)_2O.5B_2O_3$ per 100 gms. sat. sol.	Solid Phase
0	4.0	$(NH_4)_2O.5B_2O_3.8H_2O$	30	9.0	$(NH_4)_2O.5B_2O_3.8H_2O$
10	5.2	"	40	11.4	"
20	6.9	"	50	14.2	"
25	8.0	"	60	18.2	"

AMMONIUM Di BORATE, Penta BORATE, etc.

EQUILIBRIA IN THE SYSTEM AMMONIA, BORIC ANHYDRIDE AND WATER AT VARIOUS TEMPERATURES.

(At 30°, Sborgi, 1912 and 1913; at 30° and 60°, Sborgi and Meracci, 1915 and 1916; at 0° and 10°, Sborgi and Mezzetti, 1921; at the other temperatures, Sborgi and Ferri, 1921 and 1922.)

The numerous determinations were plotted on cross section paper and the following tables constructed from the curves.

BO

Gms. per 100 gms. sat. sol.		Gms. ger 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Solid Phase at Each Temperature.
$(NH_4)_2O$.	B_2O_3.	$(NH_4)_2O$.	B_2O_3.	$(NH_4)_2O$.	B_2O_3.	$(NH_4)_2O$.	B_2O_3.	
t = 0°.		t = 10°.		t = 20°.		t = 30°.		
0.0	1.46	0.0	1.96	0.0	2.70	0.0	3.60	H_3BO_3
0.2	2.2	0.2	3.0	0.2	3.7	0.2	4.7	»
0.3	2.8	0.4	4.0	0.4	4.8	0.5	6.1	»
0.37	3.26	0.5	4.4	0.5	5.5	0.8	7.6	»+1.5.8
0.5	3.5	0.8	5.0	1.0	6.4	1.5	8.8	1.5.8
0.75	4.0	1.2	5.9	1.5	7.6	2.2	10.5	»
1.0	4.5	1.6	7.1	2.0	8.9	3.0	12.7	»
1.3	5.4	2.0	8.2	2.8	10.8	3.8	15.3	»+1.2.4
1.0	4.0	1.8	7.0	2.5	9.0	3.5	13.3	1.2.4
0.9	3.2	1.6	5.0	2.2	6.7	3.0	9.0	»
1.0	2.8	1.5	3.6	2.5	4.2	4.0	6.0	»
2.0	2.5	2.0	3.0	3.0	3.8	6.0	5.0	»
4.0	2.3	4.0	2.6	4.0	3.3	10.0	3.5	»
10.0	1.8	10 0	2.0	10.0	2.4	15.0	2.5	»
20.0	1.0	20.0	1.1	20.0	1.4	20.0	1.8	»
t = 40°		t = 45°.		t = 60°		t = 90°		
0.0	4.5	0.0	5.3	0.0	7.4	0.0	13.5	H_3BO_3
0.5	6.8	0.5	8.0	0.5	10.4	1.0	18.0	»
0.9	9.5	1 0	10.6	1.4	15.6	2.4	25.0	»+1.5.8
1.5	9.9	1.5	11.0	2.0	16.0	3.0	25.4	1.5.8
2.0	10.7	2.0	11.9	3.0	15.7	4.0	26.5	»
3.0	13.0	3.0	14.0	3.5	19.0	5.0	28.4	»
3.5	14.7	3.6	16.4	4.0	20.6	6.1	31.5	»+1.4.6
3.8	15.3	4.0	16.9	5.0	22.0	8.0	34.0	1.4.6
4.0	15.6	4.5	17.6	6.0	23.8	10.0	36.8	»
4.5	16 3	5.0	18.5	7.0	26.0	12.0	39.7	»
4.9	17.5	5.6	19.8	7.9	27.8	12.8	40.7	»+1.2.4
4.2	12.0	5.0	14.0	7.5	21.0	13.0	39.0	1.2.4
6.0	7.6	6.0	9.0	8.0	17.0	14.0	35.0	»
10.0	5.0	10.0	6.0	10.0	12.6	16.0	28.5	»
20.0	2.4	20.0	3.0	20.0	5.6	20.0	23.3	»
30.0	1.0	30.0	1.6	30.0	3.0	30.0	19.0	»

1.5.8 = $(NH_4)_2O.5B_2O_3.8H_2O$; 1.2.4 = $(NH_4)_2O.2B_2O_3.4H_2O$; 1.4.6 = $(NH_4)_2O.4B_2O_3.6H_2O$.

The authors also made numerous determinations at 31°, 31°.5, 32° and 35° in order to ascertain the composition of solutions in contact with the 1.4.6 compound near its transition temperature.

The cryohydric points are as follows :

t°.	Gms. per 100 gms. sat. sol.		Solid Phase.	t°.	Gms. per 100 gms. sat. sol.		Solid Phase.
	$(NH_4)_2O$.	B_2O_3.			$(NH_4)_2O$.	B_2O_3.	
−1.37..	0.58	3.92	Ice+1.5.8	− 1.30....	1.01	1.03	Ice + 1.2.4
−1.25..	0.36	3.02	» + »+H_3BO_3	− 8.5....	3.57	0.85	»
−2.05..	1.21	4.97	» + »+1.2.4	−15.0....	17.61	0.57	»
−1.08..	0.54	1.47	» +1.2.4	+31 tr. pt.	3.63	13.59	1.5.8+1.4.6+1.2.4

SOLUBILITY OF AMMONIUM PENTABORATE AND OF AMMONIUM DIBORATE IN WATER.

(Sborgi and Ferri, 1921; Sborgi and Gallichi, 1924.)

Results for Pentaborate.
$(NH_4)_2O.5B_2O_3.8H_2O$.

t°.	Gms. $(NH_4)_2O.5B_2O_3$ per 100 gms. sat. sol.	t°.	Gms. $(NH_4)_2O.5B_2O_3$ per 100 gms. sat. sol.
− 1.37 (cryo.)..	3.92	40..	11.40
0	3.95	45..	12.81
10	5.39	60..	18.25
20	7.07	75..	24.40
30	9.10	90..	30.29
35	10.02		

Results for Diborate.
$(NH_4)_2O.2B_2O_3.4H_2O$.

t°.	Gms. $(NH_4)_2O.2B_2O_3$ per 100 gms. sat. sol.	t°.	Gms. $(NH_4)_2O.2B_2O_3$ per 100 gms. sat. sol.
− 1.08 (cryo.)..	3.62	35..	13.02
0..........	3.75	40..	15.77
10..........	5.26	45..	18.41
20..........	7.63	60..	27 interp.
25..........	9.00	65..	30.80
30..........	10.80	90..	52.68

SIMULTANEOUS SOLUBILITY OF AMMONIUM DIBORATE AND OTHER SALTS IN WATER AT 0°, 10° AND 25°.

(Sborgi and Franco, 1921.)

	Gms. equivalents per 1000 gms. mols. H_2O.				
	NH_4Cl.	NaCl.	$Na_2B_4O_7$.	$(NH_4)_2B_4O_7$.	Solid Phase.
0.	97.92	.....	.....	4.35	$(NH_4)_2B_4O_7.4H_2O+NH_4Cl$
0.	......	......	1.52	6.38	» $+Na_2B_4O_7.10H_2O$
0.	......	108.06	0.85	....	NaCl + »
0	49.33	85.79	1.58	.....	» + » $+NH_4Cl$
0.	58.71	69.14	1.92	.....	$Na_2B_4O_7.10H_2O+NH_4Cl$
0.	68.87	48.82	1.97	.....	» »
0.	74.10	40.57	2.92	.....	» »
0.	87.14	21.22	3.77	.... .	» » $+(NH_4)_2B_4O_7.4H_2O$
0.	74.98	17.06	3.57	.....	» $+(NH_4)_2B_4O_7.4H_2O$
0	48.71	10.84	3.22	.... .	» »
10.	......	.. ...	2.35	9.88	» »
10.	111.66	......	.. .	5.06	NH_4Cl + »
10.	......	109.22	0.97	.....	$NaCl+Na_2B_4O_7.10H_2O$
10.	39.20	91.52	2.25	.....	» »
10.	61.38	80.33	2.34	.... .	» » $+NH_4Cl$
10.	76.50	51.42	3 99	.....	$Na_2B_4O_7.10H_2O$ + »
10.	91.50	30.14	5.00	.....	» »
10.	95.05	25.98	6.30	.....	» » $+(NH_4)_2B_4O_7.4H_2O$
10.	73.94	18.09	5.71	.....	» $+(NH_4)_2B_4O_7.4H_2O$
10.	58.70	12.35	4.74	.....	» »
10.	112.7	0.03	4.41	.....	NH_4Cl + »
25.	132.10	......	.....	10.40	» »
25.	. ....	.. ...	6.25	19.96	$Na_2B_4O_7.10H_2O$ + »
25.	......	109.53	1.80	.. ..	» + NaCl
25.	85.16	71.49	9.80	.....	» + » $+NH_4Cl$
25.	97.99	50.00	13.00	.....	» + NH_4Cl
25.	105.52	38.32	14.83	.....	» + » $+(NH_4)_2B_4O_7.4H_2O$
25.	93.90	32.00	13.90	.....	» $+(NH_4)_2B_4O_7.4H_2O$
25.	78.90	25.00	12.80	.... .	» »

The authors discuss the application of the results to the technical production of borax and elaborate this phase of the subject in a subsequent paper.

(Sborgi and Franco, 1922.)

RECIPROCAL SOLUBILITY OF AMMONIUM DIBORATE AND AMMONIUM SULFATE IN WATER AT THE CRYOHYDRIC TEMPERATURES.

(Sborgi and Bovalini, 1924.)

	Gms. equiv per 100 gms. mols. H_2O.		Gms. per 100 gms. H_2O.		Gms. per 100 gms. sat. sol.		
t°.	$(NH_4)_2SO_4$.	$(NH_4)_2B_4O_7$.	$(NH_4)_2SO_4$.	$(NH_4)_2B_4O_7$.	$(NH_4)_2SO_4$	$(NH_4)_2B_4O_7$.	Solid Phase.
−19.34.	179.53	2.441	65.79	1.300	39.68	1.28	$(NH_4)_2B_4O_7.4H_2O+(NH_4)_2SO_4$+Ice
−16.32.	180.50	3.50	66.15	1.865	39.81	1.83	$(NH_4)_2B_4O_7.4H_2O+(NH_4)_2SO_4$

RECIPROCAL SOLUBILITY OF AMMONIUM BIBORATE AND AMMONIUM SULFATE IN WATER AT SEVERAL TEMPERATURES. (Sborgi and Gallichi, 1924.)

Results at 10°: Gms. per 100 gms. sat. sol.		Results at 20°: Gms. per 100 gms. sat. sol.		Results at 50°: Gms. per 100 gms. sat. sol.		Solid Phase at Each Temperature.
$(NH_4)_2SO_4$.	$(NH_4)_2B_4O_7$.	$(NH_4)_2SO_4$.	$(NH_4)_2B_4O_7$.	$(NH_4)_2SO_4$.	$(NH_4)_2B_4O_7$.	
0.0	5.255	3.25	6 39	0.0	20.88	$(NH_4)_2B_4O_7.4H_2O$
8.295	3.018	22.80	3.204	16.31	13 73	»
37.09	1.807	38.369	2.48	31.29	10.01	»
41.10	1.60	41.40	2.36	41.14	8.60	»+$(NH_4)_2SO_4$
42.20	0.0	42.99	0.0	45.77	0.0	$(NH_4)_2SO_4$

Results at 25°: Gms. per 100 gms. sat. sol.		Results at 35°: Gms. per 100 gms. sat. sol.		Solid Phase at Each Temperature.
$(NH_4)_2SO_4$.	$(NH_4)_2B_4O_7$.	$(NH_4)_2SO_4$.	$(NH_4)_2B_4O_7$.	
0.0	8.998	0.0	13.02	$(NH_4)_2B_4O_7.4H_2O$
5,17	6.747	1.594	11.803	»
13.07	5.10	2.518	11.326	»
23.865	4.052	14.92	7.413	»
29.65	3.518	19.50	6.672	»
37.186	3.1388	25.19	5 881	»
41.20	2.886	36.38	4.70	»
41.62	2.83	41.56	4.214	» +$(NH_4)_2SO_4$
42.17	2.016	43.17	1.69	$(NH_4)_2SO_4$
43.06	0 65	44.22	0.0	»
43.41	0.0			»

The cryohydric temperature of the system $(NH_4)_2B_4O_7 + Na_2B_4O_7 +$ Ice is — 1°.22 and 100 gms. of the saturated solution contain 3.472 gms. of $(NH_4)_2B_4O_7$ and 0.6447 gm. of $Na_2B_4O_7$. (Sborgi and Gallichi, 1924.)

RECIPROCAL SOLUBILITY OF AMMONIUM BIBORATE AND SODIUM BIBORATE IN WATER AT VARIOUS TEMPERATURES. (Sborgi and Gallichi, 1924.)

t°.	Gms. per 100 gms sat. sol. $Na_2B_4O_7$.	Gms. per 100 gms sat. sol. $(NH_4)_2B_4O_7$.	Solid Phase.	t°.	Gms. per 100 gms. sat. sol. $Na_2B_4O_7$.	Gms. per 100 gms. sat. sol. $(NH_4)_2B_4O_7$.	Solid Phase.
0..	0.844	3.216	AB.4+SB.10	45..	10.00	18.62	AB.4+SB.10
10..	1.37	1.20	SB.10	45..	8.38	8.45	SB 10
10..	1.24	4.32	»	50.5	12.3	21.21	AB.4
10..	1.237	4.91	»+AB.4	50.5	13.83	21.16	» +SB.10
10..	0.93	4.96	AB.4	50.5	13.74	21.10	» +SB.5
16..	1,83	6.60	»+SB.10	50.5	13.31	18.18	SB.10
20..	2.22	7.73	» »	55..	13.23	23.58	AB.4
30..	3.42	11.02	AB.4	55..	17 46	23.47	» +SB.5
30..	4 08	11.19	»+SB.10	55..	17.33	19.62	SB.5
30..	3.86	8.81	SB.10	55..	17.30	19.30	SB.5+SB.10
25..	1.19	9 12	AB.4	55..	15.92	13.52	SB.10
25..	2.96	9.26	»	55..	14.03	5.88	»
25..	3.07	9.27	»+SB.10	57..	17.60	24.60	AB.4+SB.5
25..	3.06	8.77	SB.10	57..	17 27	15.88	SB.5
25..	3.03	8.16	»	57..	17.25	14.28	» +SB.10
25..	3.01	7.73	»	57..	16.29	11.07	SB.10
25..	2.97	6.26	»	65..	18.62	29.00	AB.4
35..	3.42	13.27	AB.4	65..	19 36	28.94	» +SB.5
35..	5.54	13.42	»+SB.10	65..	19.25	22.01	SB.5
35..	5.12	9.82	SB.10	65..	18.70	10.70	»
35..	4 63	3.29	»	65..	18.30	5.33	»

AB.4 = $(NH_4)_2B_4O_7.4H_2O$; SB.10 = $Na_2B_4O_7.10H_2O$; SB.5 = $Na_2B_4O_7.5H_2O$.

EQUILIBRIUM IN THE SYSTEM $(NH_4)_2B_4O_7 + Na_2SO_4 \rightleftharpoons Na_2B_4O_7 + (NH_4)_2SO_4$.

(Sborgi, Bovalini and Modici, 1924; Sborgi, 1924)

Results for aqueous solutions saturated with respect to:

	$(NH_4)_2B_4O_7.4H_2O + (NH_4)_2SO_4$ Gms. equiv. per 1000 gms. mols. H_2O.		$(NH_4)_2B_4O_7.4H_2O + Na_2B_4O_7.10H_2O$ Gms. equiv. per 1000 gms. mols. H_2O.		$Na_2B_4O_7.10H_2O + Na_2SO_4.10H_2O$ Gms. equiv. per gms. mols. H_2O.	
t°.	$(NH_4)_2SO_4$.	$(NH_4)_2B_4O_7$.	$Na_2B_4O_7$.	$(NH_4)_2B_4O_7$.	$Na_2B_4O_7$.	Na_2SO_4.
—10.....	184.0	4.900	......	......	......	....
0	189.0	5.00	1.657	6.594	1.789	12.67
+10.. ..	195.45	5.257	2.349	9.801	1.384	23.319
15.....	198.42	6.50	3.22	12.797	2.326	32.222
25.....	204.23	9.563	6.25	19.88	2.627	72.27
25.65..	204.0	10.0	6 08	19 83	2.50	75.64
26.....	204.5	10.3	7.5	21.3	3.0	78.0
30.....	207.0	12.0	10 0	25.5	3.25	104.36
35.....	208.94	14.607	12.214	31.138	4.266	123.59[b]
38.7. .	212.98	18.5	16.6	37.5	5.50	119.72[b]
40.....	212.42	20.5	18.8	40.0	6 0	118.5[b]
41.....	214.0	20.5	19.0	41.0	6.25	118.0[b]
41.7...	214.5	22.5	21.0	42 36	6.80	117.17[b]
45.....	218.0	26.5	25.0	49.0	8.381	114.57[b]
50... .	223.14	32.141	37.0	60.0	12.467	110.51[c]
55.....	228.0	38.0	52.86	74.73[a]	16.26	108.0[c]
55.7...	229.0	40.0	53.25	76.26[a]	17.0	107.3[c]

[a] Solid Phase $(NH_4)_2B_4O_7.4H_2O+Na_2B_4O_7.5H_2O$. [b] Solid Phase $Na_2B_4O_7.10H_{20}+Na_2SO_4$.

[c] Solid Phase $Na_2B_4O_7.5H_2O+Na_2SO_4$.

	$(NH_4)NaSO_4.4H_2O + Na_2SO_4.10H_2O + Na_2B_4O_7.10H_2O$. Gms. equiv. par 1000 gms. mols. H_2O.			$(NH_4)NaSO_4.4H_2O + (NH_4)_2B_4O_7.4H_2O + Na_2B_4O_7.10H_2O$. Gms. equiv. per 1000 gms. mols. H_2O.		
t°.	$(NH_4)_2SO_4$.	Na_2SO_4.	$Na_2B_4O_7$.	$(NH_4)_2SO_4$.	Na_2SO_4.	$Na_2B_4O_7$.
—10.5..	157.67	14.44	3.09	166.15	10.68	2.76
—10....	156.12	14.828	3.259	157 245	14.328	2.80
0....	129.73	26.30	4.70	132.13	25.0	5.0
+10....	106 39	42.54	5.25	116.494	37.148	7.577
15....	93.0	59.0	5.50	113.56	43.80	9.35
25....	62.630	104.573	5.884	114.0	53.182	14.979
25.65.	62.13	108.76	6.0[a]	113.93	53.21	15.98
26....	63 5	107.4	7.6[b]	113.5	54.5	15.5
26....	61.0	110	3.5[c]	60.0	109	6.5[d]
30....	73.0	101.5	11.0[b]	114.0	57.5	19.5
35.. .	89.817	89.849	17.571[b]	116.786	60 219	28.187
38.7..	118.45	63.73	36.49[e] (30°)	20.0	119.0	4.5[d]

[a] Solid Phase $(NH_4)NaSO_4.4H_2O$ + $Na_2SO_4.10H_2O$ + Na_2SO_4 + $Na_2B_4O_7.10H_2O$.
[b] » » + $Na_2B_4O_7.10H_2O$ + »
[c] » » + $Na_2SO_4.10H_2O$ + »
[d] » $Na_2B_4O_7.10H_2O$ + » + »
[e] » » + $(NH_4)NaSO_4.4H_2O$ + » + $(NH_4)_2B_4O_7.10H_2O$.

	$(NH_4)NaSO_4.4H_2O + Na_2SO_4 + (NH_4)_2B_4O_7.4H_2O$. Gms. equiv. per 1000 gms. mols. H_2O.			$(NH_4)_2B_4O_7.4H_2O + Na_2SO_4 + Na_2B_4O_7.10H_2O$. Gms. equiv. per 1000 gms. mols. H_2O		
t°.	$(NH_4)_2SO$	Na_2SO_4.	$(NH_4)_2B_4O_7$.	$(NH_4)_2SO_4$.	Na_2SO	$Na_2B_4O_7$.
40....	135.09	79.81	27.75	119.50	62.25	42.25
41.7..	152.42	74.45	28.65	111.78	69.65	48.43[a]
45.0..	165.76	76.44	33.25	121.44	58.80	52.90[b]
50.0..	171.08	84 99	43.63	128.54	42.46	67.29[b]
55.0..	168.61	99.26	60.53	140.63	26.78	94.09[b]

[a] Solid Phase also contains, $Na_2B_4O_7$ $5H_2O$. [b] Solid Phase $(NH_4)_2B_4O_7.4H_2O+Na_2SO_4$ $+Na_2B_4O_7.5H_2O$

Equilibrium in the System $(NH_4)_2B_4O_7+Na_2SO_4 \rightleftharpoons Na_2B_4O_7+(NH_4)_2SO_4$ (*Con.*).

Results for aqueous solutions saturated with respect to :

	$(NH_4)_2B_4O_7.4H_2O + (NH_4)NaSO_4.4H_2O + (NH_4)_2SO_4$. Gm. equiv. per 1000 gm. mols. H_2O.				$(NH_4)_2B_4O_7.4H_2O + (NH_4)NaSO_4.4H_2O + (NH_4)_2SO_4$. Gm. equiv. per 1000 gm. mols. H_2O.		
t°.	$(NH_4)_2SO_4$.	Na_2SO_4.	$(NH_4)_2B_4O_7$.	t°.	$(NH_4)_2SO_4$.	Na_2SO_4.	$(NH_4)_2B_4O_7$.
—10.5.	177.52	9.71	2.60	35...	195.54	44.41	17.54
—10...	177.55	9.85	2.60	38.7.	195.21	49.21	21.26
0...	182.918	18.101	4.685	40...	194.5	51.5	23.0
+10...	187.654	23.778	6.047	41...	192.98	54.0	24.62
15...	189.25	27.0	7.25	41.7.	192.80	54.9	25.7
25...	193.89	34.0	10.11	45...	190.65	63.0	31.0
25.65	193.68	34.69	11.15	50...	184.06	78.13	42.40
26...	193.0	35.0	11.5	55...	170.22	98.42	60.37
30...	195.0	38.5	13.0	55.7.	168.28	101.28	62.84*

(*) Na_2SO_4 also in Solid Phase.

The authors also give results for the solubility of the individual salts in water at the above temperatures, and for mixtures of ammonium and sodium sulfates with the double salt $(NH_4)NaSO_4$. Determinations of the transformation temperatures in the above system are given by Sborgi and Stefanini, 1924.

Br

AMMONIUM BROMIDE NH_4Br.

Solubility in Water.

(Smith and Eastlack, 1916.)

(Determinations by sealed tube method.)

t°.	Gms NH_4Br per 100 Gms. H_2O.	t°.	Gms. NH_4Br per 100 Gms. H_2O.	t°.	Gms. NH_4Br per 100 Gms. H_2O.
−17 Eutec.	47.3	60	107.8	130	180
0	60.6	70	116.8	137.3	Transition pt.
10	68	80	126	140	192.3
20	75.5	90	135.6	150	202.5
30	83.2	100	145.6	160	213.4
40	91.1	110	156.5	170	225.5
50	99.2	120	167.8		

More recent determinations by Benrath and Schiffers, 1938, and Benrath Gjedebo, Schiffers and Wunderlich, 1937, gave the following results.

t°	Gms. NH_4Br per 100 gms. sat. sol.	t°	Gms. NH_4Br per 100 gms. sat. sol.	t°	Gms. NH_4Br per 100 gms. sat. sol.
0	37.3	70	52.8	200	71.5
10	40.0	80	54.4	225	74.2
20	42.6	90	56.0	250	76.5
25	43.9	100	57.4	275	78.2
30	45.0	120	61.5	300	81.0
40	47.3	140	64.5	350	84.5
50	49.4	160	67.0	400	87.5
60	51.2	180	69.5	480	91.5

SOLUBILITY OF AMMONIUM BROMIDE IN AQUEOUS SOLUTIONS OF HYDROBROMIC ACID AT 25°.

(Scott and Durham, 1930.)

Gms. per 100 gms. sat. solution	
HBr	NH_4Br
0.0	43.86
12.53	27.91
16.94	24.06
22.72	15.96

SOLUBILITY OF AMMONIUM BROMIDE IN AQUEOUS SOLUTIONS OF LEAD BROMIDE AT 25° AND VICE VERSA.

(Wilkerson, Bathurst and Parton, 1937.)

Gms. per 100 gms. H_2O		Solid Phase	Gms. per 100 gms. H_2O		Solid Phase
$PbBr_2$	NH_4Br		$PbBr_2$	NH_4Br	
0.0	79.39	NH_4Br	1.38	32.13	$NH_4Br.2PbBr_2$
4.3	82.56	"	0.392	19.26	"
8.93	84.37	"	0.232	13.58	"
16.26	88.80	" + $2NH_4Br.PbBr_2$	0.155	6.688	"
14.89	81.87	$2NH_4Br.PbBr_2$	0.155	5.607	"
14.07	76.07	"	0.173	4.239	"
12.99	69.90	"	0.200	3.398	" + $PbBr_2$
12.17	63.53	"	0.244	2.066	$PbBr_2$
11.87	61.44	" + $NH_4Br.2PbBr_2$	0.273	1.444	"
11.49	60.75	$NH_4Br.2PbBr_2$	0.572	0.395	"
5.845	50.03	"	0.981	0.00	"

AMMONIUM Cadmium **BROMIDE** $(NH_4)CdBr_3.\frac{1}{2}H_2O$.

100 parts water dissolve 137 parts of the salt; 100 parts of alcohol dissolve 18.8 parts and 100 parts of ether dissolve 0.36 part. (Eder, 1876.)

AMMONIUM Platinum **BROMIDE** $(NH_4)_2PtBr_6$.

100 gms. sat. aqueous solution contain 0.59 gm. salt at 20°. (Halberstadt, 1884.)

AMMONIUM Platinum **BROMIDE** $(NH_4)_2PtBr_6$.

SOLUBILITY IN WATER. (Archibald and Kern, 1917.)

t°.	Gms. $(NH_4)_2PtBr_6$ per 100 gms. H_2O.	t°.	Gms. $(NH_4)_2PtBr_6$ per 100 gms. H_2O.	t°.	Gms. $(NH_4)_2PtBr_6$ per 100 gms. H_2O.
0.2......	0.4165	29.7......	0.8147	70.0.....	1.9265
7.3......	0.5002	40.0......	1.0355	80.0.....	2.3002
19.0......	0.6438	50.0......	1.2087	90.0.....	2.8370
25.0......	0.7384	60.0......	1.5780	99.0.....	3.5866

SOLUBILITY IN AQUEOUS SOLUTIONS OF AMMONIUM BROMIDE AT 20°.

(Archibald and Kern, 1917.)

Gms. mols. NH_4Br per liter.	Gms. $(NH_4)_2PtBr_6$ per 100 gms. solvent.
0.10	0.0359
0.20	0.0168
1.00	0.0080
2.00	0.0032

AMMONIUM Tin BROMIDES Mono $= NH_4SnBr_3.H_2O$; Di $= (NH_4)_2SnBr_4.H_2O$; Tetra $= (NH_4)_4SnBr_6.H_2O$.

SOLUBILITY OF STANNOUS MONO AMMONIUM BROMIDE IN WATER.

(Rimbach and Fleck, 1916.)

t°.	Gms. per 100 gms. sat. sol. Br.	Sn.	NH_4.	Solid Phase.
0.1....	15.16	4.95	1.91	$NH_4.SnBr_3.H_2O + SnBr_2.H_2O$
17.7....	19.23	7.03	2.29	» »
36.8....	26.73	11.51	2.54	» »
56.7....	40.84 +	20.30 +	3.06 = 64.2 gms.	$NH_4SnBr_3.H_2O$
74.6....	49.43 +	25.56 +	3.71 = 77.7 gms.	»

At temperatures below 56°.7 the atomic ratios of Br : Sn : NH_4 did not correspond to the double salt hence in these cases the solid phase was a mixture of the double salt and stannous bromide.

SOLUBILITY OF STANNOUS DIAMMONIUM BROMIDE IN WATER

(Rimbach and Fleck, 1916.)

t°.	Gms. per 100 gms. sat. sol. Br.	Sn.	NH_4.	Solid Phase.
0.2........	21.57	1.99	4.26	$(NH_4)_2SnBr_4.H_2O+SnBr_2.H_2O$
14.4... ...	26.65	4.49	4.65	» »
36.6..	38.87	10.19	5.69	» »
60.6........	48.70	16.01	6.13	» »
80.5........	52.21 +	19.36 +	5.91 = 77.4 gms.	$(NH_4)_2SnBr_4.H_2O$

The ratio of Br : Sn : NH_4 in solution, corresponding to the double salt, was reached only at temperatures above 60°.6.

SOLUBILITY OF STANNOUS TETRA AMMONIUM BROMIDE IN WATER.

(Rimbach and Fleck, 1916.)

t°.	Gms. per 100 gms. sat. sol. Br.	Sn.	NH_4.	Solid Phase.
1.8........	30.33	0.65	6.65	$(NH_4)_4SnBr_6.H_2O+SnBr_2.H_2O$
16.0........	34.62	2.00	7.21	» »
73.3........	52.52	10.37	8.71	» »
91.6........	56.66	13.53	8.68	» »

The atomic ratio Br : Sn : NH_4 corresponding to the double salt was not reached below 91°.6.

SOLUBILITY OF AMMONIUM BROMIDE IN ABSOLUTE ETHYL ALCOHOL, METHYL ALCOHOL, AND IN ETHER.

(Eder; de Bruyn — Z. phys. Ch. 10, 783, '92.)

t°.	In Ethyl Alcohol. Gms. NH_4Br per 100 Grams. Solution.	Alcohol.	In Methyl Alcohol. Gms NH_4Br per 100 Grams. Solution	Alcohol.	In Ether (0.720 Sp. Gr.). Gms. NH_4Br per 100 Grams. Ether.
15	2.97	3.06	....	....	0.123
19	3.12	3.22	11.1	12.5	....
78	9.50	10.50	....	....	....

100 cc. ethyl alcohol of $d_{15} = 0.8352$ dissolve 7.8 grams NH_4Br at 15°, d_{15} of sat. sol. $= 0.8848$. (Greenish, 1900.)

100 cc. anhydrous hydrazine dissolve 110 gms. NH_4Br at room temp. with evolution of ammonia. (Welsh and Broderson, 1915.)

100 gms. glycerol of $d_{20} = 1.2326$ dissolve 31.9 gms. NH_4Br at 20°. (Holm, 1922.)
» 1.2645 » 27.2 » »

SOLUBILITY OF AMMONIUM BROMIDE AT 25° IN MIXTURES OF:

(Herz and Kuhn, 1908.)

Methyl and Ethyl Alcohols.			Propyl and Methyl Alcohols.			Propyl and Ethyl Alcohols.		
Gms. CH_3OH per 100 Gms. Solvent.	$d\frac{25}{4}$ of Sat. Sol.	Gms. NH_4Br per 100 cc. Sat. Sol.	Gms. C_3H_7OH per 100 Gms. Solvent.	$d\frac{25}{4}$ of Sat. Sol.	Gms. NH_4Br per 100 cc. Sat. Sol.	Gms. C_3H_7OH per 100 Gms. Solvent.	$d\frac{25}{4}$ of Sat. Sol.	Gms. NH_4Br per 100 cc. Sat. Sol.
0	0.8065	2.55	0	0.8605	9.83	0	0.8065	2.55
4.37	0.8083	2.99	11.11	0.8524	8.51	8.51	0.8062	2.51
10.40	0.8117	3.21	23.8	0.8426	6.90	17.85	0.8052	2.37
41.02	0.8252	5.06	65.2	0.8184	3.08	56.6	0.8048	1.63
80.69	0.8501	8.13	91.8	0.8097	1.28	88.6	0.8042	1.11
84.77	0.8508	8.47	93.75	0.8089	1.25	91.2	0.8049	1.05
91.25	0.8551	9.34	100	0.8059	0.95	95.2	0.8059	1.04
100	0.8605	9.83				100	0.8059	0.95

Tetra Ethyl **AMMONIUM BROMIDE** $N(C_2H_5)_4Br$

SOLUBILITY OF TETRA ETHYL AMMONIUM BROMIDE IN SEVERAL SOLVENTS.

(Bjerrum and Josefowlez, 1932.)

Solvent	Formula	t°	d. of sat. sol.	Gms. $N(C_2H_5)_4Br$ per 100 gms. sat. sol.
Water	H_2O	20	1.193	75.5
"	"	35	1.1935	76.7
Methyl Alcohol	CH_3OH	20	1.0225	58.3
" "	"	35	1.0315	61.5
Ethyl Alcohol	C_2H_5OH	20	0.9151	34.6
" "	"	35	0.9288	40.9
Acetone	$(CH_3)_2CO$	20	0.7903	0.193
"	"	35	0.7740	0.252

SOLUBILITY OF TETRA ETHYL **AMMONIUM BROMIDE** $N(C_2H_5)_4Br$, AND OF TETRA METHYL AMMONIUM BROMIDE $N(CH_3)_4Br$ IN ACETONITRILE.

(Walden — Z phys Ch., 55, 712, '06.)

100 cc. sat. solution in CH_3CN contain 9.59 gms. $N(C_2H_5)_4Br$ at 25°.
100 cc. sat. solution in CH_3CN contain 0.17 gm. $N(CH_3)_4Br$ at 25°.

SOLUBILITY OF TETRA ETHYL AMMONIUM BROMIDE IN WATER AND IN CHLOROFORM AT 25°.

(Peddle and Turner, 1913.)

100 gms. H_2O dissolve 279.5 gms. $N(C_2H_5)_4Br$.
100 gms. $CHCl_3$ dissolve 25.01 gms. $N(C_2H_5)_4Br$.

Data for the distribution of propyl benzyl methyl phenyl **AMMONIUM BROMIDE** between water and chloroform at 25° are given by Wedekind and Paschke (1910).

Tetra methyl**AMMONIUM BROMIDE** $(CH_3)_4NBr$.

100 cc. pure Ethyl urethan dissolve 0.22 gm. $(CH_3)_4NBr$ at 60°. (Stuckgold, 1917.)

Perhaloid**AMMONIUM BROMIDES**, etc.

SOLUBILITY OF EACH IN ACETIC ACID AT 38°.

(Mc Combie and Reade, 1923.)

Compound.					Formula.	Gms. cmpd. per liter.
Phenyl	trimethyl	Ammonium	Bromide	Di Chloride...	$N(C_6H_5)(CH_3)_3BrCl_2$	. 50.0
»	»	»	»	Di Bromide...	$N(C_6H_5)(CH_3)_3BrBr_2$	8.0
»	»	»	»	Di Iodide.....	$N(C_6H_5)(CH_3)_3BrI_2$	6.5
»	»	»	»	Iodo Bromide.	$N(C_6H_5)(CH_3)_3BrIBr$	6.6
»	»	»	Chloride	Iodo Chloride.	$N(C_6H_5)(CH_3)_3ClICl$	13.3
»	»	»	Iodide	Iodo Iodide...	$N(C_6H_5)(CH_3)_3II_2$	1.6

SOLUBILITY OF AMMONIUM POLYHALIDES IN WATER AND IN CARBON TETRACHLORIDE AT 25°.

(Cremer and Duncan, 1931.)

Br

Compound	Gm. Mols. Cmpd. (1) per liter CCl_4	Gms. Cmpd. per 100 gms. sat. sol. in H_2O
NH_4IBr_2	0.0084	Very soluble
$C_3H_7(a)NH_3IBr_2$	0.0076	" "
$C_3H_7(b)NH_3IBr_2$	0.0025	" "
$C_2H_5NH_3IBr_2$	0.0066	Readily soluble
$(CH_3)_3NHIBr_2$	0.0025	Moderately soluble
$CH_3NH_3IBr_2$	0.0013	" "
$(C_2H_5)_2NH_2IBr_2$	0.0012	" "
$C_6H_5N(CH_3)IBr_2$	0.00023	1.33
$C_6H_5NHIBr_2$	0.00018	1.27
$(CH_3)_2NH_2IBr_2$	0.00004	3.0 at 0°
$(CH_3)_4NIBr_2$	0.00004	0.85
$(CH_3)_3N(C_2H_5)IBr_2$	0.00002	0.60
$(C_2H_5)_4NIBr_2$	0.00000	0.25

(1) The authors fail to state the terms in which their results for CCl_4 are expressed.

SOLUBILITY OF AMMONIUM BROMIDE IN LIQUID AMMONIA.

t°	Gms. NH_4Br per 100			t°	Gms. NH_4Br per 100		
	gms. NH_3	cc sat. sol. in NH_3			gms. NH_3	cc sat. sol. in NH_3	
-50	—	47.1	(1)	-38.2	—	50.6	(1)
-44	—	48.2	(1)	-33.9	90.75	50.46 (d. = 1.0608)	(2)
-41.2	—	48.9	(1)	-31.8	—	52.0	(1)
-42.8	—	49.0	(1)	0	137.9	—	(3)
-40.5	—	49.7	(1)	25	237.9	—	(4)

(1) Scherer, 1931; (2) Johnson and Krumboltz, 1933; (3) Linhard and Stephan, 1933, 1934; (4) Hunt, 1932.

100 gms. liquid Sulfur Dioxide dissolve 0.059 gm. NH_4Br at 0°. (Jander and Wickert, 1936, 1937.)

AMMONIUM FORMATE $HCOONH_4$, and also Ammonium Acid Formate.

SOLUBILITY IN WATER.

(Groschuff — Ber. 36, 4351, '03.)

t°.	Gms. $HCOONH_4$ per 100 Gms. Solution.	Gms. $HCOONH_4$ per 100 Gms. Water.	Solid Phase.
−20	41.9	72	$HCOONH_4$
0	50.5	102	"
20	58.9	143	"
40	67.1	204	"
60	75.7	311	"
80	84.2	531	"
116 m. pt.			

t°.	Gms. per 100 Gms. Solution. $HCOONH_4$.	Gms. per 100 Gms. Solution. HCOOH.	Solid Phase.
− 6.5	46.7	34.1	$HCOONH_4.HCOOH$
+ 1.5	49.6	36.2	"
6	51.3	37.4	"
8.5	52.1	38	"
− 7	49.6	36.2	$HCOONH_4$ labil.
+13	53	38.6	" stabil.
29	55.8	40.7	" "
39	57.8	42.2.	H_2O free solution

SOLUBILITY OF AMMONIUM FORMATE IN FORMIC ACID SOLUTIONS.

(Groschuff.)

30 grams of $HCOONH_4$ dissolved in weighed amounts of anhydrous formic acid and cooled to the point at which a solid phase separated.

t°.	Gms. $HCOONH_4$ per 100 Gms. Solution.	G. M. $HCOONH_4$ per 100 G. M. HCOOH.	Solid Phase.
− 3	35.3	39.9	$HCOONH_4.HCOOH$.
+ 8.5	40.6	49.9	"
21.5	50	73	"

t°.	Gms. $HCOONH_4$. per 100 Gms. Solution.	G. M. $HCOONH_4$ per 100 G. M. HCOOH.	Solid Phase.
11	50	73	$HCOONH_4$ labil.
39	57.8	100	" stabil.
78	73.1	199	" "
116 m. pt.	100	.∞	" "

100 gms. 95% Formic Acid dissolve 6.2 gms. $HCOONH_4$ at 21°. (Aschan, 1913.)

CH

Freezing-point data for mixtures of NH_4HCOO + HCOOH are given by Kendall and Adler, 1921.

AMMONIUM METHIONATE $(NH_4)_2CH_2O_6S_2$.

100 gms. H_2O dissolve 32.01 gm. $(NH_4)_2CH_2O_6S_2$ at 25°. (Backer and Terpstra, 1929.)

AMMONIUM ACETATE CH_3COONH_4.

SOLUBILITY IN AQUEOUS SOLUTIONS OF ACETIC ACID. (Sugden, 1926.)

t°	Gms. per 100 gms sat. sol. CH_3COOH.	Gms. per 100 gms sat. sol. CH_3COONH_4	Solid Phase.
0...	3.7	63.8	CH_3COONH_4
0...	15.8	61.1*	»
0...	19.6	48.9	$CH_3COONH_4.CH_3COOH$
0...	61.6	28.1	»
16...	0.91	67.8	CH_3COONH_4
16...	7.73	64.4	»
16...	16.0	62.6	»
16...	19.7	61.1*	»
16...	23.9	59.6*	»
16...	17.1	61.1	$CH_3COONH_4.CH_3COOH$
16...	21.7	55.6	»
16...	22.7	54.3	»

t°.	Gms. per 100 gms. sat. sol. CH_3COOH.	Gms. per 100 gms. sat. sol. CH_3COONH_4.	Solid Phase.
16...	38.1	42.5	$CH_3COONH_4.CH_3COOH$
16...	57.3	32.6	»
16...	72.3	27.3	»
25...	2.15	70.6	CH_3COONH_4
25...	12.0	67.0	»
25...	21.1	63.3	»
25...	31.3	58.9*	»
25 ..	23.2	60.7	$CH_3COONH_4.CH_3COOH$
25 ..	36.2	48.5	»
25...	47.6	41.0	»
25...	59.9	33.2	»

* Indicates unstable equilibrium.

AMMONIUM PhenoxyACETATE.
AMMONIUM *o* IodoBENZOATE, etc.

SOLUBILITY OF EACH IN WATER, METHYL ALCOHOL AND IN ETHYLALCOHOL AT 20°.

(Mc Master and Pratte, 1922.)

Salt.	Formula.	Gms. salt per 100 gms. Water.	CH_3OH.	C_2H_5OH.
Ammonium Phenoxyacetate	$C_6H_5O.CH_2COONH_4$......	13.03	3.97	0.44
" *p* Nitrophenylacetate	*p* $NO_2.C_6H_4CH_2.COONH_4$...	7.41	15.14	1.82
" *o* Iodo Benzoate	*o* $I.C_6H_4COONH_4$........	67.11	184.10	63.37
" *o* Methoxy "	*o* $CH_3O.C_6H_4.COONH_4$....	38.25	17.85	4.82
" 1.2.4 Dinitro "	1 2.4 $(NO_2)_2C_6H_3COONH_4$....	62.70	21.39	3.85
" 2.5 DichlorobenzeneSulfonate	$C_6H_3Cl_2.SO_3.NH_4$.........	11.30	20.15	2.59
" 4 Nitrochlorobenzene-2-Sulfonate	$C_6H_3.NO_2.ClSO_3NH_4$.....	4.72	2.76	0.96

AMMONIUM ACETATE

EQUILIBRIUM IN THE SYSTEM AMMONIUM ACETATE AND ACETIC ACID DETERMINED BY THE FREEZING-POOINT METHOD.

(Davidson and McAllister, 1930.)

CH

t°	Mol. Percent $NH_4C_2H_3O_2$	Solid Phase	t°	Mol. Percent $NH_4C_2H_3O_2$	Solid Phase
16.5	0.0	$HC_2H_3O_2$	56.4	34.95	$NH_4C_2H_3O_2.HC_2H_3O_2$
14.2	4.64	"	63.0	40.80	"
10.45	9.35	"	65.5	45.05	"
6.90	12.03	"	66.0	47.66	"
2.8	14.54	"	66.5 m.pt.	50.00	"
-3.0	17.08	"	66.0	51.75	"
-6.5	18.54	"	65.2	53.20	" $+NH_4C_2H_3O_2$
2.5	19.43	$NH_4C_2H_3O_2.HC_2H_3O_2$	68.5	54.83	$NH_4C_2H_3O_2$
9.6	20.67	"	75.7	58.70	"
24.0	23.15	"	93.0	69.50	"
40.1	27.06	"	102.0	76.84	"
50.1	31.10	"	113.0	100.00	"

Data for equilibrium in the System Ammonium Acetate + Nickel Acetate + Acetic Acid at 30° are given by Davidson and Chappell, 1933.

100 gms. Liquid Ammonia (NH_3) dissolve 253.16(?) gms. $NH_4C_2H_3O_2$ at 25°. (Hunt and Boncyk, 1933.)

100 gms. Liquid Sulfur Dioxide (SO_2) dissolve 1.09 gm. $NH_4C_2H_3O_2$ at 0°. (Jander and Ruppolt, 1937.

100 gms. Methyl Alcohol (CH_3OH) dissolve 7.89 gms. $NH_4C_2H_3O_2$ at 15° and 131.24 gms. at 94.2° (b.pt.). (Henstock, 1934.)

100 cc sat. solution of ammonium acetate in Acetone contain 0.27 gm. CH_3COONH_4 at 19°. (Roshdestwensky and Lewis, 1912.)

AMMONIUM TARTRATE (d) $(NH_4)_2C_4H_4O_6$.

SOLUBILITY OF AMMONIUM TARTRATE IN WATER.

(Timmermans and Dumont, 1931; Campbell and Slotin, 1933.)

The results of the above named investigators, although differing somewhat, especially at 20° and 30°, gave a curve from which the following values were read.

t°	Gms. $(NH_4)_2C_4H_4O_6$ per 100 gms. H_2O	Solid Phase	t°	Gms. $(NH_4)_2C_4H_4O_6$ per 100 gms. H_2O	Solid Phase
-7.6 Eutec.	40.0	Ice+$(NH_4)_2C_4H_4O_6$	25	67.0	$(NH_4)_2C_4H_4O_6$
0	45.0	$(NH_4)_2C_4H_4O_6$	30	70.5	"
10	55.0	"	40	76.5	"
15	59.5	"	50	81.5	"
20	63.0	"	60	87.0	"

AMMONIUM Acid TARTRATE (d)$(NH_4)HC_4H_4O_6$.

SOLUBILITY OF AMMONIUM ACID TARTRATE IN WATER.

AMMONIUM Acid TARTRATE (d)$(NH_4)HC_4H_4O_6$.

SOLUBILITY OF AMMONIUM ACID TARTRATE IN WATER.

(Timmermans and Dumont, 1931.)

CH

t°	Gms. $NH_4HC_4H_4O_6$ per 100 gms. H_2O	Solid Phase
-0.3 Eutec.	1.0	Ice + $NH_4HC_4H_4O_6$
15	2.35	$NH_4HC_4H_4O_6$
20	2.70	"
25	3.24	"

Results for equilibrium in the following systems are also given by Timmermans and Dumont, 1931.

(d) Ammonium Acid Tartrate + (l) Ammonium Acid Malate ± H_2O
(l) " " " + (l) " " " + "
(d) " " " + (d) " " chlor succinate + H_2O
(d) " " " + (l) " " " " + "
(d) " Neutral " + (d) " Neutral " " + "
(l) " " " + (d) " " " " + "
(l) " Acid Malate + (l) " Acid " + "
(l) " " " + (d) " " " + "

AMMONIUM Acid MALATE (l) $NH_4HC_4H_4O_5$.

SOLUBILITY OF AMMONIUM ACID MALATE IN WATER.

(Timmermans and Dumont, 1931.)

t°	Gms. $NH_4HC_4H_4O_5$ per 100 gms. H_2O	Solid Phase
- 4.0	20.0	(l) $NH_4HC_4H_4O_5$
+10	28.56	"
20	36.63	"
25	41.72	"

AMMONIUM SUCCINATE $(NH_4)_2(CH_2)_2(COO)_2$.

EQUILIBRIUM IN THE SYSTEM AMMONIUM SUCCINATE AMMONIUM CHLORIDE AND WATER AT 25°.2.

(Lansing, 1928.)

Ammonium succinate is designated as NH_4S in the paper and no indication given as to whether this represents the neutral or acid salt. The mixtures were shaken for about three weeks at 25.2°.

Gms. per 100 gms. sat. sol. NH_4Cl	Gms. per 100 gms. sat. sol. $(NH_4)_2(CH_2)_2(COO)_2$(?)	Solid Phase	Gms. per 100 gms. sat. sol. NH_4Cl	Gms. per 100 gms. sat. sol. $(NH_4)_2(CH_2)_2(COO)_2$(?)	Solid Phase
0.0	50.74	$(NH_4)_2(CH_2)_2(COO)_2$(?)	10.75	41.57	NH_4Cl
7.62	44.34	"	15.02	29.49	"
10.63	42.15	"	22.23	12.74	"
			28.47	0.0	

100 gms. Methyl Alcohol, CH_3OH, dissolve 1.62 gms. Ammonium Succinate at 15° and 5.84 gms. at 65.6° (b.pt.).

100 gms. Acetone, $(CH_3)_2CO$, dissolve 0.47 gms. Ammonium Succinate at 15°. (Henstock, 1934.)

CH

AMMONIUM Chloro SUCCINATES (d) $(NH_4)_2CH_2CHCl(COO)_2$; $NH_4HCH_2CHCl(COO)_2$.

SOLUBILITY OF EACH IN WATER.

(Timmermans and Dumont, 1931.)

Results for the:

Neutral (d) Succinate t°	Gms. $(NH_4)_2CH_2CHCl(COO)_2$ per 100 gms. H_2O	Solid Phase	Acid (d) Succinate t°	Gms. $NH_4HCH_2CHCl(COO)_2$ per 100 gms. H_2O	Solid Phase
- 8.8 (Eutec.)	33.0	Ice+$(NH_4)_2CH_2CHCl(COO)_2$	- 5.0	27.5	Ice +$NH_4HCH_2CHCl(COO)_2$
+15.0	61.30	$(NH_4)_2CH_2CHCl(COO)_2$	+20.0	53.14	$NH_4HCH_2CHCl(COO)_2$
20.0	69.03	"			

AMMONIUM URATE (Primary) $C_5H_3N_4O_3NH_4$.

SOLUBILITY OF THE LACTAM AND LACTIM FORMS IN WATER.

(Gudzeit, 1908–09.)

t°.	Gms. of Each per 1000 cc. Sat. Solution. Lactam.	Lactim.	Mixture of the Two.
18	0.456	0.304	0.414
37	0.817	0.540	0.741

AMMONIUM CITRATES.

SOLUBILITY IN AQUEOUS SOLUTIONS OF CITRIC ACID AT 30°.

(van Itallie, 1908.)

(Data read from curve plotted from original results.)

Gms. per 100 Gms. Sat. Sol. $C_6H_8O_7$.	Gms. per 100 Gms. Sat. Sol. NH_3.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. $C_6H_8O_7$.	Gms. per 100 Gms. Sat. Sol. NH_3.	Solid Phase.
65	0	$C_6H_8O_7.H_2O$	53	7.5	$C_6H_7O_7.NH_4$
68	0.5	"	56	8.2	"
72	1.3	"	59.1	8.5	$C_6H_7O_7NH_4+C_6H_6O_7(NH_4)_2$
75	2.3	$C_6H_8O_7.H_2O+C_6H_7O_7.NH_4$	54	8.5	$C_6H_6O_7(NH_4)_2$
70	2.4	$C_6H_7O_7.NH_4$	50	7.9	"
65	2.5	"	45.8	8.4	"
60	2.7	"	47	11.1	"
55	2.8	"	50	12.9	"
52	2.8	"	54.5	14.5	$C_6H_6O_7(NH_4)_2+C_6H_5O_7(NH_4)_3.?H_2O$
50	3.6	"	52	15	$C_6H_5O_7(NH_4)_3.?H_2O$
49.2	5.1	"	50	16	"
50	6.2	"	48.4	17.9	"

Composition of the solid phases determined by "Rest Method."

(Schreinemakers, Z. anorg. Ch. 37, 207.)

AMMONIUM PICRATE $C_6H_2(NO_2)_3ONH_4$.

100 cc. H_2O dissolve 1.1 gm. Am. picrate at room temp. (Squire and Caines, 1905.)

100 cc. 90% alcohol dissolve 1.2 gm. Am. picrate at room temp.

(Squire and Caines, 1905.)

AMMONIUM BENZOATE $C_6H_5COONH_4$.

SOLUBILITY IN WATER AND IN AQUEOUS ALCOHOL AT 25°.

(Seidell, 1910.)

Gms. C_2H_5OH per 100 Gms. Solvent.	d_{25} of Sat. Sol.	Gms. $C_6H_5COONH_4$ per 100 Gms. Sat. Sol.	Gms. C_2H_5OH per 100 Gms. Solvent	d_{25} of Sat. Sol.	Gms. $C_6H_5COONH_4$ per 100 Gms. S t. Sol.
0	1.043	18.6	60	0.930	15
10	1.027	18	70	0.901	12.2
20	1.012	18	80	0.864	8.3
30	0.997	18.1	90	0.828	4.2
40	0.979	18	95	0.810	2.7
50	0.956	17	100	0.796	1.6

Results in good agreement with the above are given by Gregg, Wilson and Wright, 1928.

100 gms. water dissolve 19.6 gms. $C_6H_5COONH_4$ at 14° 5, d_{14} of sat. sol. = 1.042. (Greenish and Smith, 1901.)

100 gms. water dissolve 83.33 gms. $C_6H_5COONH_4$ at b.-pt. (U. S. P.)

100 gms. glycerol dissolve 10 gms. $C_6H_5COONH_4$ at room temp. (Hager.)

100 gms. Methyl Alcohol CH_3OH, dissolve 6.39 gms. $NH_4C_6H_5COO$ at 15° and 13.07 gms. at 66° (b.pt.). A methyl alcoholate of the composition $NH_4(C_6H_5COO).1\frac{1}{2}CH_3OH$ was prepared from hot methyl alcohol. (Hemstock, 1934.)

AMMONIUM SALICYLATE $C_6H_4.OH.COONH_4$.

SOLUBILITY IN AQUEOUS ALCOHOL SOLUTIONS AT 25°.

(Seidell, 1909, 1910.)

Gms. C_2H_5OH per 100 Gms. Solvent	Sp. Gr. of Sat. Sol.	Gms. C_6H_4 $OHCOONH_4$ per 100 Gms. Sat. Sol.	Gms. C_2H_5OH per 100 Gms. Sat. Sol.	Sp. Gr. of Sat. Sol.	Gms. $C_6H_4.OH.$ $COONH_4$ per 100 Gms. Sat. Sol.
0	1.148	50.8	70	1.015	42
20	1.122	50.3	80	0.979	38
40	1.088	48.3	90	0.936	31.6
50	1.067	46.7	95	0.907	27.8
60	1.042	44.7	100	0.875	22.3

Results in good agreement with the above are given by Gregg, Wilson and Wright, 1928.

100 gms. Methyl Alcohol, CH_3OH, dissolve 71.55 gms. $NH_4C_6H_4OHCOO$ at 15° and 163.78 gms. at 72.8° (b.pt.). (Henstock, 1934)

SOLUBILITY OF AMMONIUM SALICYLATE IN ACETONE.

(Henstock, 1934.)

CH

t°	Gms. $NH_4C_6H_4OHCOO$ per 100 gms. CH_3COCH_3	Solid Phase	t°	Gms. $NH_4C_6H_4OHCOO$ per 100 gms. CH_3COCH_3	Solid Phase
15	69.65	$NH_4C_6H_4OHCOO$	45	37	(?)
25	24.0	"	55	46	"
35	28.8	" (?)	65	67	"

100 cc Ethyl Ether (U.S.P.) dissolve 0.67 gm. $NH_4C_6H_4OHCOO$ at about 20°. (Elvove, 1920.)

AMMONIUM NITROSALICYLATE, 5.2.1 $NO_2C_6H_3(OH)COONH_4$.

AMMONIUM NAPHTHALENE SULFONATES α and β $C_{10}H_7SO_3NH_4$.

SOLUBILITY OF EACH IN WATER AND IN METHYL AND ETHYL ALCOHOLS AT 20°.

(Mc Master and Prattle, 1923; 1924.)

Compound.	Formula.	Gms. compound per 100 gms. H_2O.	Gms. compound per 100 gms. CH_3OH.	Gms. compound per 100 gms. C_2H_5OH.
Ammonium Nitrosalicylate 5.2.1....	$NO_2C_6H_3(OH)COONH_4$	4.43	4.41	1.96
» α-Naphtalene sulfonate.	$C_{10}H_7SO_3NH_4$	45.91	34.45	9.22
» β-Naphtalene sulfonate.	»	11.71	8.33	2.53

AMMONIUM GLUCONATE $NH_4C_6H_{11}O_7$.

100 cc sat. solution of Ammonium Gluconate in Water contain 29.9 gms. $NH_4C_6H_{11}O_7$ at 25°. (May, Weisberg and Herrick, 1929.)

AMMONIUM LAURATE $C_{11}H_{23}COONH_4$.

100 cc. of ethylene trichloride dissolve 0.23 gms. ammonium laurate at 0°, 0.57 gm. at 10° and 1.46 gm. at 20°. (Straub, 1918, 1926.)

AMMONIUM Calcium MECONATE $NH_4.CaC_7HO_7.2H_2O$.

1 liter of a saturated solution of ammonium calcium meconate in aqueous 0.1 *n* ammonia contains 1.2783 gm. $NH_4CaC_7HO_7.2H_2O$ at 18°.

(Heiduschka and Faul, 1917.)

AMMONIUM MANDELATE $NH_4C_6H_5CHOHCOO$ (dl) and (l).

EQUILIBRIUM IN THE SYSTEM (dl) AMMONIUM MANDELATE, (dl) MANDELIC ACID AND WATER AT 25°.

(Ross and Morrison, 1936.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$C_6H_5CH.OHCOOH$	$NH_4C_6H_5CHOHCOO$		$C_6H_5CHOHCOOH$	$NH_4C_6H_5CHOHCOO$	
17.02	56.2	1.1	50.5	27.4	1.3
20.7	50.9	"	50.9	26.3	" + $C_6H_5CHOHCOOH$
25.4	45.7	"	51.2	25.4	$C_6H_5CHOHCOOH$
28.3	42.1	"	50.8	24.5	"
35.2	36.1	"	47.9	19.8	"
41.1	33.9	"	44.2	15.9	"
47.2	32.2	"	31.1	8.9	"
47.0	32.3	1.3	22.7	4.5	"
49.7	28.7	"	16.95	0.0	"

1.1 = $NH_4C_6H_5CHOHCOO.C_6H_5CHOHCOOH$; 1.3 = $NH_4C_6H_5CHOHCOO.3C_6H_5CHOHCOOH$.

EQUILIBRIUM IN THE SYSTEM (l) AMMONIUM MANDELATE, (l) MANDELIC ACID AND WATER AT 25°.

(Ross, Morrison and Johnstone, 1937.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$C_6H_5CHOHCOOH$	$NH_4C_6H_5CHOHCOO$		$C_6H_5CHOHCOOH$	$NH_4C_6H_5CHOHCOO$	
18.7	61.5	1.1	47.2	35.4	$C_6H_5CHOHCOOH$
22.2	55.5	"	46.5	34.0	"
24.7	51.9	"	45.8	30.6	"
29.0	48.0	"	39.1	25.9	"
37.0	42.6	"	31.1	19.5	"
43.9	36.4	"	18.8	13.1	"
46.9	36.0	$C_6H_5CHOHCOOH$	12.9	7.8	"
			10.1	0.0	"

CH

1.1 = $NH_4C_6H_5CHOHCOO.C_6H_5CHOHCOOH$.

AMMONIUM β-Naphthalene Mono **SULFONATE** $C_{10}H_{17}SO_3NH_4$.

100 cc. of the saturated aqueous solution contain 13.05 gms. of the salt at 25°, and d_{25} = 1.034. (Witt, 1915.)

AMMONIUM Phenanthrene Mono **SULFONATES** $C_{14}H_9SO_3NH_4$ (2), (3) and (10).

SOLUBILITY IN WATER AT 20°.

(Sandquist, 1912.)

100 gms. H_2O dissolve 0.37 gms. $C_{14}H_9SO_3NH_4$ (2).
100 gms. H_2O dissolve 0.26 gms. $C_{14}H_9SO_3NH_4$ (3).
100 gms. H_2O dissolve 4.41 gms. $C_{14}H_9SO_3NH_4$ (10).

AMMONIUM 2.5 di-iodobenzene **SULFONATE** $C_6H_3I_2SO_3(NH_4)$.

100 gms. H_2O dissolve 4.35 gms. salt at 20°

AMMONIUM Anthraquinone Di SULFONATES

SOLUBILITY OF EACH SEPARATELY IN WATER.
(Piera-David, Krebser and Anderan, 1927.)

Compound			Formula	t°	Gms. Compound per 100 cc H_2O
Ammonium:					
Anthraquinone	1.5	DiSulfonate	$(NH_4)_2C_{14}H_6O_2(SO_3)_2$	18	2.27
"	"	"	"	100	7.70
"	1.8	"	$(NH_4)_2C_{14}H_6O_2(SO_3)_2.2H_2O$	18	1.00
"	"	"	"	100	14.3
"	1.6	"	$(NH_4)_2C_{14}H_6O_2(SO_3)_2$	18	5.26
"	"	"	"	100	33.3
"	1.7	"	$(NH_4)_2C_{14}H_6O_2(SO_3)_2.2H_2O$	18	8.33
"	"	"	"	100	50.00

The results are given in terms of cc H_2O to dissolve 1.0 gm. (anhydrous or hydrated ?) compound.

AMMONIUM N-Phenyl β Aminoethyl Hydrogen Sulfate $C_6H_5NH.C_2H_4.O.SO_3.NH_4$ (m. pt. 132°)

100 cc. sat. solution in water contain 70 gms. of the salt at 15°. (Saunders, 1922.)

CH

AMMONIUM 10-Chlorophenanthrene 3 or 6 Sulfonate $C_{14}H_8Cl.SO_3NH_4.H_2O$.

100 gms. H_2O dissolve 0.44 gms. of the anhydrous salt at about 20°. (Sandqvist, 1917.)

AMMONIUM Naphthylamine Disulfonates 2.6.8 and 2.5.7, $C_{10}H_5(NH_2)(SO_3NH_4)_2$.

100 gms. sat. solution in water contain 70.35 gms. of the 2.6.8 salt at 15°.
" " " " " 68.1 " " 2.5.7 " "
(Braunschweig, 1922, 1926)

AMMONIUM HELIANTHATE $C_{14}H_{14}N_3SO_3NH_4.2H_2O$.

1000 cc. of water saturated at 20°–25° with respect to ammonium helianthate contain 6.0 gms. $C_{14}H_{14}N_3SO_3.NH_4.2H_2O$. (Stark and Dehn, 1918)

AMMONIUM PALMITATE $C_{16}H_{31}O_2NH_4$.

SOLUBILITY IN SEVERAL SOLVENTS.
(Falciola, 1910)

t°.	Gms. $C_{16}H_{31}O_2NH_4$ per 100 c c of Absolute Alcohol	75% Alcohol.	50% Alcohol	Mixture of 1 Pt Alcohol + 2 Parts Ether	Acetone.
0	0.5	...	...	...	...
10	0.7	1.78	...	0.37 (13°)	0.2 (13°)
20	1.4	4.33	5.33	0.29	...
30	...	11.02	...	...	...
40	4.5	14.84	6.69	...	...
50	11	...	...	...	...

AMMONIUM OLEATE $C_{17}H_{33}COONH_4$.

SOLUBILITY IN SEVERAL SOLVENTS.
(Falciola, 1910.)

Solvent.	Gms. $C_{17}H_{33}COONH_4$ dissolved per 100 cc solvent:		
Absolute Alcohol	31 at 0°	59 at 10°	100 at 50°
75 per cent Alcohol	...	8.2 at 20°	10.86 at 30°
1 part Alcohol + 2 parts Ether	...	9.45 at 15°	16.9 at 20°
Acetone	...	4.7 at 15°	...

AMMONIUM STEARATE $C_{18}H_{35}O_2NH_4$.

SOLUBILITY IN SEVERAL SOLVENTS.
(Falciola, 1910.)

t°.	Gms. $C_{18}H_{35}O_2NH_4$ per 100 cc. of: Absolute Alcohol.	75% Alcohol.	50% Alcohol.	Ether.	Acetone
0	0.1	...	...	...	...
10	0.3	0.56	0.25	...	0.08 (13°)
20	0.5	...	0.51	0.1	...
30	0.9	1.83	1.16	...	...
40	1.8	5	3.21	...	...
50	5.5	...	...	...	...

100 cc Ethylene Trichloride dissolve 0.04 gm. Ammonium Sterate at 0°, 0.12 gm. at 10° and 0.31 gm. at 20°. (Strauli, 1918, 1926.).

AMMONIUM Lead COBALTICYANIDE $NH_4PbCo(CN)_6.3H_2O$.

(Schuler — Sitz. Ber. K. Akad. W. (Berlin) 79, 302.)

100 grams H_2O dissolve 12 grams of the salt at 18°.

CNS

AMMONIUM THIOCYANATE NH_4SCN

SOLUBILITY IN WATER.
(Average curve from results of Rüdorff, 1868 and 1872; Wassilijew, 1910; Smits and Kettner, 1912.)

t°.	Gms NH_4SCN per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms NH_4SCN per 100 Gms Sat. Sol.	Solid Phase.
−10	20	Ice	0	54.5	NH_4SCN
−15	28.5	"	+10	59	"
−20	35.5	"	20	63	"
−25.2	42 Eutec.	Ice+NH_4SCN	25	65.5	"
−10	50	NH_4SCN	30	67.5	"

More recent determinations with Solubility of Ammonium Thiocyanate in water by S hnidman, 1934, made by the synthetic method, gave the following results.

t°	Gms. NH_4SCN per 100 gms. sat. sol.	Solid Phase	t°	Gms. NH_4SCN per 100 gms. sat. sol.	Solid Phase
13.0	59.57	NH_4SCN	51.37	74.53	NH_4SCN
18.99	62.20	"	52.50	74.94	"
26.33	64.95	"	57.23	76.63	"
28.82	65.93	"	62.46	78.53	"
36.36	68.86	"	67.21	80.18	"
39.44	70.05	"	71.53	81.73	"
46.92	72.86	"			

Freezing-point data for mixtures of Ammonium Thiocyanate and water are given by Vasiliev, 1917.

SOLUBILITY OF AMMONIUM THIOCYANATE IN AQUEOUS SOLUTIONS OF AMMONIA

(Foote, 1921.)

t° = 10°. Gms. per 100 gms. sat. sol.		t° = 20°. Gms. per 100 gms. sat. sol.		t° = 30°. Gms. per 100 gms. sat. sol.		Solid Phase in all cases.
NH_3.	NH_4CNS.	NH_3.	NH_4CNS.	NH_3.	NH_4CNS.	
0.0	58.23	0.0	62.54	0.0	66.26	NH_4CNS
3.49	59.40	3.53	63.57	2.85	67.28	»
6.86	61.03	6.23	64.99	5.79	68.30	»
9.22	62.61	8.57	66.20	8.38	69.48	»
12.33	65.29	11.19	67.57	12.18	71.84	»
14.53	66.67	12.54	69.06	14.46	74.00	»
17.12	69.50	15.65	71.89	17.04	76.63	»
19.78	72.84	18.07	74.15	20.01	79.99	»
22.70	77.30	21.35	78.65			

Data for the system ammonium thiocyanate, thiourea and water at 25° are given by Smits and Kettner (1912) in the form of a triangular diagram, but the numerical results are omitted. The diagram confirms the freezing-point lowering results in showing that the molecular compound $NH_4SCN.4(NH_4)_2CS$ is formed.

100 gms. acetonitrile dissolve 7.52 gms. NH_4SCN at 18°. (Naumann and Schier, 1914.)

CNS

Data for the system ammonium thiocyanate, ethyl ether and water at 20° are given by Nesterow and Petine, 1931.

SOLUBILITY OF AMMONIUM THIOCYANATE IN METHYL AND IN ETHYL ALCOHOL, DETERMINED BY THE SYNTHETIC METHOD.

(Shaidman, 1934.)

Results for Methyl Alcohol		Results for Ethyl Alcohol	
t°	Gms. NH_4SCN per 100 gms. sat. solution	t°	Gms. NH_4SCN per 100 gms. sat. solution
24.58	37.11	18.45	19.07
32.94	40.05	33.25	21.54
44.80	44.70	36.93	22.16
54.76	49.30	43.36	23.46
64.55	54.55	57.62	26.72
		64.20	28.63

100 gms. Liquid Ammonia (NH_3) dissolve 312.0 gms. NH_4SCN at 25°. (Hunt, 1932.)

100 gms. Liquid Sulfur Dioxide (SO_2) dissolve 46.8 gms. NH_4SCN at 0°. (Jander and Ruppolt, 1937.)

Freezing-point data are given for:

Ammonium Thiocyanate + Ammonia (Bradley and Alexander, 1912.)
" " + Potassium Thiocyanate (Wrzesnewsky, 1912.)
" " + Thiocarbamide (Thiourea) (Renolds and Werner, 1903; Findlay, 1904; Atkins and Werner, 1912; Smits and Kettner, 1912; Wrzesnewsky, 1912; Kettner, 1919.)

AMMONIUM Bi CARBONATE NH_4HCO_3.

SOLUBILITY OF AMMONIUM BICARBONATE IN WATER.

(Jänecke, 1929.)

CO

The usual method of solubility determination could not be employed since the vapor with which the solutions are in equilibrium is not that of H_2O alone or of CO_2 and NH_3 in the molecular ratio of ammonium bicarbonate but contains relatively more CO_2. The solution therefore contains more NH_3 than corresponds to NH_4HCO_3. The synthetic sealed tube method was used and the temperatures determined at which complete solution occurred in known mixtures of NH_4HCO_3 and H_2O. At temperatures above 60° very small tubes were used and in order to avoid danger of explosion these were placed in an electrically heated metal block with a hole, protected by glass plates, through which the tube could be observed by transmitted light. The determinations were plotted and the following values taken from the curve. They agree with previous determinations except at the higher temperatures.

t°	Gms. NH_4HCO_3 per 100 gms. sat. sol.	Solid Phase	t°	Gms. NH_4HCO_3 per 100 gms. sat. sol.	Solid Phase
-3.9 Eutec	9.5	Ice + NH_4HCO_3	50	31.6	NH_4HCO_3
0	10.6 (10.6)	NH_4HCO_3	60	37.2	"
10	13.9 (13.8)	"	70	44.0	"
20	17.8 (17.3)	"	80	52.2	"
25	19.9 (19.2)	"	90	63.0	"
30	22.1 (21.3)	"	100	78.0	"
40	26.8 (24.9)	"	108 m.pt.	100.0	"

The results in parentheses are the averages of the previous determinations of Fedotieff, 1904; Nishizawa, 1920; Toparescu, 1922; and Fedotieff and Kolossoff, 1923.

The System Ammonia, Carbon Dioxide and Water. (Terres and Weiser, 1921.)

The saturated solutions were prepared by mixing various amounts of ammonium bicarbonate, carbonate or carbamate with water or aqueous solutions of ammonia and rotating at constant temperature for many days or weeks. The original tables show the composition of the mixtures used to obtain saturation with respect to one or the other of the several solid phases. In the following tables (1) designates ammonium bicarbonate, $NH_4H.CO_3$, (2) ammonium carbonate $(NH_4)_2CO_3H_2O$, (3) ammonium carbamate $NH_2CO_2NH_4$, (1.2) designates the double salt $2 NH_4HCO_3.(NH_4)_2CO_3H_2O$, (1.3) the double satl, $NH_4HCO_3.NH_2CO_2NH_4$.

CO

Results at 0°.1			Results at 20°.			Results at 40°.		
Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
NH_3.	CO_2.	Solid Phase.	NH_3.	CO_2.	Solid Phase.	NH_3.	CO_2.	Solid Phase.
2.6	6.05	(1)	3.95	9.25	(1)	6.18	14.05	(1)
8.8	12.1*	»	4.8	9.77*	»	7.2	14.9	»
10.6	14.0	»	9.3	13.9	»	10.2	17.0*	—
11.2	14.8*	(1)+(1.2)	9.4	15.1*	»	13.8	20.1*	—
14.2	17.8*	(1.2)	14.2	18.8	—	14.6	21.5	(1)
14.3	18.1*	»	16.0	20.4	»	17.3	24.4*	»
14.4	18.2	»	17.3	21.8	(1)+(1.2)	17.7	24.8	»
15.1	17.6	(2)	17.3	22.0	»	19.6	27.0*	—
15.0	18.0	»	18.5	23.2	(1.2)	20.3	28.1*	(1)
15.2	17.4*	»	19.5	24.3	»	21.0	28.2	(1)+(1.3)
15.8	17.1*	»	19.6	24.4	»	21.0	28.4	»
16.5	15.8*	»	20.0	24.8*	»	22.3	28.9*	(1.3)
17.5	13.2	»	20.1	24.8*	(2)+(1.2)	23.3	29.4	»
23.7	13.3*	»	20.3	25.0*	»	24.0	29.8*	»
25.4	13.3*	»	20.2	24.9	»	25.25	30.5	—
25.6	12.8	»	20.6	24.8	(2)	26.5	31.1	(1.3)
26.5	14.9*	»	22.0	24.8	»	27.8	31.8	»
26.5	12.7*	(?)	25.8	24.4*	»	28.1	32.3*	»
28.7	12.0	(2)	26.6	24.4	»	28.6	32.4	»
33.2	13.6	(2)+(3)	28.6	24.0	»	29.1	32.6	»
35.6	12.3*	(?)	27.8	24.0	»	29.8	32.7	(1.3)+(3)
38.9	11.5*	(3)	29.8	24.2	(2)+(3)	29.5	32.6	»
39.7	11.6	»	29.7	23.8	»	29.9	32.5	(3)
45.0	11.2	»	31.2	23.8	(3)	30.5	31.2	»
19.5	3.6**	(2)	32.0	23.4	»	32.0	28.7	»
20.8	8.8**	»	33.5	22.9	»	33.2	27.2*	»
25.0	6.5**	»						

* Indicates that equilibrium was approached from above. ** Indicates incomplete equilibrium.

Results similar to the above are also given for 60°. A number of determinations between 20° and 40° were made to fix the transition temperatures in this region.

The following results for the solubility of **Ammonium bicarbonate** in water are taken from the tables.

t°.	Gms. NH_4HCO_3 per 100 gms. sat. sol.	Solid Phase.
0	11.1	$NH_4.HCO_3$
20	17.5	»
40	24.2	»
60	30.0	»

AMMONIUM CARBONATE

EQUILIBRIUM IN THE SYSTEM AMMONIA, CARBON DIOXIDE AND WATER AT TEMPERATURES ABOVE 60°.

(Terres and Behrens, 1928.)

Due to the high pressures at temperatures above 60° glass vessels could not be used for the solubility determinations, small steel bombs of 150 to 250 cc. capacity were therefore employed. The interior walls of these were coated with enamel or ebonite, or in the case of still higher temperatures, glass cylinders inside the bombs were used.

Results at 80°			Results at 100°			Results at 120°		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
NH_3	CO_2		NH_3	CO_2		NH_3	CO_2	
10.5	21.0	(1)	11.2	24.0	(1)	16.2	28.5	melted (1)
13.5	23.9	"	13.4	25.0	"	21.2	32.0	"
16.9	26.1	"	18.6	29.2	"	23.9	36.3	"
20.2	28.8	"	20.6	31.1	"	24.5	34.9	"
22.0	31.4	"	24.3	35.0	"	25.6	37.4	"
25.9	34.6	"	28.1	40.0	"+(3)	26.5	39.2	"
27.5	37.5	"	29.6	40.2	(3)	25.7	38.1	"
37.75	31.7	(1.3)	31.0	39.7	"	29.8	40.6	(3)
37.0	41.2	(3)	33.2	39.8	"	32.1	40.5	"
35.6	40.0	"	34.8	39.7	"	34.8	40.3	"
34.4	40.8	"	35.9	40.0	"	36.0	40.7	"

(1) = NH_4HCO_3, (3) = $NH_2CO_2NH_4$, (1.3) = $NH_4HCO_3.NH_2CO_2NH_4$.

Additional results at 133°-135° for the Urea field are given. The authors also give the following additional results for the solubility of ammonium bicarbonate in water, which like their previous ones at lower temperatures, fail to agree with the determinations of Jänecke, 1929.

t°	Gms. NH_4HCO_3 per 100 gms. sat. sol.
80	36.3
100	45.5
106 m.pt.	—
120	48.6

EQUILIBRIUM IN THE SYSTEM AMMONIA, CARBON DIOXIDE AND WATER.

(Jänecke, 1929a.)

The synthetic sealed tube method was used for determination of the temperatures of complete solution or appearance of immiscible layers in all possible mixtures of the three components. The mixtures were prepared from weighed amounts of either ammonium bicarbonate or carbamate and aqueous ammonia solutions of given concentrations. In those mixtures containing a large excess of ammonia, liquid NH_3 was distilled at very low temperature into the tubes containing the salt and water. On account of the danger of explosion in these cases the tubes were incased in a metal cylinder and observed by light transmitted through protected windows. For observation of the point of complete solution at low temperatures the tubes were first cooled in a mixture of liquid CO_2 and acetone until a solid phase separated and then allowed to warm to the temperature at which this solid phase just disappeared. More than 300 such observations were made and from the diagram plotted from them the values for isotherms and the invariant points were obtained. The solid phases were identified analytically and microscopically.

The previous results of Terres and Weiser, 1921, and Terres and Behrens, 1928. are shown to be in error due to imperfections in the method employed, except at temperatures below 60° and when the solid phase is bicarbonate or sesquicarbonate. The two solid phases reported by Terres in addition to the four here mentioned are shown not to exist. In the following table (1) designates ammonium bicarbonate, NH_4HCO_3, (2) ammonium carbonate, $(NH_4)_2CO_3.H_2O$, (3) ammonium carbamate NH_4COONH_2 and 1.2 ammonium sesqui carbonate $(NH_4)_2CO_3.2NH_4HCO_3$.

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms. sat. sol.		Solid Phase
	NH_3	CO_3			NH_3	CO_3	
-95	81.0	0.5(?)	(3)+NH_3+$(NH_4)_2O$	10	15	19	(1)
-85	59.0	0.5(?)	(3)+NH_4OH+ "	"	20	17.5	(2)
-80	47.0	0.5(?)	(3)+ " + (2)	"	25	15.8	"
-95	34.0	0.5(?)	Ice+ " + (2)	"	30	15.3	"
-13	11.0	14.5	" + (1) + (2)	"	35	16.0	"
-10	11.5	15.5	(3)+ (1)	"	39	17.0	" +(3)
-10	9.5	12.5	Ice+ (1)	"	40	17.0	(3)
- 5	6.0	9.0	" + "	"	45	14.3	"
0	14.0	18.0	(3)+ (1)	"	50	12.0	"
"	5.0	8.5	(1)	"	60	8.5	"
"	10.0	13.7	"	"	70	5.0	"
"	15.0	17.0	(2)	"	15.5	20.0	(1)+(1.2)
"	20.0	19.5	"	20	5	10.8	(1)
"	25	9.0	"	"	10	15.0	"
"	30	8.0	"	"	15	20.0	"
"	35	8.5	"	"	20	22.5	(2)
"	40	10	"	"	25	21.0	"
"	42	11	" + (3)	"	30	21.5	"
"	45	10	(3)	"	35	22.8	"
"	50	8.5	"	"	36	23.0	" +(3)
"	60	6.0	"	"	40	20.3	(3)
"	70	4.0	"	"	45	17.5	""
5	15	19.5	(1)+(1.2)+(2)	"	50	14.7	"
10	5	9.6	(1)	"	60	10.5	"
"	10	14.3	"	"	70	6.0	"

AMMONIUM CARBONATE

EQUILIBRIUM IN THE SYSTEM AMMONIA, CARBON DIOXIDE AND WATER. (Continued.)

(Janecke, 1929a.)

t^o	Gms. per 100 gms. sat. sol. NH_3	Gms. per 100 gms. sat. sol. CO_3	Solid Phase
20	16	21.0	(1)+(1.2)
30	10	16.2	(1)
"	17	23.0	" +(1.2)
"	20	25	(1.2)
"	25	26	(2)
"	30	26.5	"
"	33.5	27.0	" +(3)
"	35	26	(3)
"	40	23	"
"	45	20.3	"
"	50	17.5	"
"	60	13.0	"
"	70	8.5	"
40	10	17.3	(1)
"	15	22	"
"	17.5	25	" +(1.2)
"	20	26.7	(1.2)
"	25	29.5	"
"	30	32.0	(2)
"	31.5	32	" +(3)
"	35	29	(3)
"	40	26	"
"	45	23.2	"
40	50	21	(3)
"	60	15.5	"
"	70	10.5	"
43	30	33	" +(2)+(1.2)
50	10	19.2	(1)
"	15	23	"
"	18	27	" +(1.2)
"	20	27.7	(1.2)
"	25	32	"
"	29	35	" +(3)
"	30	35	(3)
"	40	29	"
"	45	26.5	"
"	50	23.7	"
"	60	19.0	"
"	70	15.0	"
60	19	29.0	(1)+(1.2)
"	28	38	(3)+ "
70	22	33.5	(1)+ "
"	27.5	40	(3)+ "
80	24.5	39	(1)+ "
"	27	42	(3)+ "
85	27	44	" + "+(1)

CO·

Above 50° two liquid layers are formed. The compositions of these, as derived from the diagram, are as follows.

t^o	Liquid Layer I NH_3	Liquid Layer I CO_2	Liquid Layer II NH_3	Liquid Layer II CO_2
50	80	3.5	70	15
60	85	2.5	65	20
70	58	2	63	26
80	91	1.5	59	32
90	93	1.5	57.5	35
100	95	0.5	57	37.5
110	97	0.5	57	40.5

In continuation of his studies upon the System Ammonium, Carbon Dioxide and Water, Jänecke, 1930, and Jänecke and Rahlfs, 1932, give freezing-point, solubility and vapor pressure determinations of the following systems.

$CO(NH_2)_2$(urea) + NH_4HCO_3
" + $NH_4CO_2NH_2$
" + $CN.NH_2$
" + H_2O
" + NH_3
" + NH_3 + H_2O
" + " + $NH_4CO_2NH_2$
$(CN_2H_2)_2$ + "
$NH(CONH_2)_2$(Biuret) + NH_3
" + $CO(NH_2)_2$
" + NH_4HCO_3
" + " + $CO(NH_2)_2$

SOLUBILITY OF AMMONIUM CARBONATE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE AND VICE VERSA.

(Mondain Monval, 1922.)

Results at 0°. Gms. per 100 gms. H_2O. NH_4Cl.	$^1/_2(NH_4)_2CO_3$.	Solid Phase.	Results at 15°. Gms. per 100 gms. H_2O. NH_4Cl.	$^1/_2(NH_4)_2CO_3$.	Solid Phase.
0.00	55.8	$(NH_4)_2CO_3$	10.1	62.0	$(NH_4)_2CO_3$
26.4	56.7	» $+NH_4Cl$	14.5	61.2	»
27.2	13.0	NH_4Cl	31.3	61.0	» $+NH_4Cl$
29.2	0.0	»	31.7	17.6	NH_4Cl

CO

SOLUBILITY OF AMMONIUM CARBONATE IN AQUEOUS SOLUTIONS OF SODIUM CARBONATE AND VICE VERSA.

(Mondain Monval, 1922)

Results at 0°. Gms. per 100 gms. H_2O. $^1/_2Na_2CO_3$.	$^1/_2(NH_4)_2CO_3$.	Solid Phase.	Results at 15°. Gms. per 100 gms. H_2O. $^1/_2Na_2CO_3$.	$^1/_2(NH_4)_2CO_3$	Solid Phase.
18.0	64.2	$(NH_4)_2CO_3+Na_2CO_3$	4.3	59.2	$(NH_4)_2CO_3$
10.3	12.9	Na_2CO_3	15.9	65.2	» $+Na_2CO_3$
6.9	0.5	»	27.6	16.3	Na_2CO_3
7.1	0.0	»	27.6	16.5	»

SOLUBILITY OF MIXTURES OF AMMONIUM CARBONATE, AMMONIUM CHLORIDE AND OTHER SALTS IN WATER AT 0° AND AT 15°.

(Mondain Monval, 1922.)

Results at 0°: Gms. per 100 gms. H_2O. Na.	NH_4.	Cl.	$^1/_2CO_3$.	Results at 15°: Gms. per 100 gms. H_2O. Na	NH_4.	Cl.	$^1/_2CO_3$	Solid Phase at both temperatures.
11.0	6.5	27.0	2.5	9.4	7.2	27.8	10.8	$NH_4Cl+NaCl$
11.7	10.9	23.1	14.1	13.6	10.8	30.2	10.2	» + » $+Na_2CO_3$
14.6	1.7	21.1	4.2	13.3	6.0	23.3	7.7	$NaCl+Na_2CO_3$
9.7	11.0	21.7	12.6	12.7	14.3	28.2	16.6	NH_4Cl + »
9.2	38.4	22.6	56.6	18.5	39.4	38.5	57.2	» + » $+(NH_4)_2CO_3$
6.2	34.8	19.9	49.4	10.3	35.4	31.2	46.0	» $+(NH_4)_2CO_3$
1.8	31.1	17.5	39.3	2.3	31.7	21.4	37.7	» + »
6.8	24.5	4.8	45.4	10.9	38.8	21.4	60.8	Na_2CO_3 + »
2.3	10.1	19.9	3.1	4.1	12.0	23.7	5.4	NH_4Cl
7.0	6.4	12.6	9.1	10.6	10.7	21.7	13.8	Na_2CO_3
7.1	4.2	8.3	9.3	7.9	2.3	4.6	10.3	»
3.5	1.5	3.0	4.5	–	–	–	–	»

SOLUBILITY OF AMMONIUM BICARBONATE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE SATURATED WITH CO_2.

(Fedotieff — Z. phys. Ch. 49, 168, '04.)

t°.	Wt. of 1 cc. Sol.	Per 1000 cc. Solution. G. M. NH_4Cl.	G. M. NH_4HCO_3.	Gms. NH_4Cl.	Gms. NH_4HCO_3.	Per 1000 Grams H_2O. G. M. NH_4Cl.	G. M. NH_4HCO_3.	Gms. NH_4Cl.	Gms. NH_4HCO_3.
0	...	...	...	...	...	0.0	1.22	0.0	119.0
0	1.077	4.41	0.37	235.9	29.2	5.42	0.46	290.8	36.0
15	1.064	0.0	2.12	0.0	167.2	0.0	2.36	0.0	186.4
15	1.063	0.5	1.84	26.8	145.2	0.56	2.06	29.9	162.9
15	1.062	1.0	1.59	53.5	125.5	1.13	1.80	60.6	142.2
15	1.062	1.41	1.42	75.4	112.2	1.59	1.60	85.1	126.9
15	1.065	1.89	4.28	100.8	101.1	2.18	1.48	116.8	116.8
15	1.069	2.87	0.99	153.3	78.2	3.42	1.18	183.0	93.3
15	1.076	3.84	0.79	205.2	62.5	5.03	0.98	269.3	77.3
15	1.085	4.82	0.65	257.9	51.4	6.21	0.84	332.5	66.4
15	1.085	4.95	0.62	264.8	48.9	6.40	0.81	343.5	64.2
30	...	...	...	...	...	0.0	3.42	0.0	270.0
30	...	...	...	...	...	7.4	1.15	397.0	91.0

CO

SOLUBILITY OF AMMONIUM BICARBONATE IN AQUEOUS SOLUTIONS OF SODIUM BICARBONATE SATURATED WITH CO_2.

(Fedotieff.)

t°.	Wt. of 1 cc. Sol.	Per 1000 cc Solution. G. M. $NaHCO_3$.	G. M. NH_4HCO_3.	Gms. $NaHCO_3$.	Gms. NH_4HCO_3.	Per 1000 Grams H_2O. G. M. $NaHCO_3$.	G. M. NH_4HCO_3.	Gms. $NaHCO_3$.	Gms. NH_4HCO_3.
0	...	...	...	...	...	0.0	1.51	0.0	119.0
0	1.072	0.53	1.28	44.6	101.4	0.58	1.39	48.2	109.4
15	1.064	0.0	2.12	0.0	167.2	0.0	2.36	0.0	186.4
15	1.090	0.63	1.92	52.5	151.3	0.71	2.16	59.2	170.6
30	...	...	...	...	...	0.0	3.42	0.0	270.0
30	...	...	...	...	...	0.83	2.91	70.0	230.0

SOLUBILITY OF AMMONIUM BICARBONATE IN AQUEOUS SOLUTIONS OF AMMONIUM NITRATE.

(Fedotieff and Koltunoff, 1914.)

t°.	d of Sat. Sol.	Gms. per 100 Gms. H_2O. NH_4NO_3.	NH_4HCO_3.	t°.	d of Sat. Sol.	Gms. per 100 Gms. H_2O. NH_4NO_3.	NH_4HCO_3.
0		0	11.90	15	1.242	103.4	8.25
0	1.265	118	4.52	15	1.269	128.9	7.79
15	1.064	0	18.64	15	1.302	166.9	7.46
15	1.113	23.26	12.91	30	...	0	26.96
15	1.164	49.82	10.33	30	...	231.9	12.57

SOLUBILITY OF MIXTURES OF AMMONIUM BICARBONATE, SODIUM BICARBONATE, AND AMMONIUM CHLORIDE IN WATER SATURATED WITH CO_2.

(Fedotieff.)

t°.	Wt. of 1 cc. Sol.	Gram Mols. per 1000 Gms. H_2O.			Gms. per 1000 Gms. H_2O.			Solid Phase.
		$NaHCO_3$.	NaCl.	NH_4Cl.	$NaHCO_3$.	NaCl.	NH_4Cl.	
0	1.114	0.59	0.96	4.92	49.61	56.16	263.4	a + b + c
0	1.187	0.12	4.83	2.74	10.09	282.6	146.7	"
15	1.116	0.93	0.51	6.28	78.18	29.84	336.2	"
15	1.178	0.18	4.44	3.73	15.13	259.8	199.6	"
15	1.151	0.30	3.09	4.56	25.22	180.8	244.1	a + c
15	1.128	0.51	1.68	5.45	42.87	98.28	291.7	"
15	1.112	0.99	0.35	5.65	83.22	20.47	302.4	a + b
15	1.108	1.07	0.20	5.21	89.95	11.70	278.9	"
15	1.106	1.12	0.11	4.92	94.14	6.44	263.4	"
15	1.101	1.16	0.14	4.00	97.52	8.19	214.1	"
15	1.090	0.93	0.95	2.03	78.18	55.58	108.6	"

a = $NaHCO_3$, b = NH_4HCO_3, c = NH_4Cl.

CO

SOLUBILITY OF AMMONIUM BICARBONATE AT 35° IN AQUEOUS SOLUTIONS OF :

(Fedotieff and Kolossof, 1923.)

Ammonium Sulfate :

d_{35} of sat. sol.	Gms. per 100 gms. H_2O.		Solid Phase.
	$(NH_4)_2SO_4$.	NH_4HCO_3.	
1.19	28.73	22.95	NH_4HCO_3
1.23	37.19	21.18	»
1.26	56.71	17.00	»
1.34	75.78	15.57	» + $(NH_4)_2SO_4$
1.32	77.31	10.18	$(NH_4)_2SO_4$
1.25	80.74	0.00	»

Sodium Bicarbonate.

d_{35} of sat. sol	Gms. per 100 gms. H_2O.		Solid Phase.
	$NaHCO_3$.	NH_4HCO_3.	
1.11	0.0	31.08	NH_4HCO_3
1.16	7.12	29.32	» + $NaHCO_3$
1.15	7.38	28.72	$NaHCO_3$
1.11	9.51	9.78	»
1.11	10.59	3.99	»
1.08	11.66	0.00	»

100 gms. H_2O simultaneously saturated at 15° with :

Ammonium Bicarbonate + Ammonium Chloride contain 7.02 gms. NH_4HCO_3 + 35.4 gms. NH_4Cl

» » + Sodium Bicarbonate » 19.6 » + 6.2 gms. $NaHCO_3$

The following results were obtained for water simultaneously saturated with three salts at 15°.

Gms. per 100 gms. H_2O.				Solid Phase.
NH_4.	Na.	HCO_3.	Cl.	
11.2	3.4	5.9	24.5	NH_4HCO_3 + $NaHCO_3$ + NH_4Cl
6.6	10.5	1.2	29.3	NaCl + » + »

(Toporescu, 1922.)

SIMULTANEOUS SOLUBILITY OF AMMONIUM BICARBONATE AND OTHER SALTS

(Nishizawa, 1920.)

	Gm. mols. per 1000 gm. mols. H_2O.		
t°.	$(NH_4)_2SO_4$.	NH_4HCO_3.	Solid Phase.
15..	96.40	14.90	$(NH_4)_2SO_4+NH_4HCO_3$
30..	99.27	24.60	» »
40..	100.9	34.0	» »

	Gm. mols. per 1000 gm. mols. H_2O.		
t°.	$NaHCO_3$.	NH_4HCO_3.	Solid Phase.
15..	12.79	38.92	$NaHCO_3+NH_4HCO_3$
30..	12.38	37.96	» »
40..	15.87	70.83	» »

	Gm. mols. per 1000 gm. mols. H_2O.			
t°.	Na_2SO_4.	$(NH_4)_2SO_4$.	$NaHCO_3$.	Solid Phase.
15........	12.46	67.08	20.90	$NH_4HCO_3+NaHCO_3+Na_2SO_4.(NH_4)_2SO_4.4H_2O$
30........	11.27	87.04	27.56	» » »
40........	10.03	109.1	34 59	» » »
15........	6.79	97.99	14.96	» $+(NH_4)_2SO_4+$ »
30........	8.68	104.06	24.66	» » »
40........	9.79	109.2	35.48	» » »

AMMONIUM Bi CARBONATE

Results for the system Ammonium Bicarbonate, Ammonium Sulfate and Water at 15° are given by Wolfkowitsch, Belokolski and Lebedew, 1931.

EQUILIBRIUM IN THE RECIPROCAL SALT PAIR, AMMONIUM BICARBONATE AND SODIUM CHLORIDE AT 20° TO 40° AND UNDER 1.2 TO 2.5 ATMOSPHERES PRESSURE OF CARBON DIOXIDE.

(Neumann and Domke, 1928.)

The authors mention that few previous studies of the equilibrium in the ammonia soda process have been made under conditions resembling closely those of the actual manufacturing process. This consists in saturating natural or artificial sodium chloride brine with ammonia and treating this with 30-40 vol. percent CO_2 under pressure. The authors have therefor made determinations at 20° to 40° and under 1.2 and 2.5 atmospheres pressure of CO_2 with results which permit the calculation of the yield of sodium and ammonium for each varying composition of the solution.

Results for Aqueous Solutions with one or two salts under 1.2 Atmospheres Pressure of CO_2 and at:

The system $NH_4Cl + NaCl + H_2O$

20°		30°		40°	
Gms. per 1000 cc sat. sol.		Gms. per 1000 cc sat. sol.		Gms. per 1000 cc sat. sol.	
NH_4Cl	NaCl	NH_4Cl	NaCl	NH_4Cl	NaCl
294.2	0.0	315.7	0.0	337.8	0.0
241.6	82.3	291.5	36.2	307.2	44.5
202.8	150.5	236.1	127.3	263.3	115.7
172.1	206.0	199.9	191.7	228.2	177.1
52.4	279.8	116.5	243.1	77.2	268.7
37.5	289.3	63.6	274.5	0.0	316.0
0.0	312.3	0.0	314.4		

The system $NaCl + NaHCO_3 + H_2O$

t = 20°		t = 30°		t = 40°	
Gms. per 1000 cc sat. sol.		Gms. per 1000 cc sat. sol.		Gms. per 1000 cc sat. sol.	
NaCl	$NaHCO_3$	NaCl	$NaHCO_3$	NaCl	$NaHCO_3$
312.3	0.0	314.4	0.0	316.0	0.0
310.9	9.92	311.3	12.6	311.9	15.6
143.0	33.3	103.2	47.3	178.6	35.6
45.5	61.7	34.1	80.0	98.5	56.9
0.0	90.8	0.0	104.2	0.0	119.6

The system $NH_4HCO_3 + NaHCO_3 + H_2O$

t = 20°		t = 30°	
Gms. per 1000 cc sat. sol.		Gms. per 1000 cc sat. sol.	
$NaHCO_3$	NH_4HCO_3	$NaHCO_3$	NH_4HCO_3
90.8	0.0	104.2	0.0
68.9	89.4	88.1	64.0
55.4	171.0	64.2	200.3
0.0	183.2	60.7	228.6
		0.0	241.4

The System $NH_4Cl + NH_4HCO_3 + H_2O$

CO

t = 20°		t = 30°	
Gms. per 1000 cc sat. sol.		Gms. per 1000 cc sat. sol.	
NH_4Cl	NH_4HCO_3	NH_4Cl	NH_4HCO_3
294.2	0.0	315.7	0.0
288.8	15.7	290.1	85.0
276.1	55.9	260.1	91.4
167.2	83.8	210.6	107.4
93.3	117.9	163.3	125.2
0.0	183.2	74.5	177.2
		24.2	216.9

AMMONIUM CARBONATE

EQUILIBRIUM IN THE RECIPROCAL SALT PAIR AMMONIUM BICARBONATE AND SODIUM CHLORIDE. (Continued.)

(Neumann and Domke, 1928.)

Results for Aqueous Solutions Simultaneously Saturated with Two Salts, and under 1.2 Atmospheres Pressure of CO_2

Solid Phase $NaHCO_3 + NH_4Cl$				Solid Phase $NaHCO_3 + NH_4HCO_3$			
t°	Gms. per 1000 cc sat. sol.			t°	Gms. per 1000 cc sat. sol.		
	$NaHCO_3$	NH_4Cl	NaCl		$NaHCO_3$	NH_4HCO_3	NH_4Cl
20	21.8	213.5	125.7	20	68.1	67.2	109.1
"	25.2	220.4	112.2	"	68.9	68.8	106.5
"	29.4	230.3	93.5	"	62.2	94.1	74.4
30	49.6	271.2	60.8	30	68.9	127.3	95.8
"	31.1	243.4	110.5	"	66.4	136.0	85.6
"	30.4	241.8	112.8	"	65.5	148.6	71.2
"	27.1	231.7	130.4	"	64.7	157.3	63.7

Results for Aqueous Solutions Simultaneously Saturated with Three Salts, and under 1.2 Atmospheres Pressure of CO_2

Solid Phase $NaHCO_3$ + NH_4Cl + $NaHCO_3$ Solid Phase $NaHCO_3$ + NH_4Cl + NaCl

t°	Gms. per 1000 cc sat. sol.			t°	Gms. per 1000 cc sat. sol.		
	$NaHCO_3$	NH_4Cl	$NaHCO_3$		$NaHCO_3$	NH_4Cl	NaCl
20	68.8	273.9	17.5	20	14.2	169.0	206.6
30	80.7	301.5	15.8	30	19.3	193.1	192.3
				40	27.7	218.8	178.7

Results for the above Systems under 2.5 Atmospheres Pressure of CO_2.

t°	$NaHCO_3$	NH_4Cl	$NaHCO_3$	t°	$NaHCO_3$	NH_4Cl	NaCl
20	63.0	268.6	18.7 (NaCl?)	20	12.6	32.1	196.4
30	83.2	302.8	7.1 (NaCl?)	30	19.3	55.2	181.2
				40	25.2	78.1	164.9

CO

100 cc sat. solution of unaltered ammonium carbonate in U.S.P. Ethyl Alcohol contain 2.12 gms. $(NH_4)_2CO_3$ at 25°. (E'we, 1920.)

100 gms. carefully purified glycerol dissolve 20 gms. $(NH_4)_2CO_3$ at 15°. (Ossendowski, 1907.)

AMMONIUM Uranyl **CARBONATE** $2(NH_4)_2CO_3UO_2CO_3$.

(Ebelmen.)

100 grams H_2O dissolve 5 grams of the salt at 15°..

AMMONIUM OXALATE $(NH_4)_2C_2O_4.H_2O$.

COO

SOLUBILITY OF AMMONIUM OXALATE IN WATER.

(Hill and Distler, 1935.)

t°	Gms. $(NH_4)_2C_2O_4$ per 100 gms. sat. sol.	t°	Gms. $(NH_4)_2C_2O_4$ per 100 gms. sat. sol.	t°	Gms. $(NH_4)_2C_2O_4$ per 100 gms. sat. sol.
0	2.314	30	5.738	70	15.10
10	3.112	40	7.565	80	18.30
20	(1.0169) 4.259	50	9.735	90	21.84
25	(1.0188) 4.953	60	12.25	100	25.73

The solid phase is $(NH_4)_2C_2O_4.H_2O$ in all cases. The results in parentheses are densities of the sat. solution determined by Flöttmann, 1928. In addition to the above very careful determinations, results for the solubility of ammonium oxalate in water at temperatures up to 50° are also given by Engel, 1888; Foote and Andrew, 1905; Wandstra, 1912; Colani, 1916; Koenig, 1922 and Guigues, 1927.

AMMONIUM OXALATE

SOLUBILITY IN AQUEOUS SOLUTIONS OF OXALIC ACID.

(Woudstra, 1912.)

Results at 30°. (Interpolated from Original.) Gms. per 100 Gms. Sat. Sol. $(COONH_4)_2$.	$(COOH)_2$.	Solid Phase.	Results at 45°. Gms. per 100 Gms. Sat. Sol. $(COONH_4)_2$.	$(COOH)_2$.	Solid Phase.
0.14	12.36	A	0.22	21.22	A
0.28	12.78	A+T	0.31	21.31	"
0.30	12	T	0.53	20.54	A+T
0.39	10	"	0.56	21.23	T
0.47	8	"	0.61	20.55	"
0.52	7	"	0.54	20.92	"
0.68	6	"	0.79	16.44	"
1	5	"	1.23	12.88	"
2	3.96	"	7.16	7.98	"
3	3.61	"	3.54	5.83	"
4	3.60	"	5.65	5.67	"
5	3.81	"	6.72	5.95	"
5.98	4.21	T+A. O.	8.74	6.53	T+A. O.
7	3.63	A. O.	8.93	6.27	A. O.
8.19	3.36	A. O.+N. O.	9.04	6.14	"
7	2.32	N. O.	12.38	5	A. O.+N. O.
6	1.02	"	8.31	3.04	N. O.
5.53	0.22	"	9.59	1.45	"

A. = Oxalic Acid $(COOH)_2.H_2O$.
A. O. = Acid Ammonium Oxalate $(COO)_2HNH_4.H_2O$.
T = Ammonium tetroxalate $(COOH)_2(COO)_2HNH_4.2H_2O$.
N. O. = Neutral Ammonium Oxalate $(COONH_4)_2.H_2O$.

Additional data for this system at 25° are given by Walden (1905), and at 0°, by Engel (1888).

SOLUBILITY IN WATER OF MIXTURES OF AMMONIUM OXALATE AND:

Other Oxalates at 25°. (Foote and Andrew, 1905.) Gms per 100 Gms. Sat. Solution.		t°.	Other Ammonium Salts. (Colani, 1916.) Gms. per 100 Gms. Sat. Solution.	
2.79 $(COONH_4)_2.H_2O$	+25.96 $(COOK)_2H_2O$	15	0.14 $(COONH_4)_2$	+26.35 NH_4Cl
4.8 "	+5.75 $(COOLi)_2$	50	0.67 "	+32.55 "
5.45 "	+0.59 $(COO)_2Mg.2H_2O$	18	0.11 "	+42.43 $(NH_4)_2SO_4$
6.19 "	+1.45 $(COO)_2Zn.2H_2O$	50	0.65 "	+45.92 "
5.06 "	+0.28 $(COO)_2Cd.3H_2O$	19	0.085 "	+62.26 NH_4NO_3
		50	0.35 "	+72.11 "

Both salts in excess in every case. No double salts formed.

SOLUBILITY OF AMMONIUM OXALATE IN AQUEOUS SOLUTIONS OF SODIUM OXALATE AND VICE VERSA.

(Rivett and O'Conner, 1919.)

Results at 25°.				Results at 50°.			
d of sat. sol.	Gms. per 100 gms sat. sol. $Na_2C_2O_4$.	$(NH_4)_2C_2O_4$.	Solid Phase.	d of sat. sol.	Gms. per 100 gms. sat. sol. $Na_2C_2O_4$.	$(NH_4)_2C_2O_4$.	Solid Phase.
1.028	0.89	4.88	$(NH_4)_2C_2O_4.H_2O$	1.042	1.25	9.46	$(NH_4)_2C_2O_4.H_2O$
1.035	1.82	4.81	"	1.051	2.45	9.32	"
1.043	2.85	4.75	"	1.059	3.57	9.21	"
1.047	3.41	4.74	" + $Na_2C_2O_4$	1.063	4.05	9.19	" + $Na_2C_2O_4$
1.043	3.46	3.77	$Na_2C_2O_4$	1.056	4.13	7.86	$Na_2C_2O_4$
1.039	3.51	2.89	"	1.049	4.29	6.12	"
1.037	3.51	2.48	"	1.044	4.28	4.64	"
1.033	3.65	1.49	"	1.036	4.37	3.14	"
1.030	3.63	0.74	"	1.031	4.46	1.59	"
1.027	3.73	0.00	"	1.023	4.54	0.06	"

SOLUBILITY OF AMMONIUM OXALATE AND OF AMMONIUM THORIUM OXALATE IN WATER AT 25°.

(James, Whittemore and Holden, 1914.)

The mixtures were constantly agitated for periods varying from many weeks to several months.

Gms. per 100 Gms. H_2O. $(NH_4)_2C_2O_4$.	$Th(C_2O_4)_2$.	Solid Phase.	Gms. per 100 Gms. H_2O. $(NH_4)_2C_2O_4$.	$Th(C_2O_4)_2$.	Solid Phase.
5.25	0	$(NH_4)_2C_2O_4$	29.47	39.10	2.1.7+2.1.2
6.04	1.54	"	23.04	29.87	2.1.2
7.78	4.51	"	16.84	21.18	"
10.37	8.87	"	13.27	15.96	"
15.46	16.89	"	8.13	9.13	"
21.47	26.37	"	5.36	5.63	"
28.18	36.54	"+2.1.7	1.70	1.42	"

COO

2.1.7 = $2Th(C_2O_4)_2.(NH_4)_2C_2O_4.7H_2O$; 2.1.2 = $2Th(C_2O_4)_2.(NH_4)_2C_2O_4.2H_2O$.

100 gms. 95% formic acid dissolve 6.2 gms. $(NH_4)_2C_2O_4$ at 21°. (Aschan, 1913.)

100 cc. anhydrous hydrazine dissolve 44 gms. $(NH_4)_2C_2O_4$ at room temp. with evolution of ammonia. (Welsh and Broderson, 1915.)

EQUILIBRIUM IN THE SYSTEM AMMONIUM OXALATE, ZIRCONIUM OXALATE AND WATER.

(Boulenger, 1936.)

Results at 19°		Results at 39°		
Gms. per 100 gms. sat. sol. $(NH_4)_2C_2O_4$	$ZrOC_2O_4$	Gms. per 100 gms. sat. sol. $(NH_4)_2C_2O_4$	$ZrOC_2O_4$	Solid Phase at each
4.33	0.0	6.95	0.0	$(NH_4)_2C_2O_4.H_2O$
4.72	0.52	6.90	1.26	"
5.25	0.82	6.84	1.35	"
5.39	0.96	6.60	1.40	(?)
5.70	1.30	6.20	1.70	(?)
6.05	1.74	6.15	1.97	$2(NH_4)_2C_2O_4.ZrC_2O_4.H_2C_2O_4.2H_2O$ (?)
5.53	1.34	5.46	1.80	"
5.10	1.25	4.91	1.76	"
4.43	1.21	4.61	1.60	"
3.05	0.8	3.95	1.45	"
	unfilterable gels			

SOLUBILITY OF AMMONIUM OXALATE IN AQUEOUS SOLUTIONS OF ACETONE AT 17.6°.

(Hartley, 1931.)

Mol. $(CH_3)_2CO$ per 1.0 mol. $(CH_3)_2CO + H_2O$	Mol. $NH_4C_2O_4$ per 1.0 mol. sat. sol.	Mol. $(CH_3)_2CO$ per 1.0 mol. $(CH_3)_2CO + H_2O$	Mol. $NH_4C_2O_4$ per 1.0 mol. sat. sol.
0.0000	0.00604	0.0344	0.00352
0.0136	0.00488	0.0544	0.00263
0.0273	0.00395	0.0668	0.00219

AMMONIUM Ferric and Ferrous OXALATES

SOLUBILITY OF EACH SEPARATELY IN METHYL ALCOHOL.

(Henstock, 1934.)

Salt	Formula	t°	Gms. salt per 100 gms. CH_3OH
Ammonium Ferrous Oxalate	$(NH_4)_2Fe(C_2O_4)_2$	15	0.47
" " "	"	66 (b.pt.)	0.78
" Ferric "	$(NH_4)_3Fe(C_2O_4)_3$	15	0.42
" " "	"	66 (b.pt.)	0.72

AMMONIUM CHLORIDE NH_4Cl.

THE ICE CURVE FOR THE SYSTEM AMMONIUM CHLORIDE-WATER.

(Rodebush, 1918.)

Cl

The temperatures were measured with a thermoelement and the concentrations determined by conductivity.

t° of lowering of f. pt.	Gms. NH_4Cl per 100 gms. H_2O.	t° of lowering of f. pt.	Gms. NH_4Cl per 100 gms. H_2O.	t° of lowering of f. pt.	Gms. NH_4Cl per 100 gms. H_2O.
0.0.	0.0	− 8.60.....	13.76	−12.60......	19.93
−5.73.....	9.28	−10.58.....	16.89	−14.03......	22.40
−7.63.....	12.27	−11.80.....	18.80	−15.10......	24.13
−7.80.....	12.56	−12.44.....	19.94	−15.36 (Eutec.)	24.50

Similar determinations for concentrations of NH_4Cl up to 0.5 normal are given by Klein and Svanberg, 1920.

SOLUBILITY OF AMMONIUM CHLORIDE IN WATER.

Mulder; below 0°, Meerburg, 1903. More recent determinations at several temperatures in satisfactory agreement with the results of Meerburg are given by Benrath, 1927; Gerassimow, 1930; Aronowa and Lunskaja, 1931.)

t°.	Gms NH_4Cl per 100 Gms. Solution	Gms NH_4Cl per 100 Gms. Water.	t°.	Gms. NH_4Cl per 100 Gms. Solution	Gms. NH_4Cl per 100 Gms. Water.
−15	19.7	24.5	40	31.4	45.8
−10.9	20.3	25.5	50	33.5	50.4
−5.7	21.7	27.7	60	35.6	55.2
0	22.7	29.4	70	37.6	60.2
+ 5	23.8	31.2	80	39.6	65.6
10	24.9	33.3	90	41.6	71.3
15	26.0	35.2	100	43.6	77.3
20	27.1	37.2	110	45.6	83.8
25	28.2	39.3	115.6	46.6	87.3
30	29.3	41.4			

Density of saturated solution at 0° = 1.088, at 15° = 1.077, at 19° = 1.075.

Eutectic, Ice + NH_4Cl = − 16° and 19.5 gms. NH_4Cl per 100 gms. sat. sol.

100 gms. H_2O dissolve 31.25 gms. NH_4Cl at 3.5°, 38.5 gms. at 25° and 49.6 gms. at 50°. (Biltz and Marcus, 1911.)

Data for the solubility of ammonium chloride in water at 0° under pressures up to 500 atmospheres are given by Stackelberg, 1896.

SOLUBILITY OF AMMONIUM CHLORIDE IN WATER AT TEMPERATURES ABOVE 100° DETERMINED BY THE SYNTHETIC METHOD.

(Benrath, Gjedebo, Schiffers and Wunderlich, 1937.)

t°	Gms. NH_4Cl per 100 gms. sat. sol.	t°	Gms. NH_4Cl per 100 gms. sat. sol.	t°	Gms. NH_4Cl per 100 gms. sat. sol.
100	44.0	180	57.3	275	71.5
120	48.0	200	60.5	300	75.3
140	50.7	225	64.5	350	82.2
160	54.0	250	68.0	400	89.0

SOLUBILITY OF AMMONIUM CHLORIDE IN AQUEOUS HYDROCHLORIC ACID.

Results at 0°. (Engel, 1888.)

Sp. Gr. of Sat. Sol.	Gms. per 100 cc. sat. sol. HCl.	Gms. per 100 cc. sat. sol. NH_4Cl.
1.076	0	24.61
1.069	1.05	23.16
1.070	1.99	21.78
1.073	3.93	19.36
1.078	7.74	14.54
1.106	19.18	5.78
1 114	22.07	4.67

Results at 25°. (Armstrong and Eyre, 1910–11.)

Gms. HCl per 100 Gms. H_2O.	d Sat. Sol.	Gms. NH_4Cl per 100 Gms. Sat. Sol.
0	1.080	28.3
0.91	1.079	27.4
1.82	1.082	26.4
3.65	1.083	24.6
18.25	1.099	11.3

Cl

EQUILIBRIUM IN THE SYSTEM AMMONIUM CHLORIDE AMMONIUM DICHROMATE AND WATER.

(Gerassimow, 1930.)

t°	Gms. per 100 gms. sat. sol. $(NH_4)_2Cr_2O_7$	Gms. per 100 gms. sat. sol. NH_4Cl	Solid Phase	t°	Gms. per 100 gms. sat. sol. $(NH_4)_2Cr_2O_7$	Gms. per 100 gms. sat. sol. NH_4Cl	Solid Phase
0	0.0	22.9	NH_4Cl	50	0.0	33.5	NH_4Cl
".	0.948	24.42	" + $(NH_4)_2Cr_2O_7$	"	5.771	31.22	" + $(NH_4)_2Cr_2O_7$
"	3.58	15.52	$(NH_4)_2Cr_2O_7$	"	25.13	11.96	$(NH_4)_2Cr_2O_7$
"	15.37	0.0	"	"	32.06	6.46	"
19.8	1.940	26.69	NH_4Cl	"	42.03	0.0	"
"	1.964	26.60	" + $(NH_4)_2Cr_2O_7$	75	0.0	38.64	NH_4Cl
"	7.489	17.31	$(NH_4)_2Cr_2O$	"	1.619	37.43	"
"	8.687	15.10	"	"	2.984	36.84	"
"	14.362	8.414	"	"	11.406	33.17	" + $(NH_4)_2Cr_2O_7$
"	19.54	4.219	"	"	17.21	25.77	$(NH_4)_2Cr_2O_7$
"	26.23	0.0	"	"	31.45	16.68	"
				"	39.84	9.41	"
				"	47.36	2.59	"
				"	52.13	0.0	"

AMMONIUM CHLORIDE

SOLUBILITY OF AMMONIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM DICHROMATE AND OF POTASSIUM PERMANGANATE AT 25°.

(Herz and Hiebenthal, 1929.)

Results for Potassium Di Chromate

Gm. Mols. per liter $K_2Cr_2O_7/6$	Gm. Mols. per liter NH_4Cl
0.0	5.62
0.24	5.55
0.45	5.56
0.59	5.55
0.91	5.32

Results for Potassium Permanganate.

Gm. Mols. per liter $KMnO_4/5$	Gm. Mols. per liter NH_4Cl
0.0	5.62
0.04	5.62
0.13	5.66
0.34	5.61
0.73	5.55

SOLUBILITY OF AMMONIUM CHLORIDE IN AQUEOUS AMMONIUM BICARBONATE SOLUTIONS SATURATED WITH CO_2. (Fedotieff—Z. Phys. Ch. 49, 169, 1904.)

Cl

t°.	Wt of 1 cc. Sol.	Per 1000 cc. Solution. G. M. NH_4HCO_3.	G. M. NH_4Cl.	Gms. NH_4HCO_3.	Gms. NH_4Cl.	Per 1000 Gms H_2O G. M. NH_4HCO_3.	G. M. NH_4Cl.	Gms NH_4HCl.	Gms NH_4Cl.
0	1.069	0.0	4.60	0.0	246.1	0.0	5.57	0.0	298.0
0	1.077	0.37	4.41	29.2	235.9	0.46	5.42	36.0	290.8
15	1.077	0.0	5.29	0.0	283.1	0.0	6.64	0.0	355.0
15	1.085	0.62	4.95	48.9	264.8	0.81	6.40	64.2	343.5
30	...	...	...	...	...	0.0	7.78	0.0	416.4
30	...	...	...	...	...	1.15	7.40	91.0	397.0

EQUILIBRIUM IN THE SYSTEM AMMONIUM CHLORIDE, AMMONIUM NITRATE AND WATER.

(Prutton, Brosheer and Maron, 1935.)

Results at 0.4° Gms. per 100 gms. sat. sol. NH_4NO_3	NH_4Cl	Results at 25° Gms. per 100 gms. sat. sol. NH_4NO_3	NH_4Cl	Results at 50° Gms. per 100 gms. sat. sol. NH_4NO_3	NH_4Cl	Solid Phase at Each Temperature
54.26	0	67.73	0.0	77.39	0.0	NH_4NO_3
50.53	3.39	64.73	3.82	74.07	3.90	"
47.90	6.35	62.24	5.58	72.09	7.08	"
54.59	10.39	60.37	9.36	70.77	9.24	" + NH_4Cl
39.44	11.75	53.49	11.08	56.54	12.98	NH_4Cl
32.71	13.51	44.50	13.60	53.03	14.27	"
24.39	15.81	29.57	18.20	29.54	22.24	"
15.52	18.39	19.05	21.81	18.09	26.20	"
8.01	20.58	9.14	25.21	11.22	29.36	"
0.0	23.09	0.0	28.33	0.0	33.50	"

100 gms. H_2O dissolve 97.2 gms. NH_4Cl + 1000 gms. NH_4NO_3 at 100°.
(Wurmser, 1922.)

EQUILIBRIUM IN THE SYSTEM AMMONIUM CHLORIDE AMMONIUM NITRATE AND WATER.

(Jänecke, 1928.)

The results are given in terms of the Jänecke method of expressing such results, and the author found that the solid phases in contact with solutions containing the two salts, were composed of the salts and mixed crystals varying in content of NH_4Cl from 2 to 4 Mols. per 100 Mols.

t°	Mol. % NH_4Cl in dissolved salt mixture	Mols. H_2O to dissolve 100 mols. salt mixture	Solid Phase	t°	Mol. % NH_4Cl in dissolved salt mixture	MoMols. H_2O to dissolve 100 mols. salt mixture	Solid Phase
0	100	1000	NH_4Cl	40	20	280	NH_4Cl
"	80	790	"	"	19	140	"+NH_4NO_3
"	60	620	"	"	0	150	NH_4NO_3
"	40	450	"	60	100	540	NH_4Cl
"	22	310	"+NH_4NO_3	"	80	420	"
"	20	300	NH_4NO_3	"	60	320	"
"	0	340	"	"	40	220	"
20	100	800	NH_4Cl	"	20	100	"
"	80	650	"	"	18	95	"+NH_4NO_3
"	60	500	"	"	0	105	NH_4NO_3
"	40	350	"	80	100	450	NH_4Cl
"	23	200	"+NH_4NO_3	"	17.5	60	"+NH_4NO_3
"	20	190	NH_4NO_3	"	0.0	70	NH_4NO_3
"	0	210	"	100	100	390	NH_4Cl
4C	100	650	NH_4Cl	"	17	35	"+NH_4NO_3
"	80	530	"	"	0	50	NH_4NO_3
"	60	410	"	184	100	200	NH_4Cl
"	40	280	"	169	0	0	NH_4NO_3

SOLUBILITY IN AQUEOUS AMMONIA SOLUTIONS AT 0°.

(Engel — Bull. soc. chim. [3] 6, 17, 1891.)

Sp. Gr. of Solutions.	Milligram Molecules per 10 cc. Solution.		Grams per 100 cc. Solution.	
	NH_3.	NH_4Cl.	NH_4OH.	NH_4Cl.
1.067	5.37	45.8	0.92	24.52
1.054	12.02	45.5	2.05	24.35
1.031	38.0	44.5	6.48	23.82
1.025	47.0	44.0	8.02	23.56
1.017	54.5	43.63	9.30	23.35
0.993	80.0	43.12	13.66	23.09
0.992	90.0	44.0	15.36	23.56
0.983	95.5	44.37	16.29	23.75
0.953	130.0	49.75	22.18	26.63
0.931	169.75	60.0	28.97	32.14

SOLUBILITY OF NH_4Cl IN AQUEOUS AMMONIA SOLUTIONS AT 17.5°.

(Strömholm, 1908.)

Normality Equiv. per Liter.		Gms. per 1000 cc. Solution.	
NH_3	NH_4Cl.	NH_3.	NH_4Cl.
0	5.435	0	290.8
0.15	5.420	2.55	290
4.76	5.082	81	271.9

SOLUBILITIES OF MIXTURES OF AMMONIUM CHLORIDE AND OTHER SALTS IN WATER.

(Rüdorff, Karsten, Mulder.)

Both salts present in solid phase.

t°.	Grams per 100 Grams H_2O.			t°.	Grams per 100 Grams H_2O.		
19.5	29.2 NH_4Cl	+ 174.0 NH_4NO_3	R	b pt	67.7 NH_4Cl	+ 21.9 KCl	M
21.5	26.8 "	+ 46.5 $(NH_4)_2SO_4$	R	14.8	38.8 "	+ 34.2 KNO_3	K
20.0	33.8 "	+ 11.6 $BaCl_2$	R	18.5	39.8 "	+ 38.6 KNO_3	K
18.5	39.2 "	+ 17.0 $Ba(NO_3)_2$	K	14.0	36.8 "	+ 14.1 K_2SO_4	R
15.0	28.9 "	+ 16.9 KCl	R	18.7	37.9 "	+ 13.3 K_2SO_4	K
22.0	30.4 "	+ 19.1 KCl	R	18.7	22.9 "	+ 23.9 NaCl	R

EQUILIBRIUM IN THE SYSTEM AMMONIUM CHLORIDE, MONO BASIC AMMONIUM PHOSPHATE AND WATER AT 0°.

(Askenasy and Nessler, 1930.)

d. of sat. sol.	Mol. % NH_4Cl in dissolved Salts	Mols. H_2O to dissolve 100 mols. salt-mixture	Solid Phase	d. of sat. sols	Mol. % NH_4Cl in dissolved Salts	Mols. H_2O to dissolve 100 mols. Salt mixture	Solid Phase
1.0655	100.0	1000	NH_4Cl	1.0887	62.9	2060	$NH_4H_2PO_4$
1.0831	98.3	990	"	1.0955	44.6	2270	"
1.0846	92.2	955	" + $NH_4H_2PO_4$	1.0990	20.2	2450	"
1.0872	78.6	1490	$NH_4H_2PO_4$	1.1043	0.0	2815	"

Cl

EQUILIBRIUM IN THE SYSTEM

$$2NH_4Cl + Na_2HPO_4 \rightleftarrows (NH_4)_2HPO_4 + 2NaCl$$

(Lauffenburger and Brodsky, 1938.)

Results for Solutions Saturated with two salts.

t°	Gm. Mols. per 1000 gms. H_2O				Solid Phase
	NH_4Cl	NaCl	$(NH_4)_2HPO_4$	Na_2HPO_4	
0	2.73	4.89	—	—	NH_4Cl + NaCl
"	6.22	—	3.47	—	" + $(NH_4)_2HPO_4$
"	—	—	3.14	0.08	$Na_2HPO_4.12H_2O$ + $(NH_4)_2HPO_4$
"	—	—	0.48	0.25	"
"	—	5.95	—	1.00	" + NaCl
25	3.85	4.41	—	—	NH_4Cl + NaCl
"	6.65	—	1.53	—	" + $(NH_4)_2HPO_4$
"	—	—	5.14	0.14	$Na_2HPO_4.12H_2O$ + $(NH_4)_2HPO_4$
"	—	—	0.33	1.00	" "
"	—	5.70	—	0.50	" + NaCl

Results for Solutions Saturated with three salts.

t°	Gm. Ions per 1000 gms. H_2O				Solid Phase
	Na^+	NH_4^+	PO_4H^-	Cl^-	
0	4.90	2.80	0.08	7.55	NH_4Cl + NaCl + $Na(NH_4)HPO_4.nH_2O$
"	0.30	10.1	2.65	5.1	" + $(NH_4)_2HPO_4$ + "
25	4.34	4.67	0.23	8.55	" + NaCl + "
"	6.51	0.40	0.46	5.99	NaCl + $Na_2HPO_4.12H_2O$ + "
"	0.45	9.04	1.64	6.21	NH_4Cl + $(NH_4)_2HPO_4$ + "

SOLUBILITY OF AMMONIUM CHLORIDE IN AQUEOUS SOLUTIONS OF AMMONIUM SULFATE AT 30°.

(Wibaut, 1909; Schreinemakers, 1910.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
$(NH_4)_2SO_4$.	NH_4Cl.		$(NH_4)_2SO_4$.	NH_4Cl.	
0	29.5	NH_4Cl	25	18.3	$NH_4Cl+(NH_4)_2SO_4$
5	28.5	"	30	13.2	$(NH_4)_2SO_4$
10	25.7	"	35	8.5	"
15	23.2	"	40	2.8	"
20	20.2	"	42	0	"

The heterogeneous equilibria in the quarternary system Ammonium Chloride + Ammonium Sulfate + Sodium Chloride + Sodium Sulfate + Water at 0°, 25°, 40°, 60° and 80° are given by Rivett, 1922.

EQUILIBRIUM IN WATER OF THE RECIPROCAL SALT PAIRS

$$2NH_4Cl + H_2SO_4 \rightleftarrows (NH_4)_2SO_4 + HCl \text{ AT } 25°.$$

(Blumberg and Zdanovsky, 1939.)

Mols. percent composition of dissolved components				Mols. H_2O per 100 mols. of dissolved components	Solid Phase
$2NH_4Cl$	$(NH_4)_2SO_4$	H_2SO_4	2HCl		
—	100	—	—	964	$(NH_4)_2SO_4$
16.92	83.08	—	—	945	"
31.24	68.76	—	—	931	"
43.57	56.43	—	—	915	" + NH_4Cl
62.82	37.18	—	—	1115	NH_4Cl
80.34	19.66	—	—	1295	"
100.0	—	—	—	1516	"
76.47	—	—	23.53	1490	"
22.15	—	—	77.85	1166	"
8.29	—	—	91.71	801	"
6.39	—	—	93.61	565	" + (HCl)
—	—	—	100.0	578	(HCl)
—	—	99.30	0.70	0	" in (H_2SO_4)
—	31.60	68.40	—	0	$(NH_4)HSO_4$ in (H_2SO_4)
—	48.48	51.52	—	184	$(NH_4)HSO_4 + (NH_4)_3H(SO_4)_2$
—	69.90	30.10	—	459	$(NH_4)_2SO_4$ + "

C1

The authors also give results for solutions simultaneously saturated with ammonium chloride and the neutral and acid ammonium sulfates as well as all other mixtures required to complete the diagram for the 25° isotherm.

SOLUBILITY OF AMMONIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AND VICE VERSA.

(Mondain Monval, 1922.)

t°.	Gms. per 100 gms. H_2O.		Solid Phase.	t°.	Gms. per 100 gms. H_2O.		Solid Phase.
	NaCl.	NH_4Cl.			NaCl.	NH_4Cl.	
0.....	0.0	29.7	NH_4Cl	15......	0.0	35.3	NH_4Cl
0.....	8.6	24.5	"	15......	15.7	25.5	"
0.....	26.1	15.7	" +NaCl	15......	24.7	20.3	" +NaCl
0.....	35.6	0.0	NaCl	15......	27.2	16.9	NaCl
10.6...	23.86	20.0	NH_4Cl	15.9....	28.9	16.0	"
18.25..	24.05	22.3	"	24.1....	29.1	16.0	"

SIMULTANEOUS SOLUBILITY IN WATER OF AMMONIUM CHLORIDE AND SODIUM CHLORIDE.

t°.	Gms. per 100 gms. H_2O.		Solid Phase.		Authority.	
	NaCl.	NH_4Cl.				
0	27.86	14.55	$NaCl + NH_4Cl$		(Sborgi and Franco, 1921.)	
10	26.33	18.03	»	»	»	»
15	27.2	20.3	»	»	(Toporescu, 1922.)	
25	25.04	24.09	»	»	(Sborgi and Franco, 1922.)	
100	19.5	61.5	»	»	(Mlle Wurmser, 1922.)	

SIMULTANEOUS SOLUBILITY OF AMMONIUM CHLORIDE AND SODIUM CHLORIDE IN WATER.

(Gerassimow, 1930.)

t°	Gms. per 100 gms. sat. sol.		Solid Phase	
	NaCl	NH_4Cl		
0	19.78	10.26	$NH_4Cl + NaCl$	
20	17.52	14.78	"	"
50	14.26	22.5	"	"
75	13.57	28.39	"	"

Data for the simultaneous solubility in water at 100° of Ammonium chloride

Cl Ammonium nitrate, Sodium chloride and Sodium nitrate are given by Mlle Wurmser 1922.

100 gms. of *glycerol* of $d_{20} = 1.2326$ dissolve 12.58 gms. NH_4Cl at 20° (Holm. 1922.
» » » $= 1.2645$ » 10.17 » » » » »

100 cc of a sat. sol. of ammonium chloride in pure *ethyl urethan* contair 0.131 gm. NH_4Cl at 60°. (Stuckgold, 1917.

SOLUBILITY OF AMMONIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE SATURATED WITH CO_2.

(Fedotieff.)

t°.	Wt. of 1 cc. Sol.	Per 1,000 cc. Solution.				Per 1000 Gms. H_2O.			
		G. M. NaCl.	G. M. NH_4Cl.	Gms. NaCl.	Gms. NH_4Cl.	G. M. NaCl.	G. M. NH_4Cl.	Gms. NaCl.	Gms. NH_4Cl.
0	1.069	0.0	4.60	0.0	246.1	0.0	5.57	0.0	298.0
0	1.185	4.04	2.26	236.5	121.0	4.89	2.73	286.4	146.1
15	1.077	0.0	5.29	0.0	283.1	0.0	6.64	0.0	355.0
15	1.097	0.81	4.71	47.5	252.1	1.02	5.91	59.8	316.4
15	1.120	1.68	4.13	98.0	221.7	2.09	5.18	122.4	277.0
15	1.153	2.87	3.38	168.0	180.7	3.57	4.20	208.9	224.7
15	1.175	3.65	2.98	213.5	159.4	4.55	3.72	266.8	198.8
30	...	...	...	...	...	0.0	7.78	0.0	416.4
30	1.166	3.30	3.70	193.0	198.0	4.26	4.77	249.0	255.4
45	...	...	...	...	...	0.0	9.03	0.0	483.7
45	...	...	...	...	...	4.0	6.02	233.9	322.1

THE SYSTEM AMMONIUM CHLORIDE + NICKEL CHLORIDE + WATER AT 70°.

(Clendinnen, 1922.)

d of sat. sol.	Gms. per 100 gms. sat. sol.		Per cent NH_4Cl in mixed crystals (extrapolated).	d of sat. sol.	Gms. per 100 gms. sat. sol.		Per cent NH_4Cl in mixed crystals (extrapolated).
	NH_4Cl.	$NiCl_2$.			NH_4Cl.	$NiCl_2$.	
1.162	30.92	8.59	98.3	1.469	13.56	33.22	39.3
1.234	26.09	15.83	94.6	1.492	11.74	36.99	34.8
1.294	22.91	21.29	93.9	1.510	10.09	38.88	31.4
1.355	20.47	26.28	84.6	1.530	8.43	40.43	28.1
1.386	19.01	28.96	75.1	1.552	6.96	42.05	25.9
1.401	18.37	30.03	68.8	-	5.35	43.87	21.8
1.411	17.54	30.69	62.5	1.591	4.62	44.70	0.9
1.409	17.57	30.70	57.2	1.587	2.79	44.99	0.4
1.421	16.93	31.31	52.5	1.589	1.24	45.60	0.1
1.446	15.05	33.54	45.1	1.592	0.0	45.8	0.0

SOLUBILITY OF MIXTURES OF AMMONIUM AND NICKEL CHLORIDES IN WATER AT 25°.

Cl

(Foote, 1912.)

Gms. per 100 Gms. Sat. Sol. NH_4Cl.	$NiCl_2$.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. NH_4Cl.	$NiCl_2$.	Solid Phase.
26.07	3.10	Mixed crystals of NH_4Cl and $NiCl_2.2H_2O$	7.98	37.41	Mixed crystals and $NiCl_2.6H_2O$
22.27	8.04		8.07	37.73	
20.68	10.32		8.23	37.45	
17.43	15.01		8.17	37.64	
11.22	26.93		7.51	37.19	$NiCl_2.6H_2O$
10.21	30.56		3.06	37.98	
9.16	35.70		0	37.53	

AMMONIUM TinCHLORIDES

Mono = $NH_4SnCl_3.H_2O$; Di = $(NH_4)_2SnCl_4.H_2O$; Tetra = $(NH_4)_4SnCl_6.H_2O$

SOLUBILITY OF STANNOUS MONOAMMONIUM CHLORIDE IN WATER.

(Rimbach and Fleck, 1916.)

t°.	Gms. NH_4SnCl_3 per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. NH_4SnCl_3 per 100 gms. sat. sol.	Solid Phase.
1.2*....	57.0	$NH_4.SnCl_3.H_2O + SnCl_2$	36.9....	71.8	$NH_4SnCl_3.H_2O$
15.9*....	63.1	»	61.7....	80.0	»
			81.2....	85.8	»

SOLUBILITY OF STANNOUS DIAMMONIUM CHLORIDE IN WATER.

t°.	Gms. $(NH_4)_2SnCl_4$ per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. $(NH_4)_2SnCl_4$ per 100 gms sat. sol.	Solid Phase.
1.6....	28.7	$(NH_4)_2SnCl_4.H_2O$	57.0....	61.8	$(NH_4)_2SnCl_4.H_2O$
14.5....	35.4	»	79.0....	78.0	»
36.6....	48.5	»			

Solubility of Stannous Tetrammonium Chloride in Water.

t°.	Gms. per 100 gms. sol. sat. Cl.	Sn.	NH_4.	Solid Phase.
0.8*........	16.31	1.16	7.95	$(NH_4)_4SnCl_6.H_2O + Sn_2Cl$
19.1*........	19.23	2.06	9.16	» »
41.7*........	21.95	6.62	9.16	» »
58.1*........	26.73	11.33	10.17	» »
70.1*........	30.05	15.15	10.70	» »
81.3........	31.98 +	19.60 +	10.30	= 61.9 gms. $(NH_4)_4SnCl_6$

* At these temperatures the atomic ratios of Cl : Sn : NH_4 in solution do not correspond to the double salt, hence in these cases the solid phase is a mixture of the double salt and stannous chloride.

Cl

Solubility of Ammonium Chloride in Aqueous Solutions of Lead Chloride at 25° and Vice Versa.

(Wilkerson and Bathurst, 1937.)

Gms. per 1000 gms. H_2O $PbCl_2$	NH_4Cl	Solid Phase	Gms. per 1000 gms. H_2O $PbCl_2$	NH_4Cl	Solid Phase
0.0	397.8	NH_4Cl	1.21	102.1	$NH_4Cl.2PbCl_2$
5.40	400.6	"	1.22	86.12	"
7.28	401.1	"	1.21	65.61	"
10.42	403.9	"	1.44	43.62	" + $PbCl_2$
14.46	403.3	" + $NH_4Cl.2PbCl_2$	1.76	34.19	$PbCl_2$
13.63	394.5	$NH_4Cl.2PbCl_2$	1.97	26.22	"
12.27	384.7	"	2.00	22.34	"
4.58	270.0	" "	2.15	20.97	"
3.31	233.5	"	2.75	13.42	"
1.97	171.3	"	3.04	9.62	"
1.57	146.5	"	10.91	0.0	"

AMMONIUM Platinum **CHLORIDE** $(NH_4)_2PtCl_6$.

Solubility in Water. (Archibald and Kern, 1917.)

t°.	Gms. $(NH_4)_2PtCl_6$ per 100 gms. H_2O.	t°.	Gms. $(NH_4)_2PtCl_6$ per 100 gms. H_2O.	t°.	Gms. $(NH_4)_2PtCl_6$ per 100 gms. H_2O.
0.0.......	0.2900	30.0.......	0.6370	70.0......	1.7440
5.0.......	0.3550	40.0.......	0.8050	80.0......	2.1605
10.0.......	0.3745	50.0.......	1.0250	90.0......	2.6150
20.0.......	0.5000	60.0.......	1.4405	100........	3.3650

Solubility in Aqueous Solutions of Ammonium Chloride at 20°.

Gms. Mols NH_4Cl per liter.	Gms. $(NH_4)_2PtCl_6$ per 100 gms. solvent.	Gms. Mols NH_4Cl per liter.	Gms. $(NH_4)_2PtCl_6$ per 100 gms. solvent.
0.10	0.0423	1.00	0.0028
0.20	0.0186	2.00	0.0024

SOLUBILITY OF MIXTURE OF AMMONIUM CHLORIDE AND LEAD CHLORIDE IN WATER AT SEVERAL TEMPERATURES.

(At 17°, 50° and 100° Demassieux (1913) at 25° Foote and Levy, 1907.)

At 17°. Gms. per 100 Gms. Sol.		At 25°. Gms. per 100 Gms. Sol.		At 50°. Gms. per 100 Gms. Sol.		At 100°. Gms. per 100 Gms. Sol.		Solid Phase in Each Case.
$PbCl_2$.	NH_4Cl.	$PbCl_2$.	NH_4Cl.	$PbCl_2$.	NH_4Cl.	$PbCl_2$.	NH_4Cl.	
0.30	27.03	...	...	0.32	34.14	1.61	43.42	NH_4Cl
0.52	26.68	...	...	2.65	33.62	4.21	42.91	"
0.64	26.49	1.20	28.15	3.96	33.56	...	...	" +1.2
...	...	...	...	...	...	9.26	41.90	" +2.1
...	...	...	...	...	...	9.88	40.22	2.1
...	...	...	...	...	...	11.60	38.32	"
...	...	...	...	...	...	12.67	37.62	" +1.2
0.34	22.32	0.93	27.45	3.31	31.90	11.40	36.29	1.2
0.098	12.36	0.35	21.59	1.76	27.16	8.32	32.64	"
0.078	4.93	0.29	17.97	0.71	19.42	4.54	26.08	"
0.078	4.23	0.11	10.25	0.49	12.45	1.98	13.12	"
0.076	3.48	0.03	2.77	0.48	4.86	1.76	8.59	" + $PbCl_2$
0.16	1.43	...	...	0.67	1.45	1.85	5.33	$PbCl_2$
0.21	0.96	...	...	1.08	0.51	2.02	1.32	"
0.89	0	...	...	1.69	0	3.10	0	"

1.2 = $NH_4Cl.2(PbCl_2)$, 2.1 = $2NH_4Cl.PbCl_2$.

The following additional data for the above system at 22° are given by Brönsted (1909).

Gm. Equiv. NH_4Cl per 100 Gms. H_2O.	Gm. Equiv. $PbCl_2$ per 100 Gms. Sat. Sol.	Solid Phase.	Gm. Equiv. NH_4Cl per 100 Gms. H_2O.	Gm. Equiv. $PbCl_2$ per 100 Gms. Sat. Sol.	Solid Phase.
0	7.49×10^{-3}	$PbCl_2$	0.8	0.837×10^{-3}	$2PbCl_2.NH_4Cl$
0.1	3.10×10^{-3}	"	1	0.758×10^{-3}	"
0.2	1.916×10^{-3}	"	2	0.695×10^{-3}	"
0.4	1.348×10^{-3}	"	3	0.968×10^{-3}	"
0.5	1.263×10^{-3}	"	4	1.502×10^{-3}	"
0.55	1.189×10^{-3}	$2PbCl_2.NH_4Cl$	5	2.338×10^{-3}	"
0.6	1.092×10^{-3}	"	6	3.580×10^{-3}	"
0.7	0.956×10^{-3}	"	7.29 sat.	6.46×10^{-3}	" + NH_4Cl

The two curves intersect at 0.52 normal NH_4Cl.

SOLUBILITY OF AMMONIUM CHLORIDE IN AQUEOUS SOLUTIONS OF METHYL ALCOHOL AT 25°.

(Akerlof and Turck, 1935.)

Wt. percent CH_3OH in solvent	Gm. Mols. NH_4Cl per 1000 gms. solvent	Wt. percent CH_3OH in solvent	Gm. Mols. NH_4Cl per 1000 gms. solvent
0.0	7.384	80.03	1.357
20.0	5.580	89.79	0.9305
40.82	3.893	94.76	0.7691
60.21	2.657	100.0	0.6612
72.39	1.731		

SOLUBILITY OF AMMONIUM CHLORIDE IN AQUEOUS SOLUTIONS OF ZINC CHLORIDE AND VICE VERSA.

(Meerburg, 1908.)

Isotherm for 0°. Gms. per 100 Gms. Solution. ZnCl$_2$.	NH$_4$Cl.	Solid Phase.	Isotherm for 20°. Gms. per 100 Gms. Solution. ZnCl$_2$.	NH$_4$Cl.	Solid Phase.	Isotherm for 30°. Gms. per 100 Gms. Solution. ZnCl$_2$.	NH$_4$Cl.	Solid Phase.
0	22.8	NH$_4$Cl	0.0	26.9	NH$_4$Cl	0.0	29.5	NH$_4$Cl
3.5	23.0	"	5.1	27.1	"	9.2	29.4	"
7.1	23.5	"	9.5	27.4	"	16.0	29.7	"
10.2	23.9	"	12.7	27.5	"	20.2	30.1	"
15.1	24.7	"	15.7	27.7	"	24.7	30.4	"
18.0	25.3	"	18.0	27.9	"	26.3	30.8	NH$_4$Cl + *a*
22.4	26.0	"	23.5	29.0	"	27.2	30.2	*a*
24.2	26.1	"	26.0	29.5	NH$_4$Cl + *a*	30.1	29.6	"
25.7	26.3	NH$_4$Cl + *a*	29.5	28.1	*a*	36.8	28.2	"
27.5	26.4	*a*	32.3	27.7	"	42.4	27.3	"
30.7	25.7	"	35.8	27.0	"	43.8	27.3	*a* + *b*
33.9	25.3	"	38.7	26.9	"	45.0	24.4	*b*
38.8	24.4	"	40.2	26.6	"	51.2	17.6	"
42.6	24.6	*a* + *b*	41.9	26.3	"	61.9	10.4	"
44.3	21.3	*b*	43.2	26.0	*a* + *b*	66.9	9.2	ZnCl$_2$ + *b*
49.2	15.3	"	46.9	21.0	*b*	75.6	6.1	ZnCl$_2$
52.6	11.9	"	53.2	14.5	"	70.3	7.6	"
55.4	10.0	"	58.4	11.1	"	78.5	3.2	"
59.3	7.5	"	62.7	8.7	"	76.9	3.5	"
62.1	6.8	"	66.6	7.9	"	79.8	1.6	"
						81.6	0.0	"

Cl

a = ZnCl$_2$.3NHCl$_3$. *b* = ZnCl$_2$.2NH$_4$Cl.

SOLUBILITY OF AMMONIUM CHLORIDE IN MIXTURES OF SEVERAL ALCOHOLS WITH WATER.

(Armstrong, Eyre, Hussey and Paddington (1907); and Armstrong and Eyre (1910–11.)

t°.	Gm. Mols. Alcohol per 1000 Gms. H$_2$O.	Gms. NH$_4$Cl per 100 Gms. Sat. Solution in: Aq. CH$_3$OH.	Aq. C$_2$H$_5$OH.	Aq. C$_3$H$_7$OH.
0	0	23	23	23
0	0.25	22.8	22.6	22.7
0	0.50	22.6	22.2	22.3
0	1	22.1	21.5	21.1
0	3	20.5	19	...
25	0	28.3	28.13 (1.0805)	28.3
25	0.25	28.1	28 (1.0780)	28.1
25	0.50	27.9	27.6 (1.0753)	27.5
25	1	27.6	27 (1.0704)	26.6
25	3	26.1	26.5 (1.0528)	...
25	5	...	22.6 (1.0376)	...

(Figures in parentheses show Sp. Gr. of sat. sols.)

SOLUBILITY OF AMMONIUM CHLORIDE IN AQUEOUS ETHYL ALCOHOL AT 15° AND AT 30°.

Gms. C_2H_5OH per 100 Gms. Solvent.	Gms. NH_4Cl per 100 Gms. Solvent at: 15°.	30°.
0	35.2	40.4
20	25	29.7
40	16.8	19
60	9.5	11.1
80	4	5.3
92.3	1.3	...
100	0.6	...

Results at 15° by interpolation from Gerardin (1865), Greenish (1900) and deBruyn (1892). Those at 30° from Bathrick (1896).

100 gms. absolute methyl alcohol dissolve 3.35 gms. NH_4Cl at 19°. (deBruyn, 1892.)

100 gms. 98% methyl alcohol dissolve 3.52 gms. NH_4Cl at 19.5°. (deBruyn, 1892.)

SOLUBILITY OF AMMONIUM CHLORIDE IN SEVERAL ALCOHOL MIXTURES AT 25°.

(Herz and Kuhn, 1908.)

In Methyl and Ethyl Alcohol.		In Methyl and Propyl Alcohol.		In Propyl and Ethyl Alcohol.	
Gms. CH_3OH per 100 Gms. Solvent.	Gms. NH_4Cl per 100 Gms. Sat. Solution.	Gms. C_3H_7OH per 100 Gms. Solvent.	Gms. NH_4Cl per 100 Gms. Sat. Solution.	Gms. C_3H_7OH per 100 Gms. Solvent.	Gms. NH_4Cl per 100 Gms. Sat. Solution.
0	0.53	0	2.76	0	0.53
10	0.67	10	2.33	10	0.50
20	0.80	20	1.90	20	0.47
30	0.98	30	1.58	30	0.42
40	1.18	40	1.26	40	0.39
50	1.40	50	1.03	50	0.36
60	1.65	60	0.82	60	0.32
70	1.92	70	0.60	70	0.30
80	2.18	80	0.41	80	0.26
90	2.48	90	0.30	90	0.22
100	2.76	100	0.18	100	0.18

EQUILIBRIUM IN THE SYSTEM AMMONIUM CHLORIDE, TERTIARY BUTYL ALCOHOL AND WATER AT 30°.

(Ginnings and Robbins, 1930)

The points on the binodal curve of this system were determined by observing the appearance or disappearance of clouding in mixtures of weighed amounts of NH_4Cl and one of the liquids, upon addition of a weighed amount of the other. Tie lines, *, were located by determination of the NH_4Cl in two liquid layers in contact with each other, and from these the plait point, PP, was found by plotting.

Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.	
ter. $(CH_3)_3COH$	NH_4Cl	ter. $(CH_3)_3COH$	NH_4Cl	ter. $(CH_3)_3COH$	NH_4Cl
82.0	2.0*	30.2	6.6	12.9	14.3
80.0	—*	27.5	7.4	11.8	15.6
70.2	2.4	25.3	8.0	11.0	16.8
65.0	—*	23.2	8.6	10.2	18.4
61.2	3.3	22.0	9.0	10.2	18.4
54.1	3.7	20.7	9.4	9.2	20.3
47.9	4.2	19.8	10.0	8.7	21.7
44.0	5.0PP	—	10.1*	—	22.7*
39.3	5.0	15.7	11.5	8.1	23.2
33.4	6.4	14.1	12.7	7.6	24.7*

Cl

In a later paper Ginnings, Herring and Webb, 1933, found the plait point of this system at 25° to be 37.6 gms. ter. $(CH_3)_3COH$ + 6.6 gms. NH_4Cl per 100 gms. sat. solution. The original results for the remaining points of the binodal curve are not given, but only values corresponding to derived empirical equations for the curve.

EQUILIBRIUM IN THE SYSTEM AMMONIUM CHLORIDE, DIOXAN AND WATER AT 25°.

(Herz and Lorentz, 1929.)

Vol. Percent $C_4H_8O_2$ in Aq. Solvent	Gm. Mol. NH_4Cl per liter sat. sol.	Vol. Percent $C_4H_8O_2$ in Aq. Solvent	Gm. Mol. NH_4Cl per liter sat. sol.
10	5.15	34 (lower layer)	1.50
20	4.50	97 (upper layer)	0.02
33	3.50		

EQUILIBRIUM IN THE SYSTEM AMMONIUM CHLORIDE, URETHAN AND WATER AT 25°.

(Palitzsch, 1928, 1929.)

Gm. Mols. per 1000 gms. H_2O		Solid Phase
NH_4Cl	$NH_2COOC_2H_5$	
7.411	0.0	NH_4Cl
7.254	1.123	"
7.0	3.07	" + $NH_2COOC_2H_5$
6.102	3.678	$NH_2COOC_2H_5$
0.0	53.09	"

SOLUBILITY OF AMMONIUM CHLORIDE IN AQUEOUS GLYCEROL SOLUTIONS AND IN AQUEOUS ACETONE SOLUTIONS AT 25°.

(Herz and Knoch — Z. anorg. Chem. 45, 263, 267, '05.)

In Aqueous Glycerol. (Sp. Gr. of Glycerine 1.255, Impurity about 1.5%.)				In Aqueous Acetone.				
Wt. % Glycerine.	NH_4Cl per 100 cc. Solution.		Sp. Gr. at $\frac{25°}{4°}$.	Vol. % Acetone.		NH_4Cl per 100 cc. S l tion.		Sp. Gr. at $\frac{25°}{4°}$.
	Millimols.	Grams.				Millimols.	Grams.	
0.	585.1	31.32	1.0793	0		585.1	31.32	1.0793
13.28	544.6	29.16	1.0947	10		534.1	28.59	1.0618
25.98	502.9	26.93	1.1127	20		464.6	24.87	1.0451
45.36	434.4	23.26	1.1452	30		396.7	21.23	1.0263
54.23	403.5	21.60	1.1606	40		328.5	17.59	0.9998
83.84	291.4	15.60	1.2225	*46.5	L	283.7	15.19	0.9800
100.00	228.4	12.23	1.2617	*85.7	U	18.9.	1.01	0.8390
				90		9.4	0.50	0.8274

* Between these two concentrations of acetone, the solution separates into two layers. L indicates lower layer, U indicates upper layer.

100 cc. anhydrous hydrazine dissolve 75 gms. NH_4Cl at room temp. with evolution of ammonia. (Welsh and Broderson, 1915.)

SOLUBILITY OF AMMONIUM CHLORIDE IN ANHYDROUS ACETIC ACID DETERMINED BY THE SYNTHETIC METHOD.

(Davidson and Chappell, 1938.)

t°	Mol. Percent NH_4Cl in sat. sol.	Solid Phase	t°	Mol. Percent NH_4Cl in sat. sol.	Solid Phase
16.60	0.0	CH_3COOH	58	0.150	NH_4Cl
16.53	0.053	"	65	0.178	"
31	0.053	NH_4Cl	72	0.209	"
25	0.065	"	77	0.224	"
32	0.084	"	84	0.259	"
38	0.095	"	87	0.282	"
43	0.110	"	92	0.312	"
53	0.134	"	98	0.348	"

One liter anhydrous CH_3COOH dissolve 0.7 gm. NH_4Cl at 16.56°. (Eichelberger, 1934.)

SOLUBILITY OF AMMONIUM CHLORIDE IN LIQUID AMMONIA.

t°	Gms. NH_4Cl per 100 gms. NH_3	Gms. NH_4Cl per 100 cc sat. sol.	t°	Gms. NH_4Cl per 100 gms. NH_3	Gms. NH_4Cl per 100 cc sat. sol.
-49.6	—	5.2 (1)	-37.2	—	8.6 (1)
-46.8	—	5.9 (1)	-34.6	—	9.6 (1)
-44.2	—	6.5 (1)	-33.9	14.75	9.63 (d=0.7492) (2)
-42.2	—	7.0 (1)	0	66.4	— (3)
-40.1	—	7.6 (1)	25	102.5	— (4)

(1) = Scherer, 1931; (2) = Johnson and Krumboltz, 1933;
(3) = Linhard and Stephan, 1933, 1934; (4) = Hunt, 1932.

SOLUBILITY OF AMMONIUM CHLORIDE IN LIQUID AMMONIA.

(Patscheke and Tamme, 1933.)

t°	Gms. NH_4Cl per 100 gms. sat. sol.	Solid Phase
-52.9	5.23	$NH_4Cl.3NH_3$
-39.3	10.00	"
-20.5	22.60	"
-11.8	29.50	"
+ 0.9	40.65	"
4.2	44.20	"
8.2	49.20	$NH_4Cl.3NH_3$
9.1	50.50	"
9.8	51.50	"
9.3	52.50	"
8.3	54.00	"
9.8 m.pt.	—	"
36.9	55.40	NH_4Cl

The authors also give results for the -10°, 0° and + 10° isotherms of the system Ammonium Chloride, Sodium Chloride and Liquid Ammonia.

SOLUTIONS OF AMMONIUM CHLORIDE IN LIQUID AMMONIA SOLUTIONS OF AMMONIUM NITRATE AND VICE VERSA AT 25°.

(Hunt and Boncyk, 1933.)

One-fourth gram of the less soluble salt was mixed with variable amounts of the more soluble salt and ammonia added in excess. Ammonia was then allowed to escape until a single crystal of one salt came out of solution. Identical results were obtained by approaching the saturation point from opposite sides.

Cl

Mols. per 10 Mols. NH_3	
NH_4Cl	NH_4NO_3
3.257	0.0
3.01	0.255
2.27.	1.52
0.903	4.83
0.734	6.54
0.692	7.4
0.576	7.20
0.4875	7.82
0.0	8.2875

EQUILIBRIUM IN THE SYSTEM AMMONIUM CHLORIDE, SODIUM CHLORIDE AND LIQUID AMMONIA.

(Akhoumow and Easrowa, 1936.)

t°	Gms. per 100 gms. sat. sol.			Solid Phase
	NaCl	NH_4Cl	NH_3	
-76.6	0.28	0.0	99.72	NH_3 + Na5
-40	2.0	0.0	98.0	Na5
"	2.7	1.35	95.95	"
"	3.2	3.2	93.6	"
"	4.0	8.0	88.0	"
"	4.1	11.9	84.0	" + NH3
"	2.9	11.6	85.5	NH3
"	0.99	9.9	89.11	"
"	0.0	9.7	90.3	"
-30	3.8	0.0	96.2	Na5
"	8.5	17.0	74.5	" + NH3
"	0.0	15.0	85.0	NH3
-24.3	11.8	23.6	64.6	Na5 + NaCl
-20	7.6	0.0	92.4	"
"	14.1	22.9	63.0	" + NaCl
"	10.15	24.85	65.0	NH3 + "
"	0.0	23.0	77.0	"
-16.3	15.8	15.8	68.4	Na5 + NaCl
-15.0	15.52	7.76	76.72	" "
-10.0	14.5	0.0	85.5	"
-10.0	15.1	3.4	81.5	Na5 + NaCl
"	8.99	27.92	63.09	NH3 + "
"	0.0	30.87	69.13	NH3
-1.8	7.60	30.40	62.0	NH3 + NaCl
0	11.3	0.0	88.7	NaCl
"	3.92	39.2	56.88	" + NH3
"	4.86	37.49	57.65	" "
"	0.0	39.7	60.3	NH3
+8	0.0	54.61	45.39	" + NH_4Cl
10	7.83	0.0	92.17	NaCl
"	0.85	56.15	43.0	" + NH_4Cl
"	1.22	50.81	47.97	" + "
"	0.0	55.10	44.90	NH_4Cl
20	5.2	0.0	94.8	NaCl
"	0.0	54.5	45.5	NH_4Cl
30	3.3	0.0	96.7	NaCl
"	0.0	55.0	45.0	NH_4Cl
40	2.0	0.0	98.0	NaCl
"	0.0	55.8	44.2	NH_4Cl

Na5 = $NaCl.5NH_3$; NH3 = $NH_4.Cl.3NH_3$.

AMMONIUM CHLORIDE

100 gms. Liquid Sulfur Dioxide dissolve 0.009 gm. NH_4Cl at 0°. (Jander and Wickert, 1936; Jander and Ruppolt, 1937.)

Fusion-point data are given for the following mixtures.

$NH_4Cl + SbCl_3$	(Kendall, Crittenden and Miller, 1923)	$NH_4Cl + HgCl$	(Janecke, 1923.)
» $+ NH_4NO_2$	(Perman, 1922).	» $+ HgCl_2$	»
» + » $+ NaNO_3$	»	» $+ AgCl$	»
» $+ NaCl +$ »	»	» $+ FeCl_3$	(Hackmeister, 1920.)
» $+ NH_4NO_3$	(Bowen, 1926.).	» $+ LiCl$	»
» $+ CdCl_2$	(Hackmeister, 1920.)	» $+ ZnCl_2$	»
» $+ CuCl$	»		

Tetra Ethyl AMMONIUM CHLORIDE $N(C_2H_5)_4Cl$.

SOLUBILITY OF TETRA ETHYL AMMONIUM CHLORIDE IN SEVERAL SOLVENTS.

(Bjerrum and Josefowicz, 1932.)

Solvent	Formula	t°	d. of sat. sol.	Gms. $N(C_2H_5)_4Cl$ per 100 gms. sat. sol.	Solid Phase
Water	H_2O	20	1.0295	57.8	$N(C_2H_5)_4.Cl.4H_2O$
"	"	35	1.034	75.45	$N(C_2H_5)_4Cl$
Methyl alcohol	CH_3OH	20	0.9587	69.9	"
" "	"	35	0.9543	71.8	"
Ethyl "	C_2H_5OH	20	0.9187	57.6	"
" "	"	35	0.9163	60.2	"
Acetone	$(CH_3)_2CO$	20	0.7913	0.337	"
"	"	35	0.7742	0.424	"

C10

SOLUBILITY OF TETRA ETHYL AMMONIUM CHLORIDE $N(C_2H_5)_4Cl$, AND ALSO OF TETRA METHYL AMMONIUM CHLORIDE $N(CH_3)_4Cl$ IN ACETONITRILE.

100 cc. sat. solution in CH_3CN contain 29.31 gms. $N(C_2H_5)_4Cl$ at 25°.
100 cc. sat. solution in CH_3CN contain 0.265 gms. $N(CH_3)_4Cl$ at 25°.

(Walden — Z. physik. Chem. 55, 712, '06.)

SOLUBILITY OF TETRA ETHYL AMMONIUM CHLORIDE IN WATER AND IN CHLOROFORM.

(Peddle and Turner, 1913.)

100 gms. H_2O dissolve 141.0 gms. $N(C_2H_5)_4Cl$ at 25°.
100 gms. $CHCl_3$ dissolve 8.24 gms. $N(C_2H_5)_4Cl$ at 25°.

SOLUBILITY OF DIMETHYL AMMONIUM CHLORIDE IN WATER AND IN CHLOROFORM.

(Hantzsch, 1902.)

100 gms. H_2O dissolve 208 gms. of the salt.
100 gms. $CHCl_3$ dissolve 26.9 gms. of the salt (temp. not stated in abstract).

SOLUBILITY OF TETRA METHYL AMMONIUM CHLORIDE IN ETHYLENE DICHLORIDE ($CH_2Cl.CH_2Cl$) CONTAINING VARIOUS ADDED SALTS AT 25°.

(Seward, 1934.)

It was necessary to remove all traces of moisture from the Ethylene Dichloride since as little as 0.03% H_2O causes the solubility of tetra methyl ammonium chloride to increase two fold. The determinations were made in presence of dry air.

Added Salt	Formula	Gm. Mols. per liter solvent	
		Added Salt	$N(CH_3)_4Cl$
None		0.0	0.0001143
Tetra methyl Ammonium Picrate	$N(CH_3)_4OC_6H_2(NO_2)_3$	0.000375	0.0000837
" " " "	"	0.000751	0.0000866
" " " "	"	0.001125	0.0000987
Tetra ethyl Ammonium Nitrate	$N(C_2H_5)_4NO_3$	0.000267	0.000221
" " " "	"	0.000500	0.000311
" " " "	"	0.001000	0.000444
Tetra ethyl Ammonium Picrate	$N(C_2H_5)_4OC_6H_2(NO_2)_3$	0.0005	0.000172
" " " "	"	0.0010	0.000226
Tetra iso amyl Ammonium Picrate	$N(C_5H_{11})_4OC_6H_2(NO_2)_3$	0.0005	0.000162
" " " " "	"	0.0010	0.000185

C10 **AMMONIUM** Per**CHLORATE** NH_4ClO_4.

SOLUBILITY IN WATER.

(Carlton, 1910.)

t°.	Sp. Gr. Sat. Sol.	Gms. NH_4ClO_4 per 100 cc. Sat. Sol.	t°.	Sp. Gr. Sat. Sol.	Gms. NH_4ClO_4 per 100 cc. Sat. Sol.
0	1.059	11.56	80	1.193	48.19
20	1.098	20.85	100	1.216	57.01
40	1.128	30.58	107 b. pt.	1.221	59.12
60	1.158	39.05			

In a paper by Thin and Cumming (1915), it is stated that ammonium perchlorate is "sparingly soluble" in water and according to one determination at 14.2°, 100 gms. of the sat. solution was found to contain 1.735 gms. NH_4ClO_4. It is probable that these authors have misplaced the decimal point. This appears more probable since a determination of the solubility in 98.8 per cent ethyl alcohol at 25.2° gave 1.96 gms. NH_4ClO_4 per 100 gms. sat. solution, and in 98.8 per cent alcohol containing 0.2 per cent $HClO_4$ gave 1.97 gms. per 100 gms. sat. solution.

AMMONIUM Per**CHLORATE** NH_4ClO_4.

SOLUBILITY OF AMMONIUM PERCHLORATE IN WATER.

(Mazzucchelli and Rosa, 1921; Freeth, 1924.)

t°.	Gms. NH_4ClO_4 per 100 gms. sat. sol.		t°.	Gms. NH_4ClO_4 per 100 gms. sat. sol.	
− 2.72 (Eutec.).	9.84 (M and R)	9.8 (Freeth)	45.1...	27.64 (M and R)	28.02 (Freeth)
0.0.......	10.73 »	10.74 »	55.2...	31.55 »	–
+15.2.......	15.95 »	–	65.1...	35.37 »	–
25.0.......	19.89 »	20.02 »	75.0...	39.05 »	39.45 »
34.0.......	23.32 »	–	84.7...	42.54 »	–

SOLUBILITY OF AMMONIUM PERCHLORATE IN AQUEOUS SOLUTIONS OF AMMONIUM SULFATE AND VICE VERSA.

(Freeth, 1924.)

Results at 25°. Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$.	NH_4ClO_4.	Solid Phase.	Results at 60°. Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$.	NH_4ClO_4.	Solid Phase.
0.0	20.02	NH_4ClO_4	7.04	28.56	NH_4ClO_4
11.06	13.11	»	11.89	24.91	»
22.45	8.15	»	16.69	21.66	»
33.75	4.25	»	23.71	17.02	»
41.70	3.00	» + $(NH_4)_2SO_4$	30.8	12.6	»
42.83	1.22	$(NH_4)_2SO_4$	40.92	8.2	» + $(NH_4)_2SO_4$
43.5	0.0	»	44.12	3.48	$(NH_4)_2SO_4$

SOLUBILITY OF AMMONIUM PERCHLORATE IN AQUEOUS SOLUTIONS OF SODIUM PERCHLORATE AND VICE VERSA.

(Freeth, 1924.)

Results at 25°. Gms. per 100 gms. sat. sol. $NaClO_4$.	NH_4ClO_4.	Solid Phase.	Results at 60°. Gms. per 100 gms. sat. sol. $NaClO_4$.	NH_4ClO_4.	Solid Phase.
9.29	15.07	NH_4ClO_4	12.35	25.78	NH_4ClO_4
25.85	9.54	»	25.0	18.00	»
43.64	4.87	»	37.34	12.54	»
52.86	3.50	»	56.95	6.30	»
67.42	1.51	» + $NaClO_4H_2O$	72.86	1.87	» + $NaClO_4$
67.60	0.0	$NaClO_4H_2O$	74.30	0.00	$NaClO_4$

Complete data for the quaternary equilibria in the system $NH_4ClO_4 + (NH_4)_2SO_4 + NaClO_4 + Na_2SO_4 + H_2O$ at 25° and 60° are given by Freeth, 1924.

C10

AMMONIUM Per CHLORATE

SOLUBILITY OF AMMONIUM PERCHLORATE IN AQUEOUS SOLUTIONS OF AMMONIA AT 25°.

(Kolthoff and Stenger, 1934.)

Normality of Aq. NH_3 Solvent	d. of sat. sol.	Gms. NH_4ClO_4 per 100 cc sat. sol.	Gms. NH_4ClO_4 per 100 gms. sat. sol.
0.0	1.095	21.50	19.64
0.443	1.092	21.63	19.81
0.876	1.089	21.98	20.16
1.303	1.088	22.50	20.68
1.731	1.086	22.96	21.14
2.59	1.084	24.08	22.23

SOLUBILITY OF AMMONIUM PERCHLORATE IN WATER AND IN SEVERAL ANHYDROUS SOLVENTS AT 25°. (Willard and Smith, 1923.)

Solvent.	$d_{\frac{25}{4}}$ of solvent.	$d_{\frac{25}{4}}$ of sat. sol.	Gms. NH_4ClO_4 per 100 gms. sat. sol.	Solvent.	$d_{\frac{25}{4}}$ of solvent.	$d_{\frac{25}{4}}$ of sat. sol.	Gms. NH_4ClO_4 per 100 gms. sat. sol.
Water..........	–	1.0982	19.95	*n* Butyl alcohol..	0.8059	0.8069	0.017
Methyl alcohol..	0.78735	0.8218	6.41	*iso* Butyl alcohol.	0.7981	0.7988	0.127
Ethyl alcohol...	0.78515	0.79505	1.872	Acetone.........	0.7852	0.7997	2.21
n Propyl alcohol	0.7993	0.8016	0.385	Ethyl acetate....	0.8945	0.8947	0.032

SOLUBILITY OF AMMONIUM PERCHLORATE IN MIXTURES OF METHYL ALCOHOL AND ETHYL ACETATE AT 25°. (Smith, 1925.)

Volume per cent CH_3OH in Solvent.	Gms. NH_4ClO_4 per 100 gms. sat. sol.	Volume per cent CH_3OH in Solvent.	Gms. NH_4ClO_4 per 100 gms. sat. sol.
0.0 (=pure $CH_3COO.C_2H_5$)	0.029	60.0	4.35
10.0	0.135	70.0	5.08
20.0	0.550	80.0	5.67
30.0	1.27	90.0	6.12
40.0	2.31	100.0	6.42
50.0	3.47		

100 gms. Liquid Sulfur Dioxide (SO_2) dissolve 0.025 gm. NH_4ClO_4 at 0°. (Jander and Ruppolt, 1937.)

100 gms. Liquid Ammonia (NH_3) dissolve 137.93 gms. NH_4ClO_4 at 25°. (Hunt and Boncyk, 1933.)

SOLUBILITY OF AMMONIUM PERCHLORATE AND SEVERAL OF ITS DERIVATIVES IN WATER AT 15°. (Hofmann, Höbald and Quoos (1911-12).)

ClO

	Gms. Salt per 100 Gms. H_2O.		Gms. Salt per 100 Gms. H_2O.
NH_4ClO_4	18.5	$CH_3(C_2H_5)_3NClO_4$	23.6
$CH_3NH_3ClO_4$	109.6	$C_3H_7(C_2H_5)_3NClO_4$	7.9
$(CH_3)_2NH_2ClO_4$	208.7	$(CH_3)_2(C_2H_5)_2NClO_4$	134.3
$C_2H_5NH_3ClO_4$	208.7	$C_2H_3(CH_3)_3NClO_4$	5
$(C_2H_5)_2NH_2ClO_4$	150.9	$BrC_2H_4(CH_3)_3NClO_4$	3.5
$(CH_3)_3NHClO_4$	19.9	$BrC_2H_2(CH_3)_3NClO_4$	2.5
$(CH_3)_4NClO_4$	0.5	$(OH)C_2H_4(CH_3)_3NClO_4$	290.7
$(C_2H_5)_4NClO_4$	3.7	$(OH)CH_2CH(OH)CH_2(CH_3)_3NClO_4$	155.7
$C_6H_5(CH_3)_3NClO_4$	17.9	$NO_3C_2H_4(CH_3)_3NClO_4$	0.6
$ICH_2(CH_3)_3NClO_4$	3.1	$C_3H_5(CH_3)_3NClO_4$	199.5
$C_2H_5(CH_3)_3NClO_4$	10.9	$C_2H_4(NH_3ClO_4)_2$	144.5
$C_3H_7(CH_3)_3NClO_4$	15.4	$C_2H_4[(CH_3)_3NClO_4]_2$	1.2
$C_4H_9(CH_3)_3NClO_4$	3.7	$C_3H_6[(CH_3)_3NClO_4]_2$	1.5
$C_5H_{11}(CH_3)_3NClO_4$	2.2	$Br_2C_2H_3(CH_3)_3NClO_4$	2.2
		$BrC_3H_3(CH_3)_3NClO_4$	2.6

Milbauer (1912-13) found that 100 gms. of cold H_2O dissolve 1.126 gm. tetramethyl ammonium perchlorate $(CH_3)_4NClO_4$ and 100 gms. alcohol dissolve 0.04 gm. of the salt.

AMMONIUM CHROMATE $(NH_4)_2CrO_4$.

SOLUBILITY OF AMMONIUM CHROMATE IN WATER.

(Guerassimow, 1954.)

t°	Gms. $(NH_4)_2CrO_4$ per 100 gms. sat. sol.
0	20.01
20	25.35
50	34.15
75	41.80

AMMONIUM CHROMATES.

SOLUBILITY IN WATER AT 30°.

(Schreinemaker — Z. physic. Chem. 55, 80, '06.)

Composition in Wt. per cent of: The Solution. % CrO_3.	% NH_3.	The Residue. % CrO_3.	% NH_3.	Solid Phase
6.933	22.35	...	...	$(NH_4)_2CrO_4$
9.966	16.53	47.59	20.44	"
16.973	8.20	...	...	"
22.53	6.37	38.03	12.15	"
27.09	6.87	48.02	12.01	$(NH_4)_2CrO_4 + (NH_4)_2Cr_2O_7$
26.19	5.70	47.38	8.81	$(NH_4)_2Cr_2O_7$
25.99	5.10	41.56	7.58	"
30.16	3.50	...	...	"
38.89	3.10	61.08	8.80	"
42.44	3.15	59.72	6.75	$(NH_4)_2Cr_2O_7 + (NH_4)_2Cr_3O_{10}$
44.08	2.27	54.90	4.14	$(NH_4)_2Cr_3O_{10}$
52.91	1.11	60.88	3.09	"
54.56	1.03	63.07	3.09	$(NH_4)_2Cr_3O_{10} + (NH_4)_2Cr_4O_{13}$
56.57	0.97	65.70	2.95	$(NH_4)_2Cr_4O_{13}$
58.87	0.65	69.74	3.24	"
62.48	0.46	71.93	3.10	"
63.60	0.40	73.68	1.18	$(NH_4)_2Cr_4O_{13} + CrO_3$
63.66	0.41	71.47	2.07	"
62.94	0.21	...	...	CrO_3
62.28	0.0	...	...	CrO_3

100 gms. of the sat. aq. solution contain 28.80 gms. $(NH_4)_2CrO_4$ at 30°.
100 gms. of the sat. aq. solution contain 32.05 gms. $(NH_4)_2Cr_2O_7$ at 30°.

SOLUBILITY OF AMMONIUM CHROMATE IN AQUEOUS SOLUTIONS OF AMMONIA AT 15°.

(Weitz and Stamm, 1925.)

The authors give several diagrams and a lengthy discussion of the solubility of ammonium chromate and other ammonium salts (bromide, chloride, chlorate, perchlorate, molybdate, nitrate, oxalate, sulfate, sulfite and dithionate) in aqueous solutions of ammonia. Some of the data are evidently taken from the literature and the rest are based on the experiments of Stamm. Numerical results are not given and the diagrams are not large enough to permit quantitative estimations. They show in general that the solubility of ammonium salts of monovalent acids increase and those of divalent acids decrease with increase of the concentration of ammonia.

THE SYSTEM AMMONIUM CHROMATE + AMMONIUM SULFATE + WATER AT 25°.

(Araki, 1925.)

Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$.	$(NH_4)_2CrO_4$.	Solid Phase.	Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$	$(NH_4)_2CrO_4$.	Solid Phase.
43.41	0.00	$(NH_4)_2SO_4$	34.82	6.98	Solid solutions of $(NH_4)_2SO_4$ in $(NH_4)_2CrO_4$
39.73	3.67	Solid solutions of $(NH_4)_2CrO_4$ in $(NH_4)_2SO_4$	30.81	9.04	
39.13	4.22		26.81	11.73	
39.11	4.23	Mixtures of the two series of solid solutions	17.18	16.76	
39.96	4.36		14.47	17.76	
37.72	4.51		2.78	23.22	
38.06	4.88		0.00	25.16	$(NH_4)_2CrO_4$

AMMONIUM Di CHROMATE $(NH_4)_2Cr_2O_7$.

SOLUBILITY OF AMMONIUM DICHROMATE IN WATER.

(Gerassimow, 1930.)

t°	Gms. $(NH_4)_2Cr_2O_7$ per 100 gms.: sat. sol.	Gms. $(NH_4)_2Cr_2O_7$ per 100 gms.: H_2O	t°	Gms. $(NH_4)_2Cr_2O_7$ per 100 gms.: sat. sol.	Gms. $(NH_4)_2Cr_2O_7$ per 100 gms.: H_2O
0	15.37	18.26	40	36.91	58.5
16	23.88 (1)	—	50	42.03	71.4
20	26.23	35.6	60	46.24	86.0
25	28.63 (1)	—	75	52.13	108.6
30	31.74	46.5	80	53.49	115.0
30	32.05 (2)	—	100	60.89	155.6

(1) = Moles and Gonzalez, 1923; (2) = Schreinemakers, 1905.

EQUILIBRIUM IN THE SYSTEM AMMONIUM DICHROMATE SODIUM DICHROMATE AND WATER.

(Gerassimow, 1930.)

CrO

t°	Gms. per 100 gms. sat. sol. $(NH_4)_2Cr_2O_7$	Gms. per 100 gms. sat. sol. $Na_2Cr_2O_7$	Solid Phase	t°	Gms. per 100 gms. sat. sol. $(NH_4)_2Cr_2O_7$	Gms. per 100 gms. sat. sol. $Na_2Cr_2O_7$	Solid Phase
0	15.37	0.0	$(NH_4)_2Cr_2O_7$	75	52.13	0.0	$(NH_4)_2Cr_2O_7$
"	6.79	46.38	"	"	46.82	6.602	"
"	5.09	49.30	"	"	37.79	18.10	"
"	4.705	61.68	"	"	31.89	25.44	"
"	4.248	59.66	" + $Na_2Cr_2O_7$	"	28.82	30.36	"
"	0.0	62.0	$Na_2Cr_2O_7$	"	25.57	35.87	"
20	26.23	0.0	$(NH_4)_2Cr_2O_7$	"	24.92	36.99	"
"	15.41	25.42	"	"	20.21	43.03	"
"	6.269	58.13	"	"	16.405	57.27	"
"	6.179	61.38	" + $Na_2Cr_2O_7$	"	16.02	59.21	"
"	0.0	65.20	$Na_2Cr_2O_7$	"	16.05	59.28	"
50	42.03	0.0	$(NH_4)_2Cr_2O_7$	"	15.20	60.74	"
"	19.55	36.74	"	"	14.94	64.66	" + $Na_2Cr_2O_7$
"	12.61	54.41	"	"	1.225	76.43	$Na_2Cr_2O_7$
"	9.467	64.06	" + $Na_2Cr_2O_7$	"	0.0	77.7	"
"	0.0	71.3	$Na_2Cr_2O_7$				

AMMONIUM Boro FLUORIDE NH_43BF_3.

F

100 gms. H_2O dissolve 25 gms. NH_43BF_3 at 16° and about 97 gms. at the b. pt. (Stolba - Chem-Techn. Cent. Auz. 7 459)

AMMONIUM Hafnium FLUORIDE $(NH_4)_2HfF_6$.

100 gms. sat. solution of Ammonium Hafnium Fluoride in Water contain 26.0 gms. $(NH_4)_2HfF_6$ at 20°. (v. Hevesy, 1923.)

AMMONIUM Silico FLUORIDE $(NH_4)_2SiF_6$.

100 gms. H_2O dissolve 18.5 gms. $(NH_4)_2SiF_6$ at 17.5° (d = 1.096) (Stolba, 1877.)

AMMONIUM Titanium FLUORIDE $(NH_4)_2TiF_6$.

100 cc H_2O dissolve 25.0 gms. $(NH_4)_2TiF_6$ at 20-22°.
100 cc 98% C_2H_5OH dissolve 0.004 gm. $(NH_4)_2TiF_6$ at 20-22°.

(Ginsberg, 1932.)

AMMONIUM IODIDE NH_4I.

SOLUBILITY IN WATER.

(Smith and Eastlack, 1916.)

t°.	Gms. NH_4I per 100 Gms. H_2O.	t°.	Gms NH_4I per 100 Gms. H_2O.
−27.5 Eutec.	125.2	40	190.5
−20	136	50	199.6
−10	145	60	208.9
0	154.2	70	218.7
10	163.2	80	228.8
15	167.8	100	250.3
20	172.3	120	273.6
25	176.8	140	299.2
30	181.4		

SOLUBILITY IN AQUEOUS ALCOHOL AT 25°.

(Seidell, unpublished.)

Gms. C_2H_5OH per 100 Gms. Solvent.	d_{25} of Sat. Sol.	Gms. NH_4I per 100 Gms. Sat. Sol.	Gms. NH_4I per 100 Gms. Solvent.
0	1.646	64.5	181.9
10	1.590	61.7	161.1
20	1.525	58.7	142.1
30	1.462	55.5	124.8
40	1.395	52	108.3
50	1.320	48	92.3
60	1.250	43.8	77.9
70	1.168	39	64
80	1.094	33.3	49.9
90	1.013	27.5	37.9
100	0.929	20.8	26.3

EQUILIBRIUM IN THE SYSTEM AMMONIUM IODIDE, ANTIMONY IODIDE AND WATER.

I

(Francois and Delwaulle, 1938.)

The results are given only in the form of a diagram from which the following approximate values have been taken.

t°	Gms. per 100 gms. H_2O NH_4I	Gms. per 100 gms. H_2O SbI_3	Solid Phase	t°	Gms. per 100 gms. H_2O NH_4I	Gms. per 100 gms. H_2O SbI_3	Solid Phase
11	164	0	NH_4I	35	225	125	4.1.3
"	180	35	"	"	240	150	" + 2.1.2
"	195	62	" + 4.1.3	"	190	125	2.1.2
"	190	85	4.1.3	50	200	0	NH_4I
"	192	110	" + ?	"	215	50	"
"	170	120	2.1.2 + ?	"	245	100	"
"	140	110	2.1.2	"	265	135	" + 4.1.3
20	172	0	NH_4I	"	265	155	2.1.2 + "
"	195	40	"	"	200	130	2.1.2
"	210	70	" + 4.1.3	75	223	0	NH_4I
"	205	100	4.1.3	"	245	50	"
"	215	145	" + ?	"	270	100	"
"	210	150	2.1.2 + ?	"	290	145	" + 4.1.3
"	185	130	2.1.2	"	290	155	2.1.2 + "
35	186	0	NH_4I	"	350	135	2.1.2
"	205	50	"	"	150	110	"
"	235	95	" + 4.1.3				

4.1.3 = $4NH_4I.SbI_3.3H_2O$; 2.1.2 = $3NH_4I.SbI_3.2H_2O$.

The SbI_3 end of the curves could not be determined on account of hydrolysis.

SOLUBILITY OF AMMONIUM IODIDE IN LIQUID AMMONIA.

t°	Gms. NH_4I per 100: cc NH_3	Gms. NH_4I per 100: gms. NH_3	t°	Gms. NH_4I per 100: cc NH_3	Gms. NH_4I per 100: gms. NH_3
-50.0	62.1	— (1)	-38.6	69.2	— (1)
-47.5	63.3	— (1)	-35.3	71.2	— (1)
-45.2	64.6	— (1)	0.0	—	334.6 (2)
-42.0	66.7	— (1)	+25.0	—	368.5 (3)

(1) Scherer, 1931; (2) Linhard and Stephan, 1933, 1934; (3) Hunt and Boncyk, 1933.

100 gms. liquid Sulfur Dioxide (SO_2) dissolve 8.4 gms. NH_4I at 0°. (Jander and Wickert, 1936; Jander and Ruppolt, 1937.)

Determinations of the vapor pressure - temperature relations in the system $NH_4I + SO_2$ are given by Foote and Fleischer, 1931.

Data for equilibrium in the systems $NH_4I + I + C_6H_6$ and $NH_4I + I + C_6H_5CH_3$ are given by Foote and Bradley, 1933. The results show that no compound with the solvent occurs but only the binary tri iodide, NH_4I_3, which is stable over a wide range of iodine concentrations. Since NH_4I is practically insoluble in benzene and in toluene the authors analytical values are for the percentages of iodine in solution at each invariant point.

I

AMMONIUM IODIDE NH_4I.

Tetra methyl and Tetra ethyl AMMONIUM IODIDES $(CH_3)_4NI$ and $(C_2H_5)_4NI$.

SOLUBILITY OF EACH IN ETHYL URETHAN AT 60°. (Stuckgold, 1917.)

Compound.	Formula.	Gms. cmpd. per 100 cc. sat. sol.
Ammonium Iodide..............	NH_4I	9.00
Tetramethyl Ammonium Iodide..	$(CH_3)_4NI$	0.45
Tetraethyl Ammonium Iodide....	$(C_2H_5)_4NI$	1.63

SOLUBILITY OF TETRA ETHYL AMMONIUM IODIDE IN SEVERAL SOLVENTS.

(Bjerrum and Josefowicz, 1932.)

Solvent	Formula	t°	d. of sat. sol.	Gms. $N(C_2H_5)_4I$ per 100 gms. sat. sol.
Water	H_2O	20	1.0846	27.50
"	"	35	1.1227	39.55
Methyl Alcohol	CH_3OH	20	0.8277	9.05
" "	"	35	0.8430	16.14
Ethyl "	C_2H_5OH	20	0.7937	0.914
" "	"	35	0.7848	1.86
Acetone	$(CH_3)_2CO$	20	0.7903	0.198
"	"	35	0.7738	0.250

Tetra Ethyl **AMMONIUM IODIDE** $N(C_2H_5)_4I$.

SOLUBILITY IN SEVERAL SOLVENTS.

(Walden — Z. physik. Chem. 55, 698, '06.)

Solvent.	Formula.	t°.	Sp. Gr. of Solution.	Gms. $N(C_2H_5)_4I$ per 100. cc. Solution.	Gms. $N(C_2H_5)_4I$ per 100. Gms. Solution.
Water	H_2O	0	1.0470	16.31	15.58
Water	H_2O	25	1.1021	36.33 (35.5)	32.9
Methyl Alcohol	CH_3OH	0	0.8326	3.7-4.3	4.44
Methyl Alcohol	CH_3OH	25	0.8463	10.5 (10.7)	12.29
Ethyl Alcohol	C_2H_5OH	0	0.7928	0.348	0.439
Ethyl Alcohol	C_2H_5OH	25	0.7844	0.98 (0.88)	1.113
Glycol	$(CH_2OH)_2$	0	1.1039	3.27	2.97
Glycol	$(CH_2OH)_2$	25	1.0904	7.63 (7.55)	7
Acetonitrile	CH_3CN	0	0.8163	2.24	2.74
Acetonitrile	CH_3CN	25	0.7929	2.97 (3.54)	3.74
Propionitrile	CH_3CH_2CN	0	0.8059	0.618	0.767
Propionitrile	CH_3CH_2CN	25	0.7830	0.81-1.01	0.99
Benzonitrile	C_6H_5CN	25	...	0.467	0.451
Methyl Sulphocyanide	CH_3SCN	25	1.0828	4.40	4.06
Ethyl Sulphocyanide	C_2H_5SCN	25	1.0012	0.475	0.47
Nitro Methane	CH_3NO_2	0	1.1658	3.59	3.004
Nitro Methane	CH_3NO_2	25	1.1476	5.38-6.27	4.72
Nitroso Dimethyline	$(CH_3)_2N.NO$	25	1.0059	2.67	2.66
Acetyl Acetone	$CH_3COCH_2COCH_3$	25	...	0.268	..
Furfurol	$C_4H_3O.COH$	0	1.1738	3.91	3.33
Furfurol	$C_4H_3O.COH$	25	1.1692	5.33	4.55
Benzaldehyde	C_6H_5COH.	25	...	0.43	...
Salicylaldehyde	$C_6H_4.OH.COH$	25	...	changeable-17.7	...
Anisaldehyde	$C_6H_4.OCH_3.COH$	25	...	0.59	...
Acetone	$(CH_3)_2CO$	0	0.7991	0.174	0.218
Acetone	$(CH_3)_2CO$	25	...	0.249	0.316
Ethyl Acetate	$CH_3COOC_2H_5$	25	...	0.00039	...
Ethyl Nitrate	$C_2H_5ONO_2$	25	1.0984	0.062	0.056
Benzoyl Ethyl Acetate	$C_6H_5COCH_2COOC_2H_5$	25	1.1303	0.321	0.284
Dimethyl Malonate	$CH_2(COOCH_3)_2$	25	1.1335	0.040	0.035
Methyl Cyan Acetate	$CH_2CNCOOCH_3$	0	1.1341	1.82	1.605
Methyl Cyan Acetate	$CH_2CNCOOCH_3$	25	...	2.83	...
Ethyl Cyan Acetate	$CH_2CNCOOC_2H_5$	0	1.0760	1.057	0.981
Ethyl Cyan Acetate	$CH_2CNCOOC_2H_5$	25	1.0607	1.71	1.41
Nitrobenzene	$C_6H_5NO_2$	25	...	0.504	0.422
Acetophenone	$C_6H_5COCH_3$	..	...	0.13	0.127
Amyl Alcohol	$C_5H_{11}OH$	..	...	0.071	0.089
Paraldehyde	$(C_2H_4O)_3$	..	...	0.036	0.037
Methyl Formate	$HCOOCH_3$	..	...	0.031	0.032
Bromobenzene	C_6H_5Br	..	...	0.009	0.006

(Walden — Z. physik. Chem. 61, 635, 1907-'08.)

Tetra Methyl **AMMONIUM IODIDE** $N(CH_3)_4I$.

SOLUBILITY IN SEVERAL SOLVENTS.

(Walden — Z. physik. Chem. 55, 708. '06.)

Solvent.	Formula.	t°.	Sp. Gr. of Solution.	Gms. $N(CH_3)_4I$ per 100. cc. Solution.	Gms. $N(CH_3)_4I$ per 100. Gms. Solution.
Water	H_2O	0	1.0188	2.01	1.97
Water	H_2O	25	1.0155	5.31–5.89	5.22
Methyl Alcohol	CH_3OH	0	0.8025	0.18–0.22	0.22
Methyl Alcohol	CH_3OH	25	0.7920	0.38–0.42	0.48
Ethyl Alcohol	C_2H_5OH	25	0.7894	0.09	...
Glycol	$(CH_2OH)_2$	0	...	1.014	...
Glycol	$(CH_2OH)_2$	25	1.0678	0.240	0.224
Acetonitril	CH_3CN	25	...	0.650	...
Nitro Methane	CH_3NO_2	0	1.1387	0.25–0.32	0.22
Nitro Methane	CH_3NO_2	25	1.1285	0.34–0.38	0.21
Acetone	$(CH_3)_2CO$	0	...	0.118	...
Acetone	$(CH_3)_2CO$	25	...	0.187	...
Salicyl Aldehyde	$C_6H_4.OH.COH$	0	1.1492	0.302	0.263
Salicyl Aldehyde	$C_6H_4.OH.COH$	25	1.1379	0.510	0.484

Very exact determinations of the solubility of tetra methyl ammonium iodide in aqueous solutions of KOH and of NH_4OH at 25° are given by Hill (1917).

I

Tetra Propyl **AMMONIUM IODIDE** $N(C_3H_7)_4I$.

SOLUBILITY IN SEVERAL SOLVENTS.

(Walden — Z. physik. Chem. 55, 709, '06.)

Solvent.	Formula.	t°.	Sp. Gr. of Solution.	Gms. $N(C_3H_7)_4I$ per 100. cc. Solution	Gms. $N(C_3H_7)_4I$ per 100. Gms. Solution.
Methyl Alcohol	CH_3OH	0	0.9756	40.92	41.94
Methyl Alcohol	CH_3OH	25	1.0187	56.42	55.37
Ethyl Alcohol	C_2H_5OH	0	0.8349	6.5–6.8	8.14
Ethyl Alcohol	C_2H_5OH	25	0.8716	19.88–20.29	23.28
Acetonitrile	CH_3CN	0	0.8553	13.03	15.24
Acetonitrile	CH_3CN	25	0.8584	18.69	21.77
Propionitrile	C_2H_5CN	0	0.8280	6.37	7.66
Propionitrile	C_2H_5CN	25	0.8191	9.65	10.29
Benzonitrile	C_6H_5CN	25	1.0199	8.44	8.35
Nitro Methane	CH_3NO_2	0	1.181	14.79	12.52
Nitro Methane	CH_3NO_2	25	1.158	22.24	19.21
Nitro Benzene	$C_6H_5NO_2$	25	1.193	5.71	4.79
Benzaldehyde	C_6H_5COH	0	1.0581	7.06	6.67
Benzaldehyde	C_6H_5COH	25	1.0549	9.87	9.35
Anisaldehyde	$C_6H_5.OCH_3.COH$	0	1.1114	5.60	5.04
Anisaldehyde	$C_6H_5.OCH_3.COH$	25	1.1004	6.75	6.14
Salicylaldehyde	$C_6H_4.OH.COH$	25	...	39.28	...
Ethylnitrite	$C_2H_5NO_2$	0	1.1207	0.522	0.466
Ethylnitrite	$C_2H_5NO_2$	25	1.1025	0.653	0.592
Dimethyl Malonate	$CH_2(COOCH_3)_2$	0	1.1532	0.298	0.259
Dimethyl Malonate	$CH_2(COOCH_3)_2$	25	1.1345	0.320	0.282
Acetone	$(CH_3)_2CO$	0	0.8259	2.692	4.65
Acetone	$(CH_3)_2CO$	25	0.8049	3.944	4.90
Ethyl Acetate	$CH_3COOC_2H_5$	25	0.8975	0.0063	0.007
Ethyl Bromide	C_2H_5Br	25	...	...	0.187

(Walden — Z. physik. Chem. 61, 639, 1907–'08.)

SOLUBILITY OF TETRA AMYL, TETRA ETHYL AND TETRA α PROPYL AMMONIUM IODIDES IN WATER AND IN CHLOROFORM AT 25°. (Peddie and Turner, 1913.)

Solvent.	Gms. Each Salt (Determined Separately), per 100 Gms. Solvent.		
	$N(C_5H_{11})_4I$.	$N(C_2H_5)_4I$.	$\alpha N(C_3H_7)_4I$.
Water	0.74	45	18.64
$CHCl_3$	210.8	1.55	54.56

Freezing-point data for mixtures of tetra methyl ammonium iodide and iodine, and for phenyltrimethyl ammonium iodide and iodine are given by Olivari (1908).

AMMONIUM IODATE NH_4IO_3.

IO

SOLUBILITY IN AQUEOUS IODIC ACID AT 30°.

(Meerburg, 1905.)

Gms. per 100 Gms. Sat. Sol. HIO_3.	Gms. per 100 Gms. Sat. Sol. NH_4IO_3.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. HIO_3.	Gms. per 100 Gms. Sat. Sol. NH_4IO_3.	Solid Phase.
0	4.20	NH_4IO_3	24	0.62	$NH_4IO_3.2HIO_3$
2.54	3.89	"	44.43	0.39	"
4.52	3.83	"+$NH_4IO_3.2HIO_3$	76.35	0.31	" +HIO_3
6.57	1.94	$NH_4IO_3.2HIO_3$	76.70	0	HIO_3

AMMONIUM Per IODATE NH_4IO_4.

100 gms. H_2O dissolve 2.7 gms. salt at 16°, d_{16} = 1.078. (Barker, 1908.)

AMMONIUM PERMANGANATE NH_4MnO_4.

100 parts water dissolve approximately 8 parts of NH_4MnO_4 at 15°. (Aschoff.)

AMMONIUM MOLYBDATES

MoO

EQUILIBRIUM IN THE SYSTEM AMMONIA, MOLYBDENUM TRI OXIDE AND WATER AT 25°.

(Foote and Bradley, 1930.)

The study of this system is rendered difficult by the slowness with which equilibrium is reached at the molydenum end of the diagram and the colloidal character and high concentration of the solutions at the other end. The mixtures were prepared from the well crystalline ammonium para molybdate, $3(NH_4)_2MoO_4.4MoO_3.4H_2O$, and either ammonia or MoO_3, and rotated for periods of several weeks to several months. Both the saturated solutions and solid phases were analyzed.

Gms. per 100 gms. sat. sol. NH_3	Gms. per 100 gms. sat. sol. MoO_3	Solid Phase	Gms. per 100 gms. sat. sol. NH_3	Gms. per 100 gms. sat. sol. MoO_3	Solid Phase
5.72	26.94	3.4.4	3.39	17.54	3.5.4
4.40	21.97	"	3.02	14.75	"
4.09	20.86	"	2.56	12.71	"
3.60	19.45	"	2.27	11.25	"
3.44	19.03	"	1.86	9.54	"
3.56	18.87	" + 3.5.4	1.35	7.00	"

3.4.4 = $3(NH_4)_2MoO_4.4MoO_3.4H_2O$.
3.5.4 = $3(NH_4)_2MoO_4.5MoO_3.4H_2O$.

The authors call attention to the improbability of the existance at 25° of all of the five ammonium molybdates, mentioned in the literature, which contain a larger proportion of MoO_3 than present in the above two

AMMONIUM Tri and Tetra **MOLYBDATES** $(NH_4)_2O.3MoO_3.H_2O$ and $(NH_4)_2O.4MoO_3.2H_2O$.

SOLUBILITY OF EACH IN WATER AT 18°. (Travers and Malaprade, 1926.)

Compound.	Formula.	Gms. anhydrous cmpd. per liter.
Ammonium trimolybdate....	$(NH_4)_2O.3MoO_3.H_2O$	14.0
» tetramolybdate.	$(NH_4)_2O.4MoO_3.2H_2O$	9.5

AMMONIUM Tetra **MOLYBDATE** $(NH_4)_2O.4MoO_3.2H_2O$.

100 gms. H_2O dissolve 3.52 gms. salt at 15° (d = 1.03), 3.67 gms. at 18° (d = 1.04) and 4.60 gms. at 32° (d = 1.05). (Wempe, 1912.)

AMMONIUM Phospho **MOLYBDATE** $(NH_4)_3PO_4.14MoO_3.4H_2O$.

SOLUBILITY IN WATER AND AQUEOUS SOLUTIONS AT 15°. (de Lucchi, 1910.)

Solvent.	Gms. Salt per 1000 Gms. Solvent.
Water	0.238
5 per cent aqueous NH_4NO_3 solution	0.137
1 per cent aqueous HNO_3 solution	0.203

AMMONIUM Tri **NITRIDE** NH_4N_3.

N

SOLUBILITY OF AMMONIUM TRINITRIDE IN WATER.
(Frost, Cothran and Browne, 1933.)

t°	Gms. NH_4N_3 per 100 gms. sat. sol.	Solid Phase
0	13.8	NH_4N_3
20	20.16	"
40	27.07	"

Pressure-temperature-concentration relations in the binary system ammonium tri nitride-ammonia are given by Howard Jr., Friederichs and Browne, 1934. The solvates, ammonium trinitride diammonate, $NH_4N_3.2NH_3$, and ammonium trinitride penta ammonate, $NH_4N_3.5NH_3$, were obtained as white crystalline solids. The diammonate undergoes inversion into ammonous salt at -9° and the pentaammonate undergoes inversion into the diammonate at -71°. The eutectic is located at -87° and 76% ammonia.

Tetra methyl**AMMONIUM** Tri**NITRIDE** $N(CH_3)_4N_3$.

APPROXIMATE SOLUBILITY IN SEVERAL SOLVENTS AT 20°. (Friedländer, 1918.)

Solvent.	Gms. $N(CH_3)_4N_3$ per 100 gms. sat. sol.	Solvent.	Gms. $N(CH_3)_4N_3$ per 100 gms. sat. sol.
Water................	50.0	Benzene..............	0.4
Ethyl alcohol.........	5.0	Chloroform...........	0.1
Methyl alcohol........	2.0	Ethyl ether...........	0.05

Excess of the salt in contact with carbon tetrachloride forms two layers, the lower of which contains 0.5 gm. $N(CH_3)_4N_3$ per 100 cc.

AMMONIUM NITRITE NH_4NO_2.

SOLUBILITY OF AMMONIUM NITRITE IN WATER, DETERMINED BY THE FREEZING-POINT METHOD.

(Bureau, 1937.)

t°	Gms. NH_4NO_2 per 100 gms. sat. sol.	Solid Phase	t°	Gms. NH_4NO_2 per 100 gms. sat. sol.	Solid Phase
− 5.2	10.2	Ice	−11.15	50.05	NH_4NO_2
−10.5	17.95	"	+ 1.4	56.0	"
−12.4	21.3	"	19.15	64.3	"
−21.75	35.0	"	33.45	75.0	"
−27.9 (Eutec.)	42.5	" + NH_4NO_2			

Above 33° the saturated solutions decompose rapidly.

AMMONIUM NITRATE NH_4NO_3.

NO

SOLUBILITY IN WATER.

(Schwarz — Ostwald's Lehrbuch, 2d ed. p 425; Muller and Kaufmann — Z. physik. Chem, 42, 407, '01–'02.)

t°.	Sp. Gr. Solution.	G. Mols. NH_4NO_3 per 100 Mols. H_2O.	Gms. NH_4NO_3 per 100 Gms. Solution.	Water.	Solid Phase.
0	...	26.63	54.19	118.3	NH_4NO_3 rhomb. β
12.2	1.2945	34.50	60.53	153.4	"
20.2	1.3116	43.30	65.80	192.4	"
25.0	1.3197	48.19	68.17	214.2	"
30.0	1.3299	54.40	70.73	241.8	"
32.1	1.3344	57.60	71.97	256.9	NH_4NO_3 rhomb. β + rhomb. α
35.0	1.3394	59.80	72.64	265.8	NH_4NO_3 rhomb. α
40.0	1.3464	66.80	74.82	297.0	"
50.0	...	77.41	77.49	344.0	"
60.0	...	94.73	80.81	421.0	"
70.0	...	112.30	83.32	499.0	"
80.0	...	130.50	85.25	580.0	"
90.0	...	166.50	88.08	740.0	NH_4NO_3 rhombohedral?
100.0	...	196.00	89.71	871.0	"

SOLUBILITY OF AMMONIUM NITRATE IN WATER.

(Rodenbush, 1918; Early and Lowry, 1919; Millican, Joseph and Lowry, 1922; Kazantzev, 1923, 1925; Mondain Monval, 1923, 1925; Cohen and Bredée, 1925.)

The various determinations were plotted on cross section paper and the following values taken from the curve. The determinations of M. J. and L. were made by the sealed tube method and also by use of a Beckmann apparatus. The results of C and B are claimed to be accurate to 0.02-0.03 per cent, and nearer correct than those of M M.

t°.	Gms. NH_4NO_3 per 100 gms. sat. sol.		Solid Phase.	t°.	Gms. NH_4NO_3 per 100 gms. sat. sol.		Solid Phase.
− 5	12.7[a]		Ice	40.0....	73.7[b]	(74.2)[c]	NH_4NO_3 III
−10	26.0		»	45.0....	75.34	(76.1)	»
−15	38.6		»	50.0....	77.0	(77.8)	»
−16.67 (Eutec.)	42.8		» + NH_4NO_3 IV	60.0....		(80.7)	»
−10.0......	47.7		NH_4NO_3 IV	70.0....		(83.5)	»
− 5.0......	51.2		»	80	86.4[c]		»
0.0......	54.23[b]		»	84.2 (tr. pt.)	87.0		» + NH_4NO_3 x
+ 5.0......	57.23	(59.0)[c]	»	90	89.0		NH_4NO_3 x
10.0......	60.05	(61.5)	»	100	91.4		»
15.0......	62.76	(63.8)	»	110	93.4		»
20.0......	65.24	(66.0)	»	120	95.0		»
25.0......	67.63	(68.1)	»	125 (tr. pt.).	95.5		» + NH_4NO_3 y
30.0......	69.90	(70.1)	»	130	96.5		NH_4NO_3 y
32.0......	70.77	(71.0)	»	140	97.5		»
32.27 (tr. pt.).	71.0	(71.0)	» + NH_4NO_3 III	150	98.7		»
33.0......	71.12	(71.2)	NH_4NO_3 III	169.6....	100.0		»
35.0......	71.6	(72.0)	»				

NO

[a] Determinations of Rodenbush. [b] Determinations of Cohen and Bredee. [c] Determinations of Millican, Joseph and Lowry. NH_4NO_3 IV corresponds to the α rhombic form and NH_4NO_3 III corresponds to the β rhombic form of other writers. Millican, Joseph and Lowry designate as γ the form of the salt which is stable between 32° and 84°.

SOLUBILITY OF AMMONIUM NITRATE IN WATER.

(Kurnakow and Rawitsch, 1933; results in parentheses, Nikitina, 1933.)

t°	Gms. NH_4NO_3 per 100 gms. sat. sol.	Solid Phase	t°	Gms. NH_4NO_3 per 100 gms. sat. sol.	Solid Phase
−16.9	42.30	Ice+NH_4NO_3 α rhomb.	55	79.40	NH_4NO_3 rhomboedr.
−10.0	47.24	" +NH_4NO_3 β rhomb.	60	(80.41)	"
−16 tr.pt.	—	α rhomb + β rhomb.	80	85.68 (85.44)	"
0	54.94 (54.2)	NH_4NO_3 β rhomb.	85 tr.pt.	—	" + cubic
20	(64.0)	"	86	86.89	NH_4NO_3 cubic
25	68.19	"	98	(91.15)	" rhomboedr.
32.3 tr.pt.	—	β rhomb + rhomboedr.	100	89.41	NH_4NO_3 cubic
35	72.21	NH_4NO_3 rhomboedr.	125 tr.pt.	—	cubic+tetragonal
40	(74.64)	"	130	95.64	tetragonal

The following results for the solubility of ammonium nitrate in water at temperatures above 100°, determined by the synthetic method, are by Benrath, Gjedebo, Schiffers and Wunderlich, 1937.

t°	Gms. NH_4NO_3 per 100 gms. sat. sol.	t°	Gms. NH_4NO_3 per 100 gms. sat. sol.	t°	Gms. NH_4NO_3 per 100 gms. sat. sol.
101	89.8	123	94.1	147	97.7
112	91.7	133	95.6	159	99.0
119	93.5	140	96.5	170 m.pt.	100.0

Data for the Solubility of Ammonium Nitrate in Water at 25° and under pressures up to 12 kilobars are given by Adams and Gibson, 1932. The Solubility decreases continually from 67.6 percent at atmospheric pressure to 43.6% at 5 kilobars pressure, 29.7% at 10 kilobars and 25.3% at 12

SOLUBILITY OF AMMONIUM NITRATE IN NITRIC ACID.

(Groschuff — Ber. 37, 1488, '04.)

Determinations by the " Synthetic Method,"

t°.	Gms. NH_4NO_3 per 100 Gms. Sol.	Mols. NH_4NO_3 per 100 Mols. HNO_3.	Solid Phase.		t°.	Gms. NH_4NO_3 per 100 Gms. Sol.	Mols. NH_4NO_3 per 100 Mols. HNO_3.	Solid Phase	
8	21.1	21.1	$NH_4NO_3.2HNO_3$		11.0	51.7	84.3	$NH_4NO_3.HNO_3$	
23	28.7	31.6	"	a	12.0	54.7	95.1	"	labil
29.5 m.pt.	38.8	50.0	"		11.5	57.6	108.0	"	b
27.5	44.6	63.4	"	b	11.5	54.0	92.4	NH_4NO_3	labil.
23.5	49.4	76.8	"		17.0	54.7	95.1	"	stabil
17.5	54.0	92.4	"		27.0	56.2	101.0	"	
16.5	54.3	93.5	"		49.0	60.4	120.0	"	
4.0	45.8	66.7	$NH_4NO_3.HNO_3$ labil		79.0	68.1	168.0	"	

a = solution in HNO_3, b = solution in NH_4NO_3.

SOLUBILITY OF AMMONIUM TRI-NITRATE IN WATER.

(Groschuff.)

t°.	Gms. NH_4NO_3 per 100 Gms. Solution.	Gms. HNO_3 per 100 Gms. Solution.	Mols. NH_4NO_3* per 100 Mols. H_2O.	Mols. NH_4NO_3 per 100 total Mols. Solution.	Solid Phase.
−8	34.2	53.9	64.3	22	$NH_4NO_3.2HNO_3$
−2.5	34.8	54.8	75.1	23.1	"
+3	35.4	55.8	90	24.3	"
8.5	36.6	56.9	113	25.7	"
19.5	37.4	58.9	225	29	"
25	38.1	60	450	31	"
29.5 m. pt.	38.8	61.2	∞	33	"

* or $NH_4NO_3.2HNO_3$.

NO

SOLUBILITY OF AMMONIUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID.

(Kazantzev, 1923, 1925.)

Saturation was obtained by constant agitation for periods of 1 to 2 hours. Carefully purified materials were used.

Results at 0°.

Gms. per 100 gms. sat. sol. HNO_3.	NH_4NO_3.
0.0	54.3
9.2	43.5
15.5	38.4
21.0	34.5
24.0	32.8
27.0	31.9
30.0	31.1
33.2	31.0
36.2	32.1
39.1	33.2
41.4	34.0
45.8	39.5
47.4	48.2

Results at 15°.

Gms. per 100 gms. sat. sol. HNO_3.	NH_4NO_3.
0.0	62.4
0.7	61.1
2.8	59.1
7.7	53.3
9.0	52.0
16.4	45.7
21.7	42.2
27.1	40.9
31.5	39.2
36.7	39.9
39.0	40.8
44.0	46.8
45.0	52.5

Results at 30°.

Gms. per 100 gms. sat. sol. HNO_3.	NH_4NO_3.
0.0	70.2
3.5	65.5
8.6	60.9
10.6	58.8
14.4	55.6
16.7	53.1
20.8	51.5
22.1	50.0
26.4	48.5
30.0	47.5
37.5	48.6
40.1	51.0
42.2	55.6

Results at 75°.

Gms. per 100 gms. sat. sol. HNO_3.	NH_4NO_3.
0.0	84.1
12.8	73.7
16.0	71.8
26.3	67.5
31.6	66.8

20°

(Nichols, Howes et. al., 1919.)

HNO_3.	NH_4NO_3.
0.0	65.63
3.98	60.16
8.81	55.95
14.65	51.17
21.46	46.35
28.33	43.35

SOLUBILITY OF AMMONIUM NITRATE IN AMMONIA.

(Kuriloff—Z. physic. Chem. 25, 109, '98.)

t°.	Gms. NH_4NO_3.	Gms. NH_3.	Mols NH_4NO_3 per 100 Mols. NH_4NO_3 + NH_3.	t°.	Gms. NH_4NO_3.	Gms. NH_3.	Mols. NH_4NO_3 per 100 Mols NH_4NO_3 + NH_3.
−80	0	100	0.0	33.3	0.9358	0.2352	45.9
−60	1.3918	4.4327	6.25	35.9	0.7746	0.1857	47.0
−44.5	0.9526	1.2457	13.9	68.8	4.2615	0.7747	53.8
−30	0.8308	0.3700	32.3	94.0	0.6439	0.0665	67.3
−10.5	0.9675	0.3515	36.9	190.8	0.7578	0.0588	74.2
0	0.7600	0.2607	38.3	168.0	...	...	100.0

t° = temperature of equilibrium between solution and solid phase

SOLUBILITY OF AMMONIUM NITRATE IN AQUEOUS SOLUTIONS OF AMMONIA AT 25°.

(Hunt, 1932.)

Gms. H_2O per 100 gms. NH_3 + H_2O	Gms. NH_4NO_3 per 100 gms. solvent	Gms. H_2O per 100 gms. NH_3 + H_2O	Gms. NH_4NO_3 per 100 gms. solvent
0	390.0	13.2	351.9
1.78	383.7	15.9	337.4
2.80	381.0	18.6	331.8
3.40	378.6	21.8	316.8
4.82	372.8	47.5	247.0
6.86	368.6	68.0	220.0
10.1	354.7	100.	214.2
12.1	352.1		

SOLUBILITY OF AMMONIUM NITRATE IN AQUEOUS SOLUTIONS OF AMMONIUM SULFATE AND VICE VERSA.

(Massink, 1916, 1917.)

Results at 0°. (de Waal, 1910.)			Results at 30°. (Schreinemakers and Haenen, 1910.)			Results at 70°. (de Waal, 1910.)		
Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
NH_4NO_3	$(NH_4)_2SO_4$.		NH_4NO_3.	$(NH_4)_2SO_4$.		NH_4NO_3.	$(NH_4)_2SO_4$.	
54.19	0	NH_4NO_3	70.1	0	NH_4NO_3	84.03	0	NH_4NO_3
49.12	6	"	67.63	2.38	"	81.38	2.41	"
45.99	9.53	NH_4NO_3+1.3	66.93	3.46	NH_4NO_3+1.3	81.01	2.45	NH_4NO_3+1.3
31.61	19.5	1.3	63.84	4.06	1.3	80.25	2.68	1.3
30.87	20.43	1.3+1.2	58.06	8.22	1.3+1.2	76.01	3.96	"
31.04	20.4	1.2	52.75	11.42	1.2	73.48	5.14	1.3+1.2
29.81	21.33	"	49.80	13.27	" +$(NH_4)_2SO_4$	71.58	5.82	1.2
29.58	41.64	1.2+$(NH_4)_2SO_4$	37.20	19.48	$(NH_4)_2SO_4$	70.15	6.71	1.2+$(NH_4)_2SO_4$
5.61	37.89	$(NH_4)_2SO_4$	19.91	28.83	"	11.10	40.81	$(NH_4)_2SO_4$
0	41.4	"	12.05	34.7	"	0	47.81	"
			0	44.1	"			

1.3 = $(NH_4)_2SO_4.3NH_4NO_3$. 1.2 = $(NH_4)_2SO_4.2NH_4NO_3$.

Later determinations by Janecke, Eissner and Brill show that the only double salt formed at temperatures between 0° and 100° is the 1.2 salt, $(NH_4)_2SO_4.2NH_4NO_3$. The results are presented in the form of a diagram but the numerical values are not given. The authors also give the m. pt. diagram for the system NH_4NO_3 + $(NH_4)_2SO_4$ but not the numerical results.

SOLUBILITY OF AMMONIUM NITRATE IN AQUEOUS SOLUTIONS OF AMMONIUM ACID SULFATE AT 25°.

(Wöhler and Schäffer, 1925.)

Gms. per 100 gms. sat. sol. NH_4NO_3.	Gms. per 100 gms. sat. sol. NH_4HSO_4.	Solid Phase.	Gms. per 100 gms. sat. sol. NH_4NO_3.	Gms. per 100 gms. sat. sol. NH_4HSO_4.	Solid Phase.
59.0	13.9	NH_4NO_3	30.1	51.1	$NH_4NO_3.NH_4HSO_4$
52.5	25.5	»	27.3	58.8	»
45.5	36.6	»	23.3	62.5	NH_4HSO_4
35.8	47.9	$NH_4NO_3.NH_4HSO_4$	16.9	66.1	»
32.3	49.1	»	8.2	69.5	»

The authors also give the following results for the solubility of the double salt $NH_4NO_3.NH_4HSO_4$ in water at different temperatures.

t°..........	20.	30.	40.	50.	60.
Gms. $NH_4NO_3.NH_4HSO_4$ per 100 gms. sat. sol.	82.9	84.6	86.9	89.3	92.6

EQUILIBRIUM IN THE SYSTEM: AMMONIUM NITRATE + AMMONIUM THIOCYANATE + AMMONIA. (Foote and Brinkley, 1921.)

The mixtures were shaken at constant temperatures and the saturated solutions analyzed by titrating the ammonia, using Congo Red as indicator, and the thiocyanate by the Volhard method. The NH_4NO_3 was estimated by difference.

Results at 0°. Gms. per 100 gms. sat. sol. NH_3.	Results at 0°. Gms. per 100 gms. sat. sol. NH_4CNS.	Results at 10°. Gms. per 100 gms. sat. sol. NH_3.	Results at 10°. Gms. per 100 gms. sat. sol. NH_4CNS.	Results at 20°. Gms. per 100 gms. sat. sol. NH_3.	Results at 20°. Gms. per 100 gms. sat. sol. NH_4CNS.	Solid Phase at each temperature
22.88	77.12	22.70	77.30	21.35	78.65	NH_4CNS
20.96	69.88	20.11	71.49	19.59	75.72	»
19.60	64.95	17.85	64.66	18.12	70.24	»
19.05	61.72	17.28	61.64	15.20	60.00	» + NH_4NO_3
19.97	59.97	18.52	56.37	17.73	54.37	NH_4NO_3
23.70	44.58	21.87	44.53	20.37	42.38	»
24.70	37.15	23.06	34.53	21.20	29.64	»
24.75	24.55	23.32	21.70	21.15	19.47	»
24.22	9.64	22.55	8.80	21.13	14.20	»
23.13	0.0	21.91	0.0	20.55	0.00	»

SOLUBILITY OF AMMONIUM NITRATE IN PRESENCE OF SODIUM CHLORIDE.

(Rengade, 1917, 1922.)

Equimolecular mixtures of $NH_4NO_3 + NaCl$ or of $NaNO_3 + NH_4Cl$ were evaporated at gradually increasing temperatures and the solutions analyzed after the separation of NaCl and before the appearance of NH_4Cl, which could be easily distinguished by its crystalline form. The four ions were determined and the results arbitrarily expressed in terms of $NH_4NO_3 + NaCl$.

t°.	Gms. per 100 gms. H_2O. NH_4NO_3.	Gms. per 100 gms. H_2O. NaCl.	t°.	Gms. per 100 gms. H_2O. NH_4NO_3.	Gms. per 100 gms. H_2O. NaCl.	t°.	Gms. per 100 gms. H_2O. NH_4NO_3.	Gms. per 100 gms. H_2O. NaCl.	Gms. per 100 gms. H_2O. $NaNO_3$.
80*...	81	46	108*...	435	100	118...	750	140	0
98*...	128	56	111....	464	101	124...	2,015	320	35
100*...	139	59	115....	683	137	129...	3,500	427	29

* These solutions prepared from equimolecular mixtures of $NaNO_3 + NH_4Cl$, and the others from equimolecular mixtures of $NH_4NO_3 + NaCl$. The results were intended for use in the industrial preparation of NH_4NO_3.

SOLUBILITY OF MIXTURES OF AMMONIUM NITRATE AND SODIUM NITRATE IN WATER. (Mondain Monval, 1925.)

t°.	Gms. per 100 gms. H_2O. NaNO₃.	Gms. per 100 gms. H_2O. NH_4NO_3.	Solid Phase.	t°.	Gms. per 100 gms. H_2O. NaNO₃.	Gms. per 100 gms. H_2O. NH_4NO_3.	Solid Phase.
12.67....	68.4	150.4	NH_4NO_3	9.95....	74.0	140	$NaNO_3$
18.48....	68.4	176.0	"	13.15....	76.68	140	"

100 gms. H_2O dissolve 1233 gms. NH_4NO_3 + 333 gms. $NaNO_3$ at 100°. (Wurmser, 1922.)

100 cc. Pyridine dissolve 22.88 gms. NH_4NO_3 at 25°. (Müller, R., 1924.)

RECIPROCAL SOLUBILITY OF AMMONIUM NITRATE AND SODIUM NITRATE IN WATER AT 0°, 15° AND 30°.

(Fedotieff and Koltunoff, 1914.)

t°.	Sp. Gr. Sat. Sol.	Gms. per 100 Gms. H_2O. NH_4NO_3.	Gms. per 100 Gms. H_2O. $NaNO_3$.	t°.	Sp. Gr. Sat. Sol.	Gms. per 100 Gms. H_2O. NH_4NO_3.	Gms. per 100 Gms. H_2O. $NaNO_3$.
0	1.354	0	73.33	15	1.429	155.3	75.38
0	1.407	105.5	66	15	1.405	156.1	60.76
0	1.264	118.4	0	15	1.364	159	36.50
15	1.375	0	83.9	15	1.350	160	27.79
15	1.386	24.03	81.21	15	1.330	162.3	17.63
15	1.392	42.81	79.34	15	1.298	167.4	0
15	1.401	64.6	78.06	30	1.401	0	96.12
15	1.417	110.9	75.81	30	1.450	220.8	88.31
15	1.428	152	75.35	30	1.329	232.6	0

Later determinations of this system by Nikitina, 1933, gave the following results.

t°	Gms. per 100 gms. sat. sol. NH_4NO_3	Gms. per 100 gms. sat. sol. $NaNO_3$	Solid Phase	t°	Gms. per 100 gms. sat. sol. NH_4NO_3	Gms. per 100 gms. sat. sol. $NaNO_3$	Solid Phase
0	52.40	0.0	β rhomb NH_4NO_3	60	80.41	0.0	α rhomb NH_4NO_3
"	52.46	2.08	"	"	78.60	2.24	"
"	50.42	4.25	"	"	75.30	6.87	"
"	49.05	7.18	"	"	73.82	9.02	"
"	41.37	20.02	"	"	64.59	20.34	" + $NaNO_3$
"	38.71	24.63	" + $NaNO_3$	"	0.0	55.58	$NaNO_3$
"	0.0	42.34	$NaNO_3$	80	86.44	0.0	α rhomb NH_4NO_3
10	64.0	0.0	β rhomb NH_4NO_3	"	80.13	8.73	"
"	62.54	2.72	"	"	75.58	15.09	"
"	61.51	5.30	"	"	72.06	19.25	" + $NaNO_3$
"	55.01	12.64	"	"	61.48	25.37	$NaNO_3$
"	52.24	16.47	"	"	31.89	42.03	"
"	49.60	22.40	" + $NaNO_3$	"	10.83	51.6	"
"	33.48	30.27	$NaNO_3$	"	0.0	59.9	"
"	22.85	35.25	"	98	91.15	0.0	rhomboedr. NH_4NO_3
"	10.95	41.34	"	"	88.89	2.78	"
"	0.0	46.80	"	"	86.89	5.38	"
40	74.64	0.0	α rhomb NH_4NO_3	"	85.97	7.23	"
"	72.98	2.70	"	"	85.51	8.79	"
"	60.07	21.68	" + $NaNO_3$	"	78.26	18.45	" + $NaNO_3$
"	41.47	31.02	$NaNO_3$	"	0.0	63.04	$NaNO_3$
"	13.01	44.98	"				
"	0.0	51.30	"				

SOLUBILITIES OF MIXTURES OF AMMONIUM NITRATE AND OTHER SALTS.

(Rüdorf — Mulder.)

100 gms. H_2O dissolve 162.9 gms. NH_4NO_3 + 77.1 gms. $NaNO_3$ at 16° R.
100 gms. H_2O dissolve 88.8 gms. NH_4NO_3 + 40.6 gms. KNO_3 at 9° M.
100 gms. H_2O dissolve 101.3 gms. NH_4NO_3 + 6.2 gms. $Ba(NO_3)_2$ at 9° M.

SOLUBILITY OF AMMONIUM NITRATE IN AQUEOUS SOLUTIONS OF LEAD NITRATE AT 10° AND AT 20° AND VICE VERSA.

(Malquori, 1928.)

The authors results were plotted and the following results taken from the average curves.

Results at 10°			Results at 20°		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
NH_4NO_3	$Pb(NO_3)_2$		NH_4NO_3	$Pb(NO_3)_2$	
60.5	0.0	NH_4NO_3	65.8	0.0	NH_4NO_3
51.0	10.0	"	58.5	10.0	"
45.5	20.0	"	53.0	20.0	"
41.5	30.0	"	48.5	29.0	" + $Pb(NO_3)_2$
40.5	36.0	" + $Pb(NO_3)_2$	40.0	31.0	$Pb(NO_3)_2$
30.0	32.0	$Pb(NO_3)_2$	30	31.7	"
20.0	29.5	"	20	32.5	"
10.0	27.5	"	10	33.2	"
0.0	27.4	"	0	36.0	"

SOLUBILITY OF AMMONIUM NITRATE IN AQUEOUS SOLUTIONS OF LEAD NITRATE AT 25° AND VICE VERSA.

(Hill and Kaplan, 1938.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
NH_4NO_3	$Pb(NO_3)_2$		NH_4NO_3	$Pb(NO_3)_2$	
68.17	0.0	NH_4NO_3	36.92	32.61	$Pb(NO_3)_2$
56.15	18.04	"	28.75	33.65	"
49.00	29.44	" + $Pb(NO_3)_2$	16.28	34.02	"
48.47	29.63	$Pb(NO_3)_2$	12.35	33.99	"
44.58	30.79	"	0.0	37.17	"

SOLUBILITY OF AMMONIUM NITRATE IN AQUEOUS SOLUTIONS OF URANYL NITRATE AND VICE VERSA AT 25°

(Colani, 1927, 1928.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
NH_4NO_3	$UO_2(NO_3)_2$		NH_4NO_3	$UO_2(NO_3)_2$	
65.72	0.0	NH_4NO_3	24.92	49.33	2.1.2
60.84	6.9	"	22.13	52.00	"
51.84	18.10	"	20.99	54.35	" + $UO_2(NO_3)_2 \cdot 6H_2O$
48.21	23.12	"	17.24	53.06	$UO_2(NO_3)_2 \cdot 6H_2O$
43.26	30.54	"	10.38	51.79	"
35.19	40.23	" + 2.1.2	6.36	53.23	"
34.69	40.81	2.1.2	2.50	54.53	"
28.64	46.31	"	0.0	56.08	"

2.1.2 = $2NH_4NO_3 \cdot UO_2(NO_3)_2 \cdot 2H_2O$

AMMONIUM Uranyl NITRATES $NH_4NO_3.UO_2(NO_3)_2$ and $2NH_4NO_3.UO_2(NO_3)_2$.

SOLUBILITY OF AMMONIUM URANYL NITRATES IN AQUEOUS NITRIC ACID AT 20°.

(Nichols, Hawes, et al, 1919.)

Results for $NH_4NO_3.UO_2(NO_3)_2$.			Results for $2NH_4NO_3.UO_2(NO_3)_2$.		
Per cent HNO_3 in solvent.	Gms. $NH_4NO_3.UO_2(NO_3)_2$ per 100 gms. solvent.	Solid Phase.	Per cent HNO_3 in solvent.	Gms. $2NH_4NO_3.UO_2(NO_3)_2$ per 100 gms. solvent.	Solid Phase.
0	165.0	$UO_2(NO_3)_2.6H_2O$	0	251.0	$UO_2(NO_3)_2.6H_2O$
10	128.5	"	10	201.0	"
20	80 3	"	20	150.0	"
30	68.2	"	30	144.0	"
40	60.5	"	0	380.0	$NH_4NO_3.UO_2(NO_3)_2$
20	144.5	$NH_4NO_3.UO_2(NO_3)_2$	10	380.0	"
30	144.0	"	20	215.0	"
40	95.6	"	30	150.0	"
50	61.4	"	40	98.2	"
60	38.6	"	50	58.0	"
			60	35.6	"

SOLUBILITY OF AMMONIUM NITRATE IN AQUEOUS ETHYL ALCOHOL.

(Fleckenstein — Physik. Z., 6, 419, '05.)

t°	Grams of NH_4NO_3 Dissolved per 100 Grams Aq. Alcohol of (Wt. %):					
	100%.	86.77%.	76.12%.	51.65%.	25.81%.	0%.
20	2.5	11	23	70	140	195
30	4	14	32	90	165	230
40	5	18	43	115	196	277
50	6	24	55	144	244	365
60	7.5	30	70	183	320	...
70	9	41	93	230	...	...
80	10.5	56	...	...	...	...

NOTE. — The figures in the preceding table were read from curves shown in the abridged report of the work, and are, therefore, only approximately correct. Determinations of the solubility in methyl alcohol solutions were also made but not quoted in the abstract. The "Synthetic Method" was used.

100 grams absolute ethyl alcohol dissolve 4.6 grams NH_4NO_3 at 14° and 3.8 grams at 20.5°.

100 grams absolute methyl alcohol dissolve 14.6 grams NH_4NO_3 at 14°, 16.3 grams at 18.5° and 17.1 grams at 20.5°.

(Schiff and Monsacchi — Z. physik. Chem., 21, 277, '96; at 20.5° de Bruyn — *Ibid.*, 10, 783, '92.)

SOLUBILITY OF AMMONIUM NITRATE IN AQUEOUS ETHYL AND METHYL ALCOHOLS AND IN A MIXTURE OF THE TWO AT 30°.

(Schreinemakers, 1908–09.)

Gms. per 100 Gms. Sat. Sol.			Gms. per 100 Gms. Sat. Sol.			Gms. per 100 Gms. Sat. Sol.		
H_2O.	C_2H_5OH.	NH_4NO_3.	H_2O.	CH_3OH.	NH_4NO_3.	H_2O.	*CH_3OH + C_2H_5OH.	NH_4NO.
0	96.4	3.6	0	83.3	16.7	3.4	84.9	11.7
5	89.6	6.5	5	74.8	21.3	5	82.9	12.3
10	80.4	10.7	10	63.8	27.1	10	74.6	16.4
15	68.6	17	15	50.7	35	15	63.5	24
20	53.5	26.8	20	35.2	46.3	20	48.2	35.1
25	32.5	44.8	25	19.8	59	25	22.4	54
29.9	0	70.1	29.9	0	70.1	29.9	0	70.1

* Weight per cent CH_3OH = 51.7, C_2H_5OH = 48.3.

Additional determinations of the solubility of ammonium nitrate in aqueous ethyl alcohol solutions at 0°, 30° and 70° are given by deWaal (1910). At certain concentrations at 67.5° the solutions separate into two layers

EQUILIBRIUM IN THE SYSTEM AMMONIUM NITRATE, TERTIARY BUTYL ALCOHOL AND WATER AT 25°.

(Ginnings, Herring and Webb, 1933.)

The composition of the homogeneous mixture, plait point, of the three components, as determined by the synthetic method, is 21.6 gms. NH_4NO_3 + 33.1 gms. tertiary Butyl alcohol, $(CH_3)_3COH$, per 100 gms. sat. solution. The original results for the remaining points on the binodal curve are not given, but only the values corresponding to derived empirical equations for the curve.

AMMONIUM NITRATE

The binodal curve for the system
Ammonium Nitrate + Allyl Alcohol + Water at 25°
has been determined by Ginnings and Dees, 1935 but the authors do not give their experimental results but only the values of a series of constants calculated from them by means of an empirical equation. From these the conclusion is drawn that allyl alcohol seems to be more difficult to salt out than either iso propyl or normal propyl alcohol.

SOLUBILITY OF AMMONIUM NITRATE IN PURE ACETIC ACID ACID, DETERMINED BY THE FREEZING-POINT METHOD.

(Davidson and Geer, 1933.)

t°	Gm. Mols. NH_4NO_3 per 100 gm. mols. sat. sol.	t°	Gm. Mols. NH_4NO_3 per 100 gm. mols. sat. sol.	t°	Gm. Mols. NH_4NO_3 per 100 gm. mols. sat. sol.	t°	Gm. Mols. NH_4NO_3 per 100 gm. mols. sat. sol.
16.60	0.0 (1)	67.6	2.468	102.6	19.36	122.9	63.1
16.57	0.0741 (1)	69.0	2.636	106.3	23.3	124.8	66.8
16.47	0.1287 (1)	71.4	3.239	108.9	27.64	128.9	71.6
17.7	0.2832	72.8	3.447	110.6	31.25	131.4	75.0
21.4	0.3249	78.3	4.710	113.1	37.98	136.9	78.6
27.0	0.3916	80.9	5.508	115.8	43.31	143.1	82.3
33.6	0.5143	85.7	7.255	117.0	47.56	149.7	86.3
45.8	0.8745	89.0	8.620	118.3	51.67	157.8	89.6
61.2	1.634	97.1	13.68	120.0	55.5	167.5	100.0
63.5	1.887	101.0	17.15	121.4	60.1		

(1) The solid phase in these cases in CH_3COOH and NH_4NO_3 in all others.

One liter sat. solution of Ammonium Nitrate in pure acetic acid contains 3.5 gms. NH_4NO_3 at 16.46°. (Eichelberger, 1934.)

EQUILIBRIUM IN THE SYSTEM AMMONIUM NITRATE, UREA AND WATER, DETERMINED BY THE SYNTHETIC METHOD.

(Sokolov, 1939.)

NO

t°	Gms. per 100 gms. sat. sol.		Solid Phase
	$CO(NH_2)_2$	NH_4NO_3	
-20.6	30.0	21.0	Ice
-18.1	25.0	22.5	"
-16.8	20.0	24.0	"
-14.9	15.0	25.5	"
-13.6	10.0	27.0	"
-11.0	0.0	30.0	"
-12.8	30.0	7.0	"
- 9.5	20.0	8.0	"
- 6.2	10.0	9.0	"
- 3.7	0.0	10.0	"
-16.65	0.0	43.1	" + NH_4NO_3
-11.1	32.9	0.0	" + α $CO(NH_2)_2$
-14.0	37.7	6.8	" "
-20.7	30.1	20.9	" "
-23.5	29.2	26.8	Ice + α + β $CO(NH_2)_2$
-25.5	28.4	31.7	Ice + β + γ "
-26.5	29.8	35.1	" + γ " + α NH_4NO_3
-18.5	7.7	41.0	" + α + β NH_4NO_3
-13.2	33.0	6.7	α $CO(NH_2)_2$
-11.2	34.0	6.6	"
- 9.3	35.0	6.5	"
-19.8	31.0	7.44	"
- 7.4	36.4	2.07	α + β $CO(NH_2)_2$
-19.6	31.3	20.6	" "
-17.6	32.0	20.4	β $CO(NH_2)_2$
-15.2	33.0	20.1	"
-12.8	34.0	19.8	"
- 8.6	36.0	18.2	"
- 4.2	38.0	7.06	"
- 0.1	40.0	6.95	"
- 6.2	37.0	6.3	"
- 0.2	40.0	6.0	"
+ 3.5	42.0	5.8	"
8.7	45.0	5.5	"
12.2	47.0	5.3	"
15.7	49.0	5.4	"
16.2	49.2	5.0	β + γ $CO(NH_2)_2$
0.5	40.5	17.9	" "
-21.2	30.0	35.0	γ $CO(NH_2)_2$
- 7.6	35.0	32.5	"
+ 4.0	40.0	30.0	"
15.5	45.0	27.7	"
26.6	50.0	25.0	"
- 9.8	33.6	39.0	"
- 6.0	35.2	36.0	γ $CO(NH_2)_2$
- 2.6	36.9	33.0	"
+ 0.5	38.5	30.0	"
2.6	40.0	27.3	"
4.0	42.0	17.4	"
8.3	44.0	16.8	"
12.4	46.0	16.2	"
16.8	48.0	15.6	"
28.0	51.0	14.7	"
30.8	55.0	13.5	"
21.7	52.0	4.8	"
27.6	55.0	4.5	"
7.2	37.2	47.0	"
8.9	37.8	46.0	"
12.8	39.9	43.0	"
16.6	42.0	40.0	"
20.0	44.2	37.0	"
24.4	47.0	33.8	"
27.6	49.0	30.0	"
-25.9	28.4	35.9	" + α NH_4NO_3
-13.4	32.2	41.5	" + β NH_4NO_3
+ 6.6	36.8	47.4	" "
-18.5	30.5	39.5	γ $CO(NH_2)_2$ + α + β NH_4NO_3
+9.5	37.6	48.3	" + β + γ NH_4NO_3
-23.3	25.0	37.5	α NH_4NO_3
-19.2	20.0	40.0	"
-15.3	15.0	42.5	"
-11.8	10.0	40.0	"
- 8.7	5.0	47.5	"
- 5.8	0.0	50.0	"
-12.2	31.9	42.0	β NH_4NO_3
- 5.0	30.2	45.3	"
+ 0.7	28.7	48.0	"
7.0	27.0	51.0	"
7.9	36.5	48.0	"
12.0	25.7	53.5	β + γ NH_4NO_3
10.0	35.6	49.2	" "
13.1	25.3	54.0	γ NH_4NO_3
20.6	23.5	57.3	"
12.5	35.0	50.0	"
14.9	34.3	51.0	"
22.0	32.3	54.0	"
28.5	30.1	57.0	"

Freezing-point data for mixtures of NH_4NO_3 + $CO(NH_2)_2$ and NH_4NO_3 + $CO(NH_4)_2$ + $NaNO_3$ are given by Howells, 1929, 1930.

AMMONIUM NITRATE

100 cc anhydrous Hydrazine dissolve 78 gms. NH_4NO_3 with decomposition at about 18°. (Welsh and Broderson, 1915.)

100 cc Pyridine dissolve 0.34 gm. NH_4NO_3 at (?) temp. (Müller, 1925.)

SOLUBILITY OF AMMONIUM NITRATE IN LIQUID AMMONIA.

t°	Gms. NH_4NO_3 per 100		t°	Gms. NH_4NO_3 per 100	
	ccNH_3	gms. NH_3		cc NH_3	gms. NH_3
-50.6	70.1	— (1)	-40.8	75.1	— (1)
-46.5	72.6	— (1)	-36.6	77.0	— (1)
-45.0	73.4	— (1)	-34.0	77.9	— (1)
-44.0	73.5	— (1)	+25	235.56	390.0(2)(d_{25}= 1.212)

(1) Scherer, 1931; (2) Hunt, 1932.

SOLUBILITY OF AMMONIUM NITRATE IN LIQUID AMMONIA SOLUTIONS OF SODIUM CHLORIDE AND VICE VERSA AT 25°.

(Hunt and Boncyk, 1933.)

One-fourth gram of the less soluble salt was mixed with variable amounts of the more soluble salt and ammonia added in excess. Ammonia was then allowed to escape until a single crystal of one salt separated from solution.

Gm. Mols. per 10 gm. Mols. NH_3		Gm. Mols. per 10 gm. Mols. NH_3	
NaCl	NH_4NO_3	NaCl	NH_4NO_3
0.0	8.2875	0.667	5.85
0.484	8.50	0.534	1.562
0.655	8.60	0.088	0.0
0.632	7.39		

Freezing-point data are given for:

NH_4NO_3 + $AgNO_3$	(Flavitzkii, 1909; Zawidzki, 1904.)
" + $(NH_4)_2SO_4$	(Bowen, 1926.)
" + NaCl	(Perman, 1922.)
" + " + $NaNO_3$	(" "
" + $NaNO_3$	(Perman, 1922; Earley and Lowry, 1922.)
" + Na_2SO_4	(Perman and Harrison, 1924.)
" + $Pb(NO_3)_2$	(Bogitch, 1915.)

AMMONIUM Hydrogen PHOSPHITE $(NH_4H)HPO_3$.

100 grams water dissolve 171 grams $(NH_4H)HPO_3$ at 0°, 190 grams at 14.5° and 260 grams at 31°. (Amat., 1887.)

AMMONIUM Hypo PHOSPHITE $NH_4H_2PO_2$.

100 cc. H_2O dissolve 83 gms. $NH_4H_2PO_2$ at room temp. (Squire and Caines, 1905.)

AMMONIUM PHOSPHATES Mono, $NH_4H_2PO_4$ and Di, $(NH_4)_2HPO_4$.

SOLUBILITY OF EACH IN WATER.

(Buchanan and Winner, 1920.)

Results for Monoammonium Phosphate.

t°.	Gms. $NH_4H_2PO_4$ per 100 gms. Sat. sol.	H_2O.
0	18.5	22.7
10	22.8	29.5
20	27.2	37.4
30	31.7	46.4
40	36.2	56.7
60	45.2	82.5
80	54.2	118.3
100	63.4	173.2
110.5	68.3	215.0

Results for Diammonium Phosphate.

t°.	Gms. $(NH_4)_2HPO_4$ per 100 gms. Sat. sol.	H_2O.
0	30.0	42.9
10	38.6	62.8
20	40.8	69.0
30	42.9	75.2
40	45.0	81.8
50	47.2	89.2
60	49.3	97.3
70	51.4	106.0

Additional determinations for monoammonium phosphate, agreeing fairly closely with the above, are given by Apfel, 1911.

PO

The above values for mono ammonium phosphate were confirmed by Jänecke, 1927. Subsequent determinations by Ross, Merz and Jacob, 1929 are somewhat lower than the above results at the lower temperatures and slightly higher at the upper temperatures. These investigators also give a value for the solubility of diammonium phosphate in water at 25° which is lower than the interpolated value from the above table. They give as the solubility of tri ammonium phosphate in water at 25°, the value, 17.7 gms. per 100 gms. H_2O. Wolkowitsch, Berlin and Manzew, 1932, found 19.0 gms. $(NH_4)_3PO_4$ per 100 gms. H_2O at 25°.

The following additional determinations of the Solubility of Diammonium Phosphate in Water, determined by the synthetic method, at temperatures above 100°, are given by Jänecke, 1936.

t°	Gms. $(NH_4)_2HPO_4$ per 100 gms. sat. sol.	t°	Gms. $(NH_4)_2HPO_4$ per 100 gms. sat. sol.
117	63.0	180	80.6
122	65.9	191	83.1
160	74.8	250 m.pt.	100.0

The temperature is that of complete solution of the solid phase.

EQUILIBRIUM IN THE SYSTEM AMMONIA, PHOSPHORUS PENTOXIDE AND WATER AT 0° AND AT 25°.

(Jänecke, 1927.)

Results at 0°				Results at 25°	
Percent NH_3 in dissolved $NH_3 + P_2O_5$	Gms. H_2O to dissolve 100 gms. $NH_3 + P_2O_5$	Percent NH_3 in dissolved $NH_3 + P_2O_5$	Gms. H_2O to dissolve 100 gms. $NH_3 + P_2O_5$	Percent NH_3 in dissolved $NH_3 + P_2O_5$	Gms. H_2O to dissolve 100 gms. $NH_3 + P_2O_5$
92.2	1090	34.0	659	95.3	563
86.1	1480	31.0	257	85.8	881
75.0	1870	26.0	210	60.7	1090
68.0	2075	24.5	315	41.5	705
65.0	2110	24.0	326	32.5	222
55.7	1990	19.2	486	27.2	127
43.0	1440	6.0	65.8	22.5	92.2
				20.1	333
				12.62	232
				8.60	63.7

Using the above results supplemented by those of Parravano and Mieli, 1908, upon this system, the author obtained the following results for solutions saturated with $NH_4H_5(PO_4)_2 + H_3PO_4$.

t°	Percent NH_3 in dissolved $NH_3 + P_2O_5$	Gms. H_2O to dissolve 100 gms. $NH_3 + P_2O_5$	t°	Percent NH_3 in dissolved $NH_3 + P_2O_5$	Gms. H_2O to dissolve 100 gms. $NH_3 + P_2O_5$
0	0	73.0	25	4.2	32.7
"	3.2	79.0	"	4.9	58.1
"	5.9	126.6	"	7.1	97.5
"	10.0	185.0	"	10.8	140.0

PO

The author also gives data for the quarternary system $NH_3 + K_2O + P_2O_5 + H_2O$ at 0° and at 25°.

SOLUBILITY OF AMMONIUM PHOSPHATES IN AQUEOUS SOLUTIONS OF ORTHO PHOSPHORIC ACID AT 25°.

(Parker, 1914.)

Gms. per 100 Gms. Sat. Solution.		Solid Phase.	Gms. per 100 Gms. Sat. Solution.		Solid Phase.
H_3PO_4.	NH_3.		H_3PO_4.	NH_3.	
4.1	22.6	$(NH_4)_3PO_4.3H_2O$	40	9	$NH_4H_2PO_4$
4.4	18.4	"	30	5.4	"
10	13.1	"	20.6	4	"
20	7	"	30	3.8	"
30	7.7	"	40	4	"
34.4	10	$(NH_4)_3PO_4.3H_2O+(NH_4)_2HPO_4$	50	4.2	"
40	10.2	$(NH_4)_2HPO_4$	60.6	4.4	"
48.2	11.6	$(NH_4)_2HPO_4+NH_4H_2PO_4$			

The original figures have been calculated to grams, plotted on cross-section paper and the above table read from the curve.

Data for this system are also given by D'Ans and Schreiner (1910). The agreement is satisfactory except for the $(NH_4)_3PO_4.3H_2O$ end of the curve, for which much lower values for the NH_3 component are given by D'Ans and Schreiner.

AMMONIUM PHOSPHATES

EQUILIBRIUM IN THE SYSTEM AMMONIA, ORTHO PHOSPHORIC ACID AND WATER, DETERMINED BY THE SYNTHETIC METHOD.

(Jänecke, 1930.)

The temperatures are those at which the last trace of solid phase disappeared.

PO

t°	Wt. Percent NH_3	Wt. Percent H_2O	Solid Phase	t°	Wt. Percent NH_3	Wt. Percent H_2O	Solid Phase
90(?)	6.5	35.0	$NH_4H_5(PO_4)_2$	185(?)	22.6	19.2	$(NH_4)_3PO_4 \cdot 2H_2O$
49	5.9	3.0	"	187	21.5	22.3	"
—	11.3	2.2	$NH_4H_2PO_4$	146	18.5	32.6	"
126	8.5	30.0	"	148	18.7	36.3	"
88	6.5	30.0	"	149	19.1	41.1	"
93	11.0	35.0	"	124	16.7	40.9	"
85	8.5	35.0	"	115	19.3	58.9	"
88	10.0	40.0	"	138	18.6	57.0	"
—	17.0	30.7	$(NH_4)_2H_2PO_4$	121	27.0	17.0	"
164	18.5	22.6	"	117	16.6	57.3	"
180	16.4	18.4	"	125(?)	16.5	51.4	"
110	15.0	30.0	"	114	15.3	52.5	"
100	12.5	30.0	"	95	13.9	53.9	"
72	13.5	35.0	"	101	17.8	69.6	"
58	13.2	41.8	"				
53	12.5	40.0	"				

The author also gives similar determinations for the region of the system in which two liquid layers are formed.

SOLUBILITY OF MONOAMMONIUM PHOSPHATE IN AQUEOUS SOLUTIONS OF AMMONIUM SULFATE AT 25°.

(Apfel, 1911.)

Mols. per 1000 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Mols. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.	
PO_4.	SO_4.	$NH_4H_2PO_4$.	$(NH_4)_2SO_4$.	PO_4.	SO_4.	$NH_4H_2PO_4$.	$(NH_4)_2SO_4$.
2.58	0.0	29.7	0.0	1.53	1.43	17.6	18.90
2.40	0.17	27.6	2.25	1.31	1.84	15.1	24.31
2.34	0.27	26.9	3.57	0.99	2.55	11.4	33.68
2.26	0.35	26.0	4.62	0.82	2.92	9.44	38.58
1.78	1.05	20.5	13.87	0.814	2.89	9.37	38.18

EQUILIBRIUM IN THE SYSTEM DI AMMONIUM PHOSPHATE, ISO PROPYL ALCOHOL AND WATER AT 25°.

(Ginnings and Chen, 1931.)

The points on the binodal curve of this system were determined by observing the appearance or disappearance of clouding in a mixture of weighed amounts of the salt and one of the liquids upon addition of weighed amounts of the other. Tie lines, *, were located by means of determinations of the salt in pairs of liquid layers in contact with each other, and the Plait Point, PP, was found by plotting.

Gms. per 100 gms. homogeneous mixture		Gms. per 100 gms. homogeneous mixture	
$(NH_4)_2HPO_4$	Iso C_3H_7OH	$(NH_4)_2HPO_4$	Iso C_3H_7OH
3.48	39.20*	17.19	14.11
5.55	32.84	18.10	13.19
9.53	24.80	23.20	8.79
11.8	21.6 PP	27.14	6.18
12.74	20.10	32.84	3.62*
16.48	14.90		

The composition of the homogeneous mixture (plait point) of the system composed of Di Ammonium Phosphate, Tertiary Butyl Alcohol and Water at 25° was found by Ginnings, Herring and Webb, 1933, to be 3.8 percent $(NH_4)_2HPO_4$ + 33.8 percent tertiary $(CH_3)_3COH$ + 62.4 percent H_2O. The original results for the remaining points on the binodal curve are not given but only the values of constants calculated by means of empirical equations.

PO

The binodal curve for the system Di Ammonium Phosphate, Allyl Alcohol and Water at 25° was determined by Ginnings and Dees, 1935, but the authors give only the values of constants calculated by means of empirical equations. The conclusion is drawn that allyl alcohol seems to be more difficult to salt out than either normal or iso propyl alcohol.

AMMONIUM Sodium PHOSPHATES

Data for the distribution of each of 5 ammonium sodium ortho- and pyrophosphates between water and chloroform at 18°, are given by Abbott and Bray (1909).

AMMONIUM Zinc PHOSPHATE NH_4ZnPO_4

100 cc sat. solution of Ammonium Zinc Phosphate in Water contain 0.0136 gm. NH_4ZnPO_4 at 10.5° and 0.0145 gm. at 17.5°. (Artmann, 1915.)

AMMONIUM Per RHENATES

One liter sat. solution of Ammonium Per Rhenate in water contain about 120 gms. NH_4ReO_4 at 20°, (Noddak and Noddak, 1929.)

100 gms. sat. solution of Ammonium Sulfo Per Rhenate in Water contain 58.5 gms. NH_4ReO_3S at 20°. (Feit, 1931.)

AMMONIUM SULFIDE $(NH_4)_2S$.

100 gms. Liquid Ammonia dissolve 120 gms. $(NH_4)_2S$ at 25°. (Hunt and Boncyk, 1933.)

S

AMMONIUM Antimony SULFIDE (Sulfoantimonate) $(NH_4)_3SbS_4.4H_2O$.

SOLUBILITY IN WATER AND IN AQUEOUS ALCOHOL.

(Donk, 1908.)

In Water.			In Aqueous Alcohol at 10°. Gms. per 100 Gms. Sat. Solution.	
t°.	Gms. $(NH_4)_3SbS_4$ per 100 Gms. Sat. Sol	Solid Phase.	C_2H_5OH.	$(NH_4)_3SbS_4$.
−1.9	9.9	Ice	0	43.2
−5	20	"	5.1	35.9
−8	30.2	"	19.1	23.1
−13.5	41.6	Ice + $(NH_4)_3SbS_4.4H_2O$	43.1	8.7
0	41.6	$(NH_4)_3SbS_4.4H_2O$	53.1	4.1
+20	47.7	"	93.3	0
30	54.5	"		

AMMONIUM SULFITE $(NH_4)_2SO_3.H_2O$.

SOLUBILITY OF AMMONIUM SULFITE IN WATER.

(Ishikawa and Murooka, 1928. 1933.)

SO

t°	d. of sat. sol.	Gms. $(NH_4)_2SO_3$ per 100 gms. sat. sol.	Solid Phase	t°	d. of sat. sol.	Gms. $(NH_4)_2SO_3$ per 100 gms. sat. sol.	Solid Phase
−1.73	—	4.961	Ice	25	1.2042	39.29	$(NH_4)_2SO_3.H_2O$
−3.35	—	9.698	"	30	1.2097	40.77	"
−6.27	—	16.817	"	40	1.2203	43.96	"
−9.69	—	23.652	"	50	1.2306	47.26	"
−12.96	—	28.855	" + $(NH_4)_2SO_3.H_2O$	60	1.2424	50.94	"
				70	1.2558	54.71	"
−11.52	—	29.16	$(NH_4)_2.SO_3.H_2O$	80	1.2716	58.99	"
−6.55	—	30.62	"	80.8	tr. pt.	—	" + $(NH_4)_2SO_3$
0	1.1792	32.40	"	85	—	59.53	$(NH_4)_2SO_3$
+10	1.1896	35.05	"	90	—	60.00	"
15	1.1943	36.40	"	100	—	60.44	"
20	1.1995	37.80	"				

SOLUBILITY OF AMMONIUM SULFITE IN AQUEOUS SOLUTIONS OF AMMONIUM SULFATE AND VICE VERSA.

(Ishikawa and Murooka, 1929.)

Results at 15°

Gms. per 100 gms. sat. sol.		Solid Phase
$(NH_4)_2SO_3$	$(NH_4)_2SO_4$	
36.40	0.0	$(NH_4)_2SO_3.H_2O$
34.10	3.64	"
31.22	7.98	"
29.73	10.31	"
27.11	14.19	"
25.65	16.94	"
22.81	21.76	"
21.92	23.38	"
19.72	27.30	" $+(NH_4)_2SO_4$
17.15	28.80	$(NH_4)_2SO_4$
13.63	31.68	"
9.69	34.82	"
5.45	38.08	"
0.0	42.52	"

Results at 30°

Gms. per 100 gms. sat. sol.		Solid Phase
$(NH_4)_2SO_3$	$(NH_4)_2SO_4$	
40.77	0.00	$(NH_4)_3SO_3.H_2O$
38.86	2.83	"
36.19	6.99	"
33.33	11.19	"
31.03	14.30	"
28.04	19.61	"
25.87	23.31	"
24.64	25.21	" $+(NH_4)_2SO_4$
18.41	29.60	$(NH_4)_2SO_4$
12.66	33.88	"
8.41	37.13	"
2.74	41.68	"
0.0	43.87	"

SO

SIMULTANEOUS SOLUBILITY OF AMMONIUM SULFITE AND AMMONIUM SULFATE IN WATER.

(Ishikawa and Murooka, 1929.)

t°	Gms. per 100 gms. sat. sol.		t°	Gms. per 100 gms. sat. sol.	
	$(NH_4)_2SO_3$	$(NH_4)_2SO_4$		$(NH_4)_2SO_3$	$(NH_4)_2SO_4$
-21.5	10.89	30.57	50	32.75	21.89
-11.52	12.88	29.85	70	42.28	17.71
0	15.41	29.05	80	48.26	15.13
15	19.72	27.20	90	49.14	15.01
30	24.64	25.21	100	50.53	14.80

Solid Phase $(NH_4)_2SO_3.H_2O$ + $(NH_4)_2SO_4$ up to 80° and $(NH_4)_2SO_3$ + $(NH_4)_2SO_4$ thereafter.

AMMONIUM Pyro **SULFITE** $(NH_4)_2S_2O_5$.

100 gms. sat. solution of Ammonium Pyro sulfite in Water contain 71.33 gms. $(NH_4)_2S_2O_5$ at 25°. (Ishikawa and Hagisawa, 1931.) The authors also give results for the systems $(NH_4)_2S_2O_5$ + $(NH_4)_2SO_3$ + H_2O and $(NH_4)_2S_2O_5$ + SO_2 + H_2O at 25°.

100 gms. liquid Sulfur Dioxide dissolve 0.048 gm. $(NH_4)_2S_2O_4$ at 0°: (Jander and Ruppolt, 1937.)

AMMONIUM Sodium Hydrogen **SULFITE** $(NH_4)Na_2H(SO_3)_24H_2O$.

100 gms. H_2O dissolve 42.3 gms. salt at 12.4° and 48.5° gms. at 15°.

(Schwincker, 1889.)

AMMONIUM SULFATE $(NH_4)_2SO_4$.

SOLUBILITY IN WATER.

(Average curve from the results of Rodebush, 1918; Sborgi and Bovalini, 1924; Sborgi, Bovalini and Medici. 1924; Sborgi, 1924; Nishizawa, 1920; Britton, 1922; Caven and Mitchell, 1924; and Weston, 1922.)

t°.	Gms. $(NH_4)_2SO_4$ per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. $(NH_4)_2SO_4$ per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. $(NH_4)_2SO_4$ per 100 gms. sat. sol.	Solid Phase.
— 5......	17.0	Ice	0 ..	41.35	$(NH_4)_2SO_4$	25...	43.3	$(NH_4)_2SO_4$
—10......	28.0	»	+ 5...	41.65	»	30...	43.75	»
—15......	36.0	»	10...	42.05	»	40 ..	44.7	»
—19 (Eutec.)	39.8	»+$(NH_4)_2SO_4$	15...	42.45	»	50 ..	45.8	»
—10......	40.5	$(NH_4)_2SO_4$	20...	42.85	»	60...	47.0	»

The density of the sat. solution at 15° is 1.248, and at 19° it is 1.241.

Later determinations by Ishikawa and Murooka, 1929 are as follows:

80

t°	Gms. $(NH_4)_2SO_4$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $(NH_4)_2SO_4$ per 100 gms. sat. sol.	Solid Phase
- 1.05	3.246	Ice	25	43.47	$(NH_4)_2SO_4$
- 3.70	12.233	"	30	43.87	"
- 5.28	17.102	"	40	44.80	"
-18.5 Eutec	39.75	" + $(NH_4)_2SO_4$	50	45.75	"
-11.52	40.42	$(NH_4)_2SO_4$	60	46.64	"
- 6.55	40.59	"	70	47.54	"
0	41.22	"	80	48.47	"
10	42.11	"	90	49.44	"
15	42.52	"	100	50.42	"
20	43.00	"	108.5 b.pt.	51.53	"

Individual determinations by a number of other investigators are usually in good agreement with the above results.

The following results for the Solubility of Ammonium Sulfate at temperatures above 100°, determined by the synthetic method, are given by Benrath, Gjedebo, Schiffers and Wunderlich, 1937.

t°	Gms. $(NH_4)_2SO_4$ per 100 gms. sat. sol.	t°	Gms. $(NH_4)_2SO_4$ per 100 gms. sat. sol.	t°	Gms. $(NH_4)_2SO_4$ per 100 gms. sat. sol.
100	50.8	225	62.0	325	71.5
125	53.2	250	64.2	350	74.0
150	55.5	275	66.7	375	76.5
175	57.5	300	69.2	400	78.7
200	59.7				

SOLUBILITY OF AMMONIUM SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 30°.

(Van Dorp, 1910 and 1911.)

Gms. per 100 Gms. Sat. Solution. $(NH_4)_2SO_4$.	H_2SO_4.	Solid Phase.
44.3	0	$(NH_4)_2SO_4$
43.6	10	"
44.1	13.2	$(NH_4)_2SO_4$+3.1
42.9	15	3.1
41	20	"
40.8	25	"
43	30	"
45.5	33.8	3.1+$(NH_4)HSO_4$
42.3	35	$(NH_4)HSO_4$
32.8	40	$(NH_4)HSO$
26.1	45	"
20.9	50	"
17.6	55	"
17.8	60	"
20	61.7	"
30	62.9	"
37	62.2	"

3.1 = $3[(NH_4)_2SO_4].H_2SO$.

Additional results for this system are given by D'Ans, 1909, 1913.

Results for the solubility of mixtures of ammonium sulfate and lithium sulfate in concentrated H_2SO_4 containing traces of H_2O at 30°, are given by Van Dorp, 1913-14.

EQUILIBRIUM IN THE SYSTEM AMMONIUM SULFATE, SULFURIC ACID AND WATER.

(Locuty and Laffitte, 1933, 1934.)

Gms. per 100 gms. sat. sol. H_2SO_4	$(NH_4)_2SO_4$	Solid Phase
Results at 30°		
0.0	44.03	$(NH_4)_2SO_4$
13.11	44.71	" + MC(4.1) + (3.1)
25.31	41.48	MC(4.1) + (3.1)
33.88	45.44	" + NH_4HSO_4
59.27	17.62	NH_4HSO_4
61.5	38.5	"
Results at 50°		
0.0	45.79	$(NH_4)_2SO_4$
15.25	47.82	" + (4.1)
17.92	46.29	(4.1)
24.60	45.51	MC(4.1) + (3.1)
Results at 50° (con.)		
34.35	50.96	(3.1) + NH_4HSO_4
54.28	25.5	NH_4HSO_4
60.5	39.5	"
Results at 70°		
0.0	58.08	$(NH_4)_2SO_4$
17.5	50.5	" + MC(4.1)+(3.1)
24.62	49.02	(3.1)
34.92	54.97	" + NH_4HSO_4
55.02	31.15	NH_4HSO_4
59.45	40.55	"

(4.1) = $4(NH_4)_2SO_4 + H_2SO_4$; (3.1) = $3(NH_4)_2SO_4.H_2SO_4$.

Determinations at 0° and 90° were also made but the numerical results are not given in the present papers.

EQUILIBRIUM IN THE SYSTEM AMMONIUM SULFATE, SULFURIC ACID AND WATER AT 98.3°.

(Siskin and Pochvalensky, 1938.)

Gms. per 100 gms. sat. sol. H_2SO_4	Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$	Solid Phase	Gms. per 100 gms. sat. sol. H_2SO_4	Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$	Solid Phase
0.0	49.45	$(NH_4)_2SO_4$	35.9	58.53	(3.1) + NH_4HSO_4
8.75	48.87	"	39.39	52.36	$NH_4.HSO_4$
14.73	49.95	"	44.4	46.94	"
20.45	54.27	" + (3.1)	47.18	42.78	"
23.0	53.28	(3.1)	52.8	41.26	"
27.66	54.01	"	54.0	42.3	"
29.81	54.7	"	54.55	43.71	"
32.43	56.23	"	55.16	44.15	"
34.21	57.68	"	55	45	"
35.5	57.5	"			

(3.1) = $3(NH_4)_2SO_4.H_2SO_4$.

SOLUBILITY OF AMMONIUM SULFATE IN AQUEOUS SOLUTIONS OF AMMONIA AT 25°.

(D'Ans and Schreiner, 1910.)

SO

Gm. Mols. per 1000 gms. sat. sol. $(NH_3)_2$	Gm. Mols. per 1000 gms. sat. sol. $(NH_4)_2SO_4$	Gms. per 1000 gms. sat. sol. NH_3	Gms. per 1000 gms. sat. sol. $(NH_4)_2SO_4$
0	3.28	0.0	433.4
1.02	2.60	34.8	343.6
1.95	2.13	66.4	281.5
3.44	1.59	117.2	210.1
5.35	1.16	182.2	153.3
7.13	0.78	242.8	103
9.47	0.0	322.4	0

SOLUBILITY OF AMMONIUM SULFATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE AND VICE VERSA.

(Results of 15° and at 35° by Fedotieff and Kolossof, 1923; at 25° and 60° by Freeth, 1924.)

Results at 15°.

d of sat. sol.	Gms. per 100 gms. H_2O. Na_2SO_4.	Gms. per 100 gms. H_2O. $(NH_4)_2SO_4$.	Solid Phase.
1.245	0.0	73.49	$(NH_4)_2SO_4$
1.253	2.86	73.13	»
1.259	3.95	72.80	»
1.261	5.26	72.17	»
1.272	7.79	71.06	»
1.286	12.77	69.70	» + 1.1.4
1.280	14.05	65.01	1.1.4
1.276	16.46	54.60	»
1.276	18.57	48.98	»
1.276	21.24	42.29	»
1.278	22.87	36.92	»
1.279	24.47	34.28	»
1.280	25.44	33.89	»
1.286	26.29	32.79	» + $Na_2SO_4.10H_2O$
1.265	22.91	30.95	$Na_2SO_4.10H_2O$
1.187	18.02	11.98	»
1.111	13.26	0.00	»

Results at 35°.

d of sat. sol.	Gms. per 100 gms. H_2O. Na_2SO_4.	Gms. per 100 gms. H_2O. $(NH_4)_2SO_4$.	Solid Phase.
1.250	0.0	80.74	$(NH_4)_2SO_4$
1.272	6.98	78.30	»
1.306	13.80	77.05	»
1.307	18.67	74.10	»
1.308	20.13	73.22	» + 1.1.4
1.305	23.63	56.11	1.1.4
1.312	27.14	48.59	»
1.313	28.84	44.91	»
1.314	30.46	42.43	»
1.328	36.61	35.12	»
1.338	39.18	32.15	»
1.344	42.13	30.75	» + Na_2SO_4
1.342	43.35	26.64	Na_2SO_4
1.340	45.16	19.61	»
1.333	46.01	14.27	»
1.327	47.64	6.91	»
1.325	49.53	0.00	»

Results at 25°.

Gms. per 100 gms. sat. sol. Na_2SO_4.	Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$.	Solid Phase
3.35	41.23	$(NH_4)_2SO_4$
6.65	39.16	»
8.00	38.70	» + 1.1.4*
14.12	27.42	1.1.4
23.90	15.8	»
25.76	14.1	» + $Na_2SO_4.10H_2O$
24.5	12.5	$Na_2SO_4.10H_2O$
21.78	7.4	»

Results at 60°.

Gms. per 100 gms. sat. sol. Na_2SO_4.	Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$.	Solid Phase.
0.0	46.80	$(NH_4)_2SO_4$
10.70	40.30	»
16.33	36.91	» + Na_2SO_4
18.70	29.48	Na_2SO_4
26.94	9.70	»
31.20	0.00	»

1.1.4 = $(NH_4)_2SO_4.Na_2SO_4.4H_2O$

Freeth also gives complete data for the quaternary equilibrium in the system : $(NH_4)_2SO_4 + NH_4ClO_4 + Na_2SO_4 + NaClO_4 + H_2O$ at 25° and at 60°.

100 gms. H_2O dissolve 46.6 gms. $NH_4NaSO_4.2H_2O$ at 15° and the density of the sat. solution is 1.1749.

EQUILIBRIUM IN THE SYSTEM AMMONIUM SULFATE + SODIUM SULFATE + WATER.

(This system has been studied in great detail by Dawson, 1918; Matignon and Meyer, 1917-1918 and Levi, 1924. Results at selected temperatures are given by Nishizawa, 1920; Fedotieff and Kolossoff, 1923; Sborgi et. at ,1924; and Freeth, 1924. Levi presents a diagram constructed from all available determinations and his results agree in general with the curves obtained. The following table is taken from the paper of Dawson.)

1.1.4 = $(NH_4)_2SO_4.Na_2SO_4.4H_2O$. 80

t°.	Gms. per 100 gms. H_2O. Na_2SO_4.	Gms. per 100 gms. H_2O. $(NH_4)_2SO_4$.	Mols. per 1000 mols. H_2O. Na_2SO_4.	Mols. per 1000 mols. H_2O. $(NH_4)_2SO_4$.	Solid Phase.
-19.5 (Eutec.).	5.29	63.5	6.70	86.6	Ice+$Na_2SO_4.10H_2O$+$(NH_4)_2SO_4$
-18........	5.40	63.5	6.85	86.6	$Na_2SO_4.10H_2O$+$(NH_4)_2SO_4$
-16........	5.32	63.6	6.75	86.8	» » +1.1.4
13........	5.68	64.9	7.20	88.5	$(NH_4)_2SO_4$+1.1.4
-10........	6.33	65.6	8.03	89.2	» »
0........	7.81	66.7	9.9	91.0	» »
+15........	10.85	69.6	13.75	94.9	» »
25........	14.6	71.0	18.5	96.8	» »
40........	19.7	75.1	25.0	102.4	» »
50........	25.8	76.1	32.7	103.8	» »
-13........	6.52	58.6	8.26	79.9	$Na_2SO_4.10H_2O$+1.1.4
-10........	7.78	56.1	9.86	76.5	» »
0........	12.05	46.6	15.25	63.5	» »
+15........	22.9	33.3	29.0	45.4	» »
20........	31.5	28.9	39.9	39.4	» »
25........	40.9	22.1	51.8	30.2	» »
26.5......	45.2	21.0	57.3	28.6	» » +Na_2SO_4
35.0......	41.7	28.7	52.9	39.2	Na_2SO_4+1.1.4
40........	40.5	34.7	51.3	47.3	» »
50........	37.2	50.5	47.2	68.9	» »
55........	36.0	62.0	45.6	84.6	» »
25........	32.9	30.5	41.6	41.6	1.1.4
35........	37.3	34.7	47.3	47.3	»
54.3......	34.3	77.7	43.5	106.0	1.1.4+Na_2SO_4+$(NH_4)_2SO_4$
75........	36.1	84.3	45.7	115.0	Na_2SO_4+$(NH_4)_2SO_4$
100........	37.9	95.0	48.0	129.5	» »

EQUILIBRIUM IN THE SYSTEM AMMONIUM SULFATE NICKEL SULFATE AND WATER AT 25°.

(Hill and Taylor, 1938.)

Gms. per 100 gms. sat. sol. $NiSO_4$	$(NH_4)_2SO_4$	Solid Phase	Gms. per 100 gms. sat. sol. $NiSO_4$	$(NH_4)_2SO_4$	Solid Phase
0.0	43.42	$(NH_4)_2SO_4$	3.82	3.27	1.1.6
0.023	43.36	" + 1.1.6	12.32	1.94	"
0.048	35.20	1.1.6	18.23	1.49	"
0.079	29.44	"	22.75	1.23	"
0.125	23.91	"	26.20	1.01	"
0.209	17.87	"	28.92	0.83	" + $NiSO_4.7H_2O$
0.352	12.57	"	28.97	0.0	$NiSO_4.7H_2O$

1.1.6 = $(NH_4)_2SO_4.NiSO_4.6H_2O$.

The previous determinations upon this system at 25° by Caven and Gardner, 1933, are considered by Hill and Taylor to be incorrect.

AMMONIUM Nickel **SULFATE** $(NH_4)_2Ni(SO_4)_2.6H_2O$.

SOLUBILITY IN WATER.

(Average curve from Tobler, Locke, at 25°.)

SO

t°.	G. $(NH_4)_2Ni(SO_4)_2$ per 100 Gms Water.	Solution.	t°.	G. $(NH_4)_2Ni(SO_4)_2$ per 100 Gms. Water.	Solution.
0	1.0	0.99	40	12.0	10.72
10	4.0	3.85	50	14.5	12.96
20	6.5	6.10	60	17.0	14.53
25	7.57	7.04	70	20.0	16.66
30	9.0	8.45			

EQUILIBRIUM IN THE SYSTEM AMMONIUM SULFATE, NICKEL SULFATE AND WATER AT SEVERAL TEMPERATURES.

(Benrath, 1932.)

t°	Gms. per 100 gms. sat. solution $NiSO_4$	$(NH_4)_2SO_4$	Solid Phase	t°	Gms. per 100 gms. sat. solution $NiSO_4$	$(NH_4)_2SO_4$	Solid Phase
0	trace	41.2	1.1.6 + $(NH_4)_2SO_4$	46	0.29	45.32	1.1.6 + $(NH_4)_2SO_4$
"	24.45	1.22	" + $NiSO_4.7H_2O$	"	32.95	1.94	" + $NiSO_4.6H_2O\alpha$
25	0.1	43.7	" + $(NH_4)_2SO_4$	54	35.35	2.02	" + "
"	29.5	1.20	" + $NiSO_4.7H_2O$	80	0.51	48.68	" + $(NH_4)_2SO_4$
29	32.02	1.29	" + " + $NiSO_4.6H_2O\alpha$	"	41.84	3.02	" + $NiSO_4.6H_2O\beta$
				100	1.10	49.9	" + $(NH_4)_2SO_4$
				"	46.91	3.31	" + $NiSO_4.6H_2O\beta$

EQUILIBRIUM IN THE SYSTEM AMMONIUM NICKEL SULFATE, AMMONIUM ZINC SULFATE AND WATER AT 25°.

(Hill and Taylor, Jr., 1938.)

Gms. per 100 gms. sat. solution $(NH_4)_2SO_4.ZnSO_4$	$(NH_4)_2SO_4.NiSO_4$	Gms. per 100 gms. solid phase $(NH_4)_2SO_4.ZnSO_4$	$(NH_4)_2SO_4.NiSO_4$
12.24	0.0	73.09	0.0
9.29	1.54	45.80	27.19
8.27	2.16	37.08	35.86
6.93	2.75	28.75	44.06
5.11	3.94	13.87	58.99
1.97	5.70	5.72	66.89
0.0	7.09	0.0	72.63

AMMONIUM Lead SULFATE $(NH_4)_2SO_4.PbSO_4$.

SOLUBILITY IN WATER.
(Barre, 1909.)

t°.	Gms. $(NH_4)_2SO_4$ per 100 Gms. Sat. Solution.	Gms. $(NH_4)_2SO_4$ per 100 Gms. Water.	Solid Phase.
20	12.17	13.86	$(NH_4)_2SO_4.PbSO_4$
50	16.15	19.25	"
75	19.52	24.31	"
100	22.74	29.42	"

EQUILIBRIUM IN THE SYSTEM AMMONIUM SULFATE PRASEODYMIUM SULFATE AND WATER AT 25°.
(Zambonini and Restaino, 1929.)

Gms. per 100 gms. sat. sol. $Pr_2(SO_4)_3$	Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$	Solid Phase	Gms. per 100 gms. sat. sol. $Pr_2(SO_4)_3$	Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$	Solid Phase
0.11	43.12	$(NH_4)_2SO_4$ + 1.5	0.69	14.91	1.1.8
0.30	40.13	1.5	0.68	7.07	"
0.66	35.63	"	3.52	0.98	"
0.64	32.40	" + 1.1.8	3.55	0.53	"
0.67	19.88	1.1.8	8.24	0.50	" + $Pr_2(SO_4)_3.8H_2O$

1.5 = $Pr_2(SO_4)_3.5(NH_4)_2SO_4$; 1.1.8 = $Pr_2(SO_4)_3.(NH_4)_2SO_4.8H_2O$

AMMONIUM Strontium SULFATE $(NH_4)_2SO_4.SrSO_4$.

SO

SOLUBILITY IN WATER.
(Barre, 1909.)

t°.	Gms. $(NH_4)_2SO_4$ per 100 Gms. Sat. Solution.	Gms. $(NH_4)_2SO_4$ per 100 Gms. Water.	Solid Phase.
50	43.99	78.54	$(NH_4)_2SO_4.SrSO_4+SrSO_4$
75	45.40	83.15	"
100	46.27	66.2	

AMMONIUM Thorium SULFATE

EQUILIBRIUM IN THE SYSTEM AMMONIUM SULFATE THORIUM SULFATE AND WATER AT 25°.
(Rosenheim and Zickermann, 1932.)

Gms. per 100 gms. sat. sol. $Th(SO_4)_2$	Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$	Solid Phase	Gms. per 100 gms. sat. sol. $Th(SO_4)_2$	Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$	Solid Phase
1.46	43.13	$(NH_4)_2SO_4$	2.59	33.42	2.1.3½
1.36	42.46	" + 3.1.3	3.40	29.23	"
1.24	44.35	3.1.3	5.26	24.30	" "
1.73	42.80	"	6.66	22.10	"
2.08	41.85	"	8.98	19.05	" + 1.1.5
1.83	41.53	2.1.3½	9.28	18.80	1.1.5
1.92	41.12	"	10.16	18.80	1.1.5
2.03	39.96	"	12.47	15.80	"
2.33	37.56	"	11.04	14.60	" + $Th(SO_4)_2$
			14.50	10.00	" "excess

3.1.3 = $3(NH_4)_2SO_4.Th(SO_4)_2.3H_2O$; 2.1.3½ = $2(NH_4)_2SO_4.Th(SO_4)_2.3\frac{1}{2}H_2O$;
1.1.5 = $(NH_4)_2SO_4.Th(SO_4)_2.5H_2O$.

EQUILIBRIUM IN THE SYSTEM AMMONIUM SULFATE, URANYL SULFATE AND WATER AT 25°.

(Colani, 1928.)

Gms. per 100 gms. sat. sol. UO_2SO_4	Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$	Solid Phase	Gms. per 100 gms. sat. sol. UO_2SO_4	Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$	Solid Phase
0.0	43.25	$(NH_4)_2SO_4$	16.46	7.46	1.1.2
1.89	42.13	"	19.23	6.80	"
4.53	40.36	"	31.84	4.49	"
9.34	40.59	"	35.70	4.15	" + 1.2.5
10.00	40.65	" + 1.1.2	36.96	3.89	1.2.5
9.70	37.18	1.1.2	47.25	2.00	"
10.29	30.09	"	59.00	0.84	"
10.81	17.65	"	61.32	0.38	"+$UO_2SO_4 \cdot 3H_2O$
12.98	9.76	"	61.28	0.25	$UO_2SO_4 \cdot 3H_2O$
			61.18	0.0	"

1.1.2 = $(NH_4)_2SO_4 \cdot UO_2SO_4 \cdot 2H_2O$; 1.2.5 = $(NH_4)_2SO_4 \cdot 2UO_2(SO_4)_3 \cdot 5H_2O$.

AMMONIUM Vanadium **SULFATE** (Alum) $(NH_4)_2V_2(SO_4)_4 24H_2O$.

100 cc. H_2O dissolve 31.69 gms. anhydrous or 78.50 gms. hydrated salt at 25°. (Locke.)

AMMONIUM Zinc **SULFATE** $(NH_4)_2Zn(SO_4)_2.6H_2O$.

SOLUBILITY IN WATER.

(Average curve, Tobler, Locke, at 25°.)

t°.	G. $(NH_4)_2Zn(SO_4)_2$ per 100 Gms. Solution.	G. $(NH_4)_2Zn(SO_4)_2$ per 100 Gms. Water.	t°.	G. $(NH_4)_2Zn(SO_4)_2$ per 100 Gms. Solution.	G. $(NH_4)_2Zn(SO_4)_2$ per 100 Gms. Water.
0	6.54	7.0	40	16.66	20
10	8.67	9.5	50	20.0	25
20	11.11	12.5	60	23.1	30
25	12.36	14.1	70	25.9	35
30	13.79	16.0	80	29.6	42

EQUILIBRIUM IN THE SYSTEM AMMONIUM SULFATE, ZINC SULFATE AND WATER AT 25°.

Results of Craven and Gardner, 1935

Gm. Mols. per 1000 gms. H_2O $ZnSO_4$	Gm. Mols. per 1000 gms. H_2O $(NH_4)_2SO_4$	Solid Phase
0.0	5.820	$(NH_4)_2SO_4$
0.0183	3.742	1.1.6
0.0291	2.993	"
0.0795	1.913	"
0.0930	1.288	"
0.1708	0.8511	"
0.3176	0.6054	"
0.6220	0.4680	"
1.429	0.3248	"
2.100	0.2628	"
3.160	0.1703	"
3.560	0.1313	"+$ZnSO_4 \cdot 7H_2O$
3.571	0.0	$ZnSO_4 \cdot 7H_2O$

Results of Hill and Taylor, Jr., 1938

Gms. per 100 gms. sat. sol. $ZnSO_4$	Gms. per 100 gms. sat. sol. $(NH_4)_2SO_4$	Solid Phase
0.0	43.42	$(NH_4)_2SO_4$
0.09	43.40	" + 1.1.6
0.23	34.02	1.1.6
0.47	25.24	"
1.23	14.65	"
2.96	8.42	"
6.73	5.47	"
8.53	4.93	"
16.07	3.29	"
26.21	2.02	"
36.22	0.98	"+$ZnSO_4 \cdot 7H_2O$
36.72	0.0	$ZnSO_4 \cdot 7H_2O$

1.1.6 = $(NH_4)_2SO_4 \cdot ZnSO_4 \cdot 6H_2O$.

Results for equilibrium in this system at 0°, 17.5°, 40.5°, 64.5° and 100° are given by Benrath, 1931. This author also gives the following values for the solubility of the double salt in water.

AMMONIUM Zinc SULFATE $(NH_4)_2SO_4.ZnSO_4.6H_2O$.

SOLUBILITY OF AMMONIUM ZINC SULFATE IN WATER.

(Benrath, 1931.)

t°	Gms. $(NH_4)_2SO_4.ZnSO_4$ per 100 gms. H_2O	Solid Phase	t°	Gms. $(NH_4)_2SO_4.ZnSO_4$ per 100 gms. H_2O	Solid Phase
0	7.3	1.1.6	70	38.19	1.1.6
17	11.86	"	80	46.75	"
35	17.95	"	90	58.1	"
50	25.30	"	100	72.5	"

SOLUBILITY OF AMMONIUM SULFATE IN AQUEOUS ETHYL ALCOHOL SOLUTIONS.

(Traube and Neuberg — Z. physik. Chem. 1, 510, '87; Bodländer — *Ibid.* 7, 318, '91; Schreinemaker — *Ibid.* 23, 657, '97; de Bruyn — *Ibid.* 32, 68, '00; Linebarger — Am. Ch. J. 14, 380, '92.)

Upper Layer Results. Grams per 100 Gms. Solution at 10°-40°.	
C_2H_5OH.	$(NH_4)_2SO_4$
100	0.0
80	0.1
70	0.3
60	1.4
50	3.2
45	4.8
40	6.6
35	9.2
30	12.2
25	14.6

Lower Layer Results.			
Gms. C_2H_5OH per 100 Gms. Solution.	Gms. $(NH_4)_2SO_4$ per 100 g. Solution at:		
	6.5°.	15°.	33°.
0	42.0	42.6	44
2.5	39.0	40.2	?
5.0	36.2	37.2	?
7.5	33.2	34.5	42
10.0	30.0	31.0	35
12.5	27.2	28.0	?
15.0	24 6	25.2	?
17.5	22.0	22.4	?
20.0	20.0	20.0	?

SO

NOTE. — When ammonium sulfate is added to aqueous solutions of alcohol, it is found that for certain concentrations and temperatures the solutions separate into two liquid layers, the upper of which contains the larger percentage of alcohol.

Most of the determinations which have been made upon this system, as contained in the papers referred to above, are given in terms of grams of ammonium sulfate, of alcohol and of water per 100 grams of these three components taken together. Those results which are given in other terms can be readily calculated to this basis, and it is, therefore, possible to make a comparison of the several sets of determinations by plotting on cross-section paper and drawing curves through the points. In the present case the grams of alcohol per 100 grams of solution were taken as ordinates, and the grams of ammonium sulfate in the same quantity of each solution taken as abscissæ. It was found that a single curve could be drawn through practically all the points representing the upper layer solutions at the several temperatures, but the points for the solutions containing the larger amounts of water gave curves which diverged with increase of temperature. The results given for 33° in the above table are not to be accepted as correct until further work has been done.

SOLUBILITY OF AMMONIUM SULFATE IN AQUEOUS SOLUTION OF ETHYL ALCOHOL AT 30° AND AT 50°.

(Results at 30°, Wibaut, 1909; at 50°, Schreinemakers and de Baat, 1907.)

Results at 30°. Two liquid layers are formed at concentrations of alcohol between 5.8 and 62%. These have the compositions:

Upper Layer. Gms. per 100 Gms. Sat Solution.			Lower Layer. Gms. per 100 Gms. Sat. Solution.		
$(NH_4)_2SO_4$.	C_2H_5OH.	H_2O.	$(NH_4)_2SO_4$.	C_2H_5OH.	H_2O.
2.2	56.6	41.2	37.1	5.8	57.1
2.6	54.5	42.9	35.7	6.3	58
3.4	52.3	44.3	33.8	7.4	58.8
13.2	31.8	55	21.7	18.4	59.9
17	25	58	17	25	58

At a concentration of 62% alcohol the liquid is homogeneous and contains 1.3 gms. $(NH_4)_2SO_4$ per 100 gms. sat. solution. At 90.4% alcohol no $(NH_4)_2SO_4$ is dissolved.

Results at 50°.

SO

Gms. per 100 Gms. Saturated Solution.		
$(NH_4)_2SO_4$.	C_2H_5OH.	H_2O.
43.02	2.32	54.66
41.1	4.1	54.8
1.2	64.5	34.3
0.2	75.5	24.3

Between the concentrations 4.1 and 64.5% C_2H_5OH the mixtures separate into two layers. The percentage composition of each member of several such conjoined layers, is as follows:

Upper Layer. Gms. per 100 Gms. Sat. Solution.			Lower Layer. Gms. per 100 Gms. Sat. Solution.		
$(NH_4)_2SO_4$.	C_2H_5OH.	H_2O.	$(NH_4)_2SO_4$.	C_2H_5OH.	H_2O.
1.2	64.5	34.3	41.1	4.1	54.8
1.6	60	38.4	36.8	6	57.2
3.8	50	46.2	30.8	9	60.2
7.4	40	52.6	26.6	12	61.4
10	34.4	55.6	23.6	15	61.4

Two determinations at 0° by deWaal (1910) gave 30 gms. $(NH_4)_2SO_4$ per 100 gms. sat. solution in 9.41% alcohol and 0.14 gm. $(NH_4)_2SO_4$ in 73.03% alcohol. Between these concentrations of alcohol two liquid layers are formed.

100 gms. 95% formic acid dissolve 25.4 gms. $(NH_4)_2SO_4$ at 16.5°.

(Aschan, 1913.)

Data for the System $(NH_4)_2SO_4$ + H_2SO_4 + C_2H_5OH at 18° are given by Dunnicliff, Aggarval and Hoon, 1928.)

F. pt. data for $(NH_4)_2SO_4$ + H_2SO_4 are given by Kendall and Landon, 1920, and by Cambi and Bozza, 1923.

SOLUBILITY OF AMMONIUM SULFATE IN AQUEOUS PROPYL ALCOHOL SOLUTIONS AT 20°.

(Linebarger — Am. Ch. J. 14, 380, '92.)

Gms per 100 Gms. Solution. C_3H_7OH.	Gms per 100 Gms. Solution. $(NH_4)_2SO_4$.
70	0.4
60	1.0
50	2.0
40	3.2
30	4.8
20	6.7

EQUILIBRIUM IN THE SYSTEM AMMONIUM SULFATE, ISO PROPYL ALCOHOL AND WATER AT 25°.

(Ginnings and Chen, 1931.)

The binodal curve of this system was determined by observing the appearance and disappearance of clouding in a mixture of weighed amounts of the salt and one of the liquids upon addition of weighed amounts of the other. A tie line, *, was located by determination of the salt in two liquid phases in contact with each other and the plait point, PP., was found by plotting.

Gms. per 100 gms. homogeneous mixture $(NH_4)_2SO_4$	Gms. per 100 gms. homogeneous mixture Iso C_3H_7OH
45.58	3.12*
31.45	6.85
22.20	9.95
18.6	11.6 PP
14.2	14.10
8.98	18.96
5.35	24.20
3.93	27.54
0.97	41.50*

EQUILIBRIUM IN THE SYSTEM AMMONIUM SULFATE, TERTIARY BUTYL ALCOHOL AND WATER AT 30°.

(Ginnings and Robbins, 1930.)

The binodal curve, tie lines, *, and plait point, PP., for this system were determined as mentioned above.

Gms. per 100 gms. homogeneous mixture $(NH_4)_2SO_4$	Gms. per 100 gms. homogeneous mixture ter. $(CH_3)_3COH$
—	99 *
—	82 *
0.4	63.4
—	60.0*
1.4	48.8
—	42 *
3.2	34.3
3.7	32.0 PP
4.0	28.2
4.6	24.6
5.1	— *
5.7	19.8
6.5	17.4
12.1	— *
13.0	8.9
14.1	7.7
18.2	5.3
26.1	2.5
27.4	—*
28.7	1.8
32.1	1.4
37.8	0.8*

In a later paper Ginnings, Herring and Webb, 1933, give the value 3.2 gms. $(NH_4)_2SO_4$ + 35.4 gms. ter. $(CH_3)_3COH$ + 61.4 gms. H_2O for the plait point of this system at 25° but do not give the original results for the other points on the binodal curve.

AMMONIUM SULFATE

The binodal curves of the systems:

Ammonium Sulfate + Allyl Alcohol + Water at 25°
and Ammonium Sulfate + Pyridine + Water at 25°

have been determined respectively, by Ginnings and Dees, 1935; and Ginnings, Webb and Hinohara, 1933. The authors do not give their original experimental results but only the values of a series of arbitrary constants calculated from them by means of empirical equations. In the case of allyl alcohol it is concluded that this alcohol is more difficult to salt out than either normal or iso propyl alcohol.

EQUILIBRIUM IN THE SYSTEM AMMONIUM SULFATE, URETHAN AND WATER AT 25°.
(Palitsch, 1928, 1929.)

Gm. Mols. per 1000 gms. H_2O		Solid Phase	Gm. Mols. per 1000 gms. H_2O		Solid Phase
$(NH_4)_2SO_4$	$NH_2COOC_2H_5$		$(NH_4)_2SO_4$	$NH_2COOC_2H_5$	
5.805	0.0	$(NH_4)_2SO_4$	4.0	0.387	$NH_2COOC_2H_5$
5.778	0.029	"	3.7	0.351	lower liquid layer
5.763	0.106	" + $NH_2COOC_2H_5$	0.06	47.86	upper " "
			0.0	53.09	$NH_2COOC_2H_5$

100 gms. liquid Sulfur Dioxide (SO_2) dissolve 0.067 gm. $(NH_4)_2SO_4$ at 0°. (Jander and Wickert, 1936; Jander and Ruppolt, 1937.)

SO

AMMONIUM PERSULFATE $(NH_4)_2S_2O_8$.

100 parts H_2O dissolve 58.2 parts $(NH_4)_2S_2O_8$ at 0°. (Marshall, 1891.)

AMMONIUM DITHIONATE $(NH_4)_2S_2O_6.{}^1/_2H_2O$.

SOLUBILITY IN WATER. (de Baat, 1926.)

t°.	Gms. $(NH_4)_2S_2O_6$ per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. $(NH_4)_2S_2O_6$ per 100 gms. sat. sol.	Solid Phase.
0..	57.05	$(NH_4)_2S_2O_6.{}^1/_2H_2O$	20..	62,43	$(NH_4)_2S_2O_6.{}^1/_2H_2O$
10..	60.14	»	30..	64.10	»

SOLUBILITY OF AMMONIUM DITHIONATE IN AQUEOUS SOLUTIONS OF STRONTIUM DITHIONATE AT 30° AND VICE VERSA. (de Baat, 1926.)

Gms. per 100 gms. sat sol		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
SrS_2O_6.	$(NH_4)_2S_2O_6$.		SrS_2O_6.	$(NH_4)_2S_2O_6$.	
0.98	63.73	$(NH_4)_2S_2O_6.{}^1/_2H_2O$	6.47	34.57	$SrS_2O_6.4H_2O$
2.17	60.66	» $+SrS_2O_6.4H_2O$	8.79	24.52	»
2.71	56.76	$SrS_2O_6.4H_2O$	10.73	16.55	»
4.45	45.04	»	14.90	0.0	»

SOLUBILITY OF AMMONIUM TRI AND TETRATHIONATES, EACH SEPARATELY, IN WATER.
(Kurtenacker and Laszlo, 1938.)

Results for:

Trithionate

t°	Gms. $(NH_4)_2S_3O_6$ per 100 gms. sat. sol.
0	53.2
20	56.4
30	58.4

Tetrathionate

t°	Gms. $(NH_4)_2S_4O_6$ per 100 gms. sat. sol.
0	51.2
20	54.3
30	56.2

EQUILIBRIUM IN THE SYSTEM AMMONIUM TRITHIONATE, AMMONIUM TETRATHIONATE AND WATER.

(Kurtenacker and Laszlo, 1938.)

The tri and tetrathionates decompose while being shaken with water, especially at 20°. The decomposition products include thiosulfate, pentathionate, sulfate and free acid. Determinations are given for the percentage of pentathionate and thiosulfate. The maximum amount of thio sulfate was 0.2 percent

Results at 0°

Gms. per 100 gms. sat. sol. $(NH_4)_2S_3O_6$	$(NH_4)_2S_4O_6$	$(NH_4)_2S_5O_6$	Solid Phase
1.2	51.0	0.0	$(NH_4)_2S_4O_6$
1.1	48.9	0.8	"
15.5	30.5	3.9	"
27.8	21.5	0.9	"
41.2	16.7	0.7	—
46.7	76.1	0.0	$(NH_4)_2S_3O_6$
52.1	1.0	0.0	"
53.0	0.9	0.0	"

Results at 20°

Gms. per 100 gms. sat. sol. $(NH_4)_2S_3O_6$	$(NH_4)_2S_4O_6$	$(NH_4)_2S_5O_6$	Solid Phase
0.0	54.2	0.0	$(NH_4)_2S_4O_6$
1.0	52.9	0.0	"
9.0	43.3	1.6	"
19.6	32.2	4.5	"
39.9	19.0	1.8	"
45.5	15.9	1.8	—
53.0	5.2	0.0	$(NH_4)_2S_3O_6$
56.0	2.0	0.0	"

AMMONIUM SELENITE $(NH_4)_2SeO_3.H_2O$.

SOLUBILITY OF AMMONIUM SELENITE IN WATER.

(Janickis, 1934; Janickis and Gutmanaite, 1936.)

t°	d. of sat. sol.	Gms. $(NH_4)_2SeO_3$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $(NH_4)_2SeO_3$ per 100 gms. sat. sol.	Solid Phase
-0.105	1.0002	0.326	Ice	- 8.5	47.18	$(NH_4)_2SeO_3.H_2O$
-0.260	1.0036	0.812	"	+ 1.0	49.21	"
-0.875	1.019	3.20	"	14.0	51.99	"
-2.06	1.051	7.75	"	25.0	54.70	"
-8.81	1.197	27.24	"	35.2	57.13	"
-15.95	1.297	39.88	"	43.0	59.90	"
-21.9	—	44.8	"+ $(NH_4)_2SeO_3.H_2O$	50	62.31	"
-20.0	—	45.12	$(NH_4)_2SeO_3.H_2O$	70	69.08	

AMMONIUM Pyro SELENITE $(NH_4)_2Se_2O_5.3H_2O$.

SOLUBILITY OF AMMONIUM PYROSELENITE IN WATER.

(Janickis, 1934; Janickis and Gutmanaite, 1936.)

t°	d. of sat. sol.	Gms. $(NH_4)_2Se_2O_5$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $(NH_4)_2Se_2O_5$ per 100 gms. sat. sol.	Solid Phase
-0.148	1.002	0.547	Ice	+15.0	66.65	$(NH_4)_2Se_2O_5.3H_2O$
-0.373	1.0075	1.36	"	20	69.50	"
-0.697	1.019	2.69	"	25	73.24	"
-1.365	1.035	5.29	"	30	79.74	"
-3.18	1.090	12.57	"	32	82.29	"
-6.23	1.178	23.35	"	32	86.23	$(NH_4)_2Se_2O_5$
-13.0	1.351	40.7	"	33.2	86.35	"
-16.9	—	49.0	"+ $(NH_4)_2Se_2O_5.3H_2O$	34.0	86.43	"
-15.0	—	49.62	$(NH_4)_2Se_2O_5.3H_2O$	45.1	87.23	"
-10.0	—	52.86	"	57.2	88.78	"

AMMONIUM Tetra SELENITE $(NH_4)H_3(SeO_3)_2$.

SOLUBILITY OF AMMONIUM TETRASELENITE IN WATER.

(Janickis, 1934; Janickis and Gutmanaite, 1936.)

t°	d. of sat. sol.	Gms. $(NH_4)H_3(SeO_3)_2$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $(NH_4)H_3(SeO_3)_2$ per 100 gms. sat. sol.	Solid Phase
-0.147	1.002	0.549	Ice	-14.8	60.08	Ice+$(NH_4)H_3(SeO_3)_2$
-0.335	1.0075	1.365	"	-10.3	64.58	$(NH_4)H_3(SeO_3)_2$
-0.595	1.0165	2.71	"	- 5.8	68.70	"
-1.055	1.034	5.32	"	+ 0.1	73.61	"
-2.435	1.063	12.94	"	8.8	79.30	"
-4.385	1.174	24.73	"	18.0	85.11	"
-8.06	1.345	40.89	"	30.0	91.62	"
-12.85	1.511	54.60	"			

AMMONIUM SELENATE $(NH_4)_2SeO_4$.

SOLUBILITY OF AMMONIUM SELENATE IN AQUEOUS SOLUTIONS OF SELENIC ACID AT 30°.

(King, 1937.)

SeO

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$(NH_4)_2SeO_4$	H_2SeO_4		$(NH_4)_2SeO_4$	H_2SeO_4	
55.12	0.0	$(NH_4)_2SeO_4$	44.74	34.52	—
53.82	3.56	"	34.41	42.50	$(NH_4)_2SeO_4.H_2SeO_4$
53.03	5.39	"	24.13	50.53	"
53.22	9.08	"	23.41	50.77	"
54.40	10.75	"	20.04	55.26	—
53.11	12.73	—	18.47	58.61	$(NH_4)_2SeO_4.H_2SeO_4$
50.48	14.88	$3(NH_4)_2SeO_4.H_2SeO_4$	17.27	60.74	"
48.40	19.24	"	17.40	61.08	"
46.36	24.18	"	17.20	63.28	"
45.49	28.08	"	23.79	67.38	"
43.92	34.13	—	29.72	66.23	"

AMMONIUM MetaVANADATE NH_4VO_3.

SOLUBILITY IN WATER. (Lachartre, 1924.)

t°.	Gms. NH_4VO_3 per 100 gms. sat. sol.	t°.	Gms. NH_4VO_3 per 100 gms. sat. sol.
15	5.18	70	36.0
32	10.4	96	65.0
50	16.1		

At temperatures above 50° the results are not exact on account of the decomposition of the vanadate with loss of ammonia.

AMMONIUM BiVANADATE $(NH_4)_2O(V_2O_5).3H_2O$.

100 gms. sat. solution in water contain 28.0 gms. $(NH_4)_2O(V_2O_5)_2$ at 16°. (Lachartre, 1924.)

NOTE. — The above results by Lachartre, are about ten times too high as compared with previous determinations. The decimal points should probably be moved one place to the left.

AMMONIUM Meta VANADATE NH_4VO_3.

SOLUBILITY IN WATER AND IN AQUEOUS AMMONIUM SALT AND AMMONIUM HYDROXIDE SOLUTIONS.

(Meyer, 1909.)

t°.	Gms. per 1000 cc. in Each Solvent.							
	Water.	0.05 n. NH_4Cl.	0.1 n. NH_4Cl.	0.05 n. NH_4NO_3.	0.1 n. NH_4NO_3.	0.0668 n. NH_3.	0.245 n. NH_3.	0.588 n. NH_3.
18	4.35	1.66	0.41	1.67	0.58	5.58	7.97	12.06
25	6.08	2.63	1.17	2.77	1.23	7.06	8.58	12.66
35	10.77	5.21	2.69	...	...	...	...	...
45	15.71	8.88	5.40	...	...	...	..	...
55	19.97	11.18	7.40	...	...	...	...	...
70	30.47	...	...	...	...	...	...	...

100 cc. anhydrous hydrazine dissolve 2 gms. ammonium metavanadate at room temp. (Welsh and Broderson, 1915.)

AMMONIUM Para WOLFRAMATE (Tungstate) $5(NH_4)_2O.12WO_3.11H_2O$.

SOLUBILITY OF AMMONIUM PARA WOLFRAMATE IN WATER.

(Rosenheim and Wolff, 1936.)

t°	Gms. $5(NH_4)_2O.12WO_3$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $5(NH_4)_2O.12WO_3$ per 100 gms. sat. sol.	Solid Phase
17	1.064	$5(NH_4)_2O.12WO_3.11H_2O$	49	4.341	$5(NH_4)_2O.12WO_3.11H_2O$
25	1.586	"	52	3.280	$5(NH_4)_2O.12WO_3.7H_2O$
29	2.014	"	62	6.145	"
35	2.424	"	70	7.971	"
45	3.467	"			

NITROUS OXIDE N_2O.

SOLUBILITY IN WATER.

(Bunsen; Roth, 1897; Knopp, 1904; Geffcken, 1904.)

t°.	Coefficient of Absorption β		q.	Solubility in Terms of Ostwald Expression (l).*		
	(B.)	(R.)		(R.)	(K.)	(G.)
5	1.0954	1.1403	0.205	1.161	...	1.067
10	0.9196	0.9479	0.171	0.9815	...	0.9101
15	0.7778	0.7896	0.143	0.8315	...	0.7784
20	0.6700	0.6654	0.121	0.7131	0.6739	0.6756
25	0.5961	0.5752	0.104	0.6281	...	0.5942

* Calculated by Geffcken.

NOTE. — Knopp and also Geffcken call attention to the fact that Roth in making his determinations used a rubber tube between the gas burette and the shaking flask, and give this as an explanation of the high results which he obtained.

β = the Bunsen Absorption Coefficient which shows the volume of gas (reduced to 0° and 760 mm pressure) absorbed by one volume of the solvent when the pressure of the gas itself without that of the solvent is 760mm.
g = the weight of gas in grams which is taken up by 100 gms. of the pure solvent at the indicated temperature and a total pressure of 760mm.
l = the Ostwald Solubility Expression which is the ratio of the volume (v) of gas absorbed at any temperature and pressure, to the volume (V) of the absorbing liquid. The solubility l is therefore the volume of gas dissolved by unit volume of solvent at the temperature of the experiment.

The solubility of Nitrous Oxide in Water at 25°, in terms of the Bunsen Absorption Coefficient, was found by Orcutt and Sievers, 1936 to be 0.549. Their value for the solubility of N_2O in blood at 25° is 0.416, which is in good agreement with the previous result of Siebeck, 1909. Additional results for blood are given by Findlay and Creighton, 1910-1911. Orcutt and Sievers made use of the Van Slyke and Neill, 1924, manometric apparatus which is based upon the principal of extracting the gas from the solvent and measuring its pressure. By means of a special technique and method of calculating the correction for unextracted gas, this becomes a simple method of determining the solubility of any gas in any liquid without the aid of previously determined constants.

O

SOLUBILITY OF NITROUS OXIDE (N_2O) IN AQUEOUS SOLUTIONS OF ACIDS AT 25°.

(Manchot, Jahrstorfer and Zepter, 1924;

Acid.	$d_{\frac{25}{4}}$ of aq. acid.	Gms. acid per 100 cc. sol.	Abs. coef. a per 100 cc. sol.	Acid.	$d_{\frac{25}{4}}$ of aq. acid.	Gms. acid per 100 cc. sol.	Abs. coef. a per 100 cc. sol.
HNO_3...	1.0351	6.932	54.1	H_2SO_4...	1.0680	11.084	44.2
» ...	1.0731	14.242	55.1	» ..	1.1630	26.974	38.7
» ...	1.1191	22.938	56.2	» ..	1.2687	45.415	38.2
HCl.....	1.0168	3.9387	51.2	» ...	1.3363	58.853	39.9
»	1.0335	7.7318	50.1				
»	1.0741	16.703	49.9	H_3PO_4...	1.0593	11.473	46.4
»	1.1050	23.706	52.1	» ...	1.0964	18.631	43.8
HIO_4....	1.1740	20.421	38.7	» ...	1.2557	49.520	35.3
»	1.4066	47.023	23.8				

Absorption Coefficient a in the above table is the same as the Bunsen Coefficient β which is the volume of gas (reduced to 0° and 760 mm pressure) absorbed by one volume of the solvent when the partial pressure of the gas equals 760 mm mercury.

NITROGEN OXIDE (ous) N_2O.

SOLUBILITY OF NITROUS OXIDE IN AQUEOUS SOLUTIONS OF SALTS AT 25°.

(Manchot, Jahrstorfer and Zepler, 1924.)

Salt.	$d\frac{25}{4}$ of salt solution.	Gms. anhy. salt per 100 cc. solution.	Abs. coef. α for 100 cc. solution.	Salt.	$d\frac{25}{4}$ of salt solution.	Gms. anhy. salt per 100 cc. solution.	Abs. coef. α for 100 cc. solution.
None (= H_2O).	–	0.0	53.14	$Mg(NO_3)_2$.	1.0935	14.389	39.2
NH_4Cl	1.0146	5.724	46.6	»	1.1846	28.630	28.5
»	1.0312	12.037	41.1	$Ca(NO_3)_2$..	1.1503	22.398	32.2
»	1.0594	23.005	34.7	»	1.2927	44.796	19.4
KCl	1.0334	5.8157	45.3	$Zn(NO_3)_2$.	1.1223	15.909	39.7
»	1.0540	9.3200	41.0	»	1.2433	31.818	29.1
»	1.0850	14.763	35.5	$Cd(NO_3)_2$.	1.1435	18.465	35.0
»	1.1385	23.934	28.1	»	1.2874	36.93	27.0
»	1.1734	30.123	24.0	$Cu(NO_3)_2$.	1.1028	12.944	35.6
NaCl	1.0438	6.723	39.0	»	1.2049	25.888	27.8
»	1.0874	13.504	28.5	$Al(NO_3)_3$.	1.0703	10.22	36.1
»	1.1600	25.255	17.2	»	1.1414	20.44	29.3
$CaCl_2$........	1.0786	10.322	33.9	$(NH_4)_2SO_4$.	1.0896	17.786	27.1
»	1.1665	22.087	20.2	»	1.1393	28.807	17.5
$BaCl_2$........	1.1090	12.914	37.4	K_2SO_4	1.0762	10.440	35.5
»	1.2290	27.348	26.1	Na_2SO_4 ...	1.0550	6.600	36.5
NH_4Br.......	1.0535	10.225	47.4	»	1.1141	13.879	24.8
»	1.1088	20.745	42.3	$MgSO_4$...	1.0992	10.835	29.5
»	1.2122	40.803	35.8	»	1.1925	21.430	15.9
KBr	1.0891	13.211	43.0	$ZnSO_4$....	1.1403	15.337	29.9
»	1.1752	25.590	35.1	»	1.2699	29.705	16.9
»	1.3380	49.969	24.7	$MnSO_4$...	1.1226	14.194	30.6
NaBr	1.0849	11.578	40.1	»	1.2460	29.143	17.0
»	1.1645	22.334	30.9	$FeSO_4$....	1.1017	10.938	34.0
»	1.3338	45.902	17.8	»	1.2011	21.845	21.6
NH_4NO_3....	1.0249	7.125	49.8	$CoSO_4$....	1.1131	12.217	27.5
»	1.0527	14.809	46.4	»	1.2218	24.433	17.1
»	1.1040	29.058	40.9	$NiSO_4$	1.1355	14.499	24.6
»	1.2116	54.236	30.8	»	1.2642	28.998	13.8
KNO_3........	1.0586	10.313	44.8	$Al_2(SO_4)_3$.	1.1558	17.688	22.4
»	1.1231	21.739	38.3	»	1.2381	27.875	13.4
$NaNO_3$	1.0560	9.181	42.3	$Fe_2(SO_4)_3$.	1.2240	26.390	25.9
»	1.0677	11.136	40.3	»	1.4319	52.781	13.1
»	1.1141	18.447	33.5	$Cr_2(SO_4)_3$.	1.1657	22.356	31.8
»	1.1543	25.588	27.7	»	1.3280	44.712	18.2
»	1.2152	35.704	21.6	Na_2HPO_4.	1.0470	5.661	37.6
				Na_3PO_4...	1.0348	3.6088	40.7
				KIO_4	1.0008	0.3608	52.1

Solubility of Nitrous Oxide in Aqueous Sulphuric Acid.

(Lunge — Ber. 14, 2188, '81; see also Geffcken's results.)

Sp. Gr. of H_2SO_4	1.84	1.80	1.705	1.45	1.25
Vols. N_2O dissolved by 100 vols. H_2SO_4	75.7	66.0	39.1	41.6	33.0

100 vols. of KOH solution of 1.12 Sp. Gr. absorb 18.7 vols. N_2O.
100 vols. of NaOH solution of 1.10 Sp. Gr. absorb 23.1 vols. N_2O.

Solubility of Nitrous Oxide in Aqueous Solutions of Acids.

(Geffcken.)

Results in terms of the Ostwald Solubility Expression (l). p. 1136

In Hydrochloric Acid.			In Nitric Acid.			In Sulphuric Acid.		
Gms. HCl per Liter.	N_2O Dissolved		Gms. HNO_3 per Liter.	N_2O Dissolved		Gms. H_2SO_4 per Liter.	N_2O Dissolved	
	l_{15}.	l_{25}.		l_{15}.	l_{25}.		l_{15}.	l_{25}.
18.22	0.755	0.577	36.52	0.777	0.597	24.52	0.734	0.566
36.45	0.738	0.568	63.05	0.777	0.602	49.04	0.699	0.543
72.90	0.716	0.557	126.10	0.775	0.611	98.08	0.645	0.509
						147.12	0.602	0.482
						196.16	0.562	0.463

Solubility of Nitrous Oxide in Aqueous Solutions of:

(Roth.)

t°.	Phosphoric Acid.					Oxalic Acid.	
	Coefficient of Abs. in H_3PO_4 Solutions of:					Coefficient of Abs. in $(COOH)_2$ Solutions of:	
	3.38%.	4.72%.	8.84%.	9.89%.	13.35%.	0.812%.	3.70%.
5	1.057	1.0365	0.9883	0.9635	0.9171	1.1450	1.1094
10	0.8827	0.8665	0.8296	0.8101	0.7711	0.9526	0.9264
15	0.7388	0.7258	0.6977	0.6826	0.6505	0.7940	0.7745
20	0.6253	0.6147	0.5926	0.5810	0.5555	0.6694	0.6538
25	0.5427	0.5329	0.5143	0.5054	0.4860	0.5784	0.5643

Solubility of Nitrous Oxide in Alcohol and in Aqueous Chloral Hydrate Solutions at 20 .

(Bunsen; Knopp — Z. physik. Ch. 48, 106, '04.)

In Alcohol (B.).		In Aq. Chloral Hydrate (K.).		
t°.	Vols. N_2O (at 0° and 760 mm) per 1 Vol. Alcohol.	Normality of $C_2HCl_3O.H_2O$.	Gms. $C_2HCl_3O\ H_2O$ per Liter.	Coef. of Abs. of N_2O.
0	4.178	0.184	30.43	0.618
5	3.844	0.445	73.60	0.613
10	3.541	0.942	155.8	0.596
15	3.268	1.165	192.7	0.589
20	3.025	1.474	243.8	0.579
24	2.853	1.911	316.4	0.567

Solubility of Nitrous Oxide in Petroleum. Coefficient of Absorption at 10° = 2.49, at 20° = 2.11.

(Gniewasz and Walfisz — Z. physik. Ch. 1, 70, '87.)

SOLUBILITY OF NITROUS OXIDE IN AQUEOUS SALT SOLUTIONS.

Results by Gordon in terms of coefficient of absorption. page 1136

Salt.	Concentration of Salt. Grams per 100 Grams Solution.	Concentration of Salt. Gram Mols. per Liter.	Coefficient of Absorption of N_2O at: 5°.	10°.	15°.	20°.
Calcium Chloride	5.79	0.547	0.819	0.697	0.591	0.500
"	9.86	0.964	0.668	0.586	0.509	0.435
"	13.99	1.416	0.510	0.441	0.380	0.328
Lithium Chloride	1.35	0.319	0.986	0.831	0.700	0.594
"	3.85	0.928	0.878	0.743	0.629	0.536
"	11.48	2.883	0.606	0.512	0.437	0.382
Lithium Sulphate	2.37	0.219	0.934	0.792	0.670	0.569
"	5.46	0.521	0.795	0.665	0.557	0.474
"	8.56	0.836	0.646	0.555	0.477	0.415
Magnesium Sulphate	5.90	0.521	0.766	0.664	0.561	0.471
"	7.66	0.687	0.708	0.586	0.488	0.414
"	10.78	0.997	0.569	0.491	0.417	0.346
Potassium Chloride	4.90	0.676	0.879	0.751	0.643	0.555
"	7.64	1.037	0.799	0.693	0.591	0.494
"	14.58	2.147	0.654	0.574	0.500	0.430
"	22.08	3.414	0.544	0.459	0.390	0.339
Potassium Sulphate	2.62	0.154	0.986	0.831	0.701	0.605
"	4.78	0.285	0.918	0.763	0.637	0.542
Sodium Chloride	6.20	1.107	0.800	0.682	0.585	0.509
"	8.88	1.614	0.713	0.603	0.510	0.434
"	12.78	2.391	0.634	0.532	0.449	0.386
Sodium Sulphate	5.76	0.427	0.808	0.677	0.584	0.495
"	8.53	0.646	0.692	0.574	0.482	0.416
"	12.44	0.974	0.559	0.486	0.417	0.354
Strontium Chloride	3.31	0.215	0.928	0.788	0.671	0.578
"	5.73	0.380	0.848	0.709	0.610	0.550
"	13.24	0.939	0.644	0.547	0.463	0.390

Results by Knopp, in terms of the coefficient of absorption.

Salt.	Formula.	Conc. of Salt per Liter. Normality.	Conc. of Salt per Liter. Grams.	Coef. of Absorption of N_2O at 20°.
Potassium Nitrate	KNO_3	0.1061	10.74	0.6173
"	"	0.2764	27.94	0.6002
"	"	0.5630	56.97	0.5713
"	"	1.1683	118.2	0.5196
Sodium Nitrate	$NaNO_3$	0.1336	11.37	0.6089
"	"	0.3052	25.97	0.5876
"	"	0.6286	53.50	0.5465
"	"	1.1200	95.30	0.4926

SOLUBILITY OF NITROUS OXIDE IN AQUEOUS SALT SOLUTIONS.

Results by Geffcken in terms of the Ostwald expression (l). page 1136

Salt.	Formula.	Conc. of Salt per Liter.		Solubility of N_2O.	
		Gram Equiv.	Grams.	l_{15}.	l_{25}.
Ammonium Chloride	NH_4Cl	0.5	26.76	0.730	0.557
Ammonium Chloride	NH_4Cl	1.0	53.52	0.691	0.529
Caesium Chloride	$CsCl$	0.5	84.17	0.710	0.544
Lithium Chloride	$LiCl$	0.5	21.24	0.697	0.535
Lithium Chloride	$LiCl$	1.0	42.48	0.623	0.483
Potassium Bromide	KBr	0.5	59.55	0.697	0.536
Potassium Bromide	KBr	1.0	119.11	0.627	0.485
Potassium Chloride	KCl	0.5	37.3	0.686	0.527
Potassium Chloride	KCl	1.0	74.6	0.616	0.475
Potassium Iodide	KI	0.5	83.06	0.702	0.541
Potassium Iodide	KI	1.0	166.12	0.633	0.492
Potassium Hydroxide	KOH	0.5	28.08	0.668	0.514
Potassium Hydroxide	KOH	1.0	56.16	0.559	0.436
Rubidium Chloride	$RbCl$	0.5	60.47	0.695	0.533
Rubidium Chloride	$RbCl$	1.0	120.95	0.625	0.483

Results by Roth, in terms of the coefficient of absorption.

Grams NaCl per 100 Grams Solution.	Coefficient of Absorption of N_2O at:				
	5°.	10°.	15°.	20°.	25°.
0.99	1.0609	0.8812	0.7339	0.6191	0.5363
1.808	1.0032	0.8383	0.7026	0.5962	0.5190
3.886	0.9131	0.7699	0.6495	0.5520	0.4775
5.865	0.8428	0.7090	0.5976	0.5088	0.4424

SOLUBILITY OF NITROUS OXIDE IN AQUEOUS SOLUTIONS OF PROPIONIC ACID AT 20°.

(Knopp.)

Gms. C_2H_5COOH per liter	15.15	60.42	158.4	176.6	344.0
Coef. of Absorption of N_2O	0.6323	0.6369	0.6504	0.6534	0.7219

SOLUBILITY OF NITROUS OXIDE IN AQUEOUS SOLUTIONS OF GLYCEROL AND OF UREA.

(Roth, 1897.)

t°.	Coefficient of Absorption of N_2O in Glycerol Solutions of:			
	3.46 Per cent.	6.73 Per cent.	12.12 Per cent.	16.24 Per cent.
5	1.097	1.055	0.999	0.959
10	0.917	0.887	0.841	0.810
15	0.767	0.745	0.710	0.686
20	0.647	0.630	0.605	0.585
25	0.556	0.542	0.527	0.508

t°.	Coefficient of Absorption of N_2O in Urea Solutions of:				
	3.31 per cent.	4.97 per cent.	6.37 per cent.	7.30 per cent.	9.07 per cent.
5	1.104	1.096	1.088	1.101	1.069
10	0.921	0.920	0.909	0.921	0.901
15	0.771	0.773	0.761	0.772	0.761
20	0.653	0.656	0.644	0.655	0.651
25	0.569	0.567	0.559	0.570	0.569

SOLUBILITY OF NITROUS OXIDE IN AQUEOUS SOLUTIONS OF GLYCEROL.

(Henkel, 1905, 1912.)

Results at 15°.		Results at 20°.	
Per cent Glycerol.	Absorption Coef. α.	Per cent Glycerol.	Absorption Coef. α.
0	0.7327	0	0.6288
2.49	0.7181	2.36	0.6131
3.28	0.7103	4.88	0.5993
7.17	0.6844	6.88	0.5903
10.52	0.6668	9.86	0.5633
14.05	0.6410	15.82	0.5315
17.08	0.6229		

Data for the influence of colloids and fine suspensions on the solubility of nitrous oxide in water at 25° are given by Findlay and Creighton (1910), and Findlay and Howell (1914).

Results for solutions of ferric hydroxide, dextrin, arsenious sulfide, starch, gelatin, glycogen, egg albumen, serum albumen, silicic acid and suspensions of charcoal and of silica are given.

SOLUBILITY OF NITROUS OXIDE IN AQUEOUS SOLUTIONS OF UREA AT 25°.

(Manchot, Jahrstorfer and Zepter, 1924;

0

$d_{\frac{25}{4}}$ of aq. sol. of Urea.	Mol. $CO(NH_2)_2$ per 1000 cc. sol.	Abs. coef. a * per 100 cc. sol.
1.0134	0.97	51.0
1.0287	1.95	49.2
1.0619	4.05	46.3
1.0905	5.89	44.5

*see page 1136

SOLUBILITY OF NITROUS OXIDE IN SEVERAL ORGANIC SOLVENTS.

(Horiuti, 1928, 1931.)

	cc N_2O per 1cc solvent (Ostwald Solubility Expression l) in:				
	Carbon Tetrachloride	Chloro Benzene	Benzene	Acetone	Methyl Acetate
- 1.4	—	—	—	9.30	—
+10	5.26	3.891	4.453	7.64	8.035
15	4.89	3.638	—	—	—
20	4.57	3.382	—	—	—
25	4.285	3.174	3.686	5.95	6.27
30	4.005	2.981	—	—	—
35	3.775	2.801	—	—	—
40	3.565	2.650	3.123	4.73	4.95
45	—	2.520	—	—	—
50	—	2.400	—	—	—
55	—	2.279	—	—	—

The author also gives results for the coefficient of dilation of N_2O in the above solvents at 25°.

SOLUBILITY OF NITROUS ACID IN WATER AND IN ORGANIC SOLVENTS.

(Kunerth, 1922.)

An apparatus similar to that of Mc Daniel (*J. Phys. Chem.*, 15, 587, 1911) was used. The N_2O was frozen by means of liquid air and ethyl alcohol and all other gases pumped off. The N_2O sublimed from the frozen gas was dried over P_2O_5. Its density was found to be 1.968 gms. per liter at standard temp. and pressure. In the present determinations the N_2O was sat. with the vapor of the solvent before being shaken with the solvent for the solubility determination. Hence it was not necessary to allow for the vapor pressure of the solvent.

	Cc. N_2O dissolved per 1 cc. solvent (both at same temp. and pressure) at:									
Solvent.	18°.	20°.	22°.	24°.	26°.	28°.	30°.	32°.	34°.	36°.
(1)...	0.703	0.675	0.638	0.617	0.587	0.561	0.530	0.513	0.478	0.449
(2)...	6.30	6.03	5.78	5.50	5.21	4.84	4.46	4.07	3.66	3.26
(3)...	5.00	4.85	4.70	4.55	4.39	4.25	4.11	3.98	3.84	3.75
(4)...	–	3.58	3.50	3.45	3.34	3.25	3.17	3.10	3.02	2.94
(5)...	3.38	3.32	3.27	3.23	3.19	3.07	2.98	2.88	–	–
(6)...	3.07	2.99	2.91	2.85	2.77	2.68	2.61	2.52	2.43	2.33
(7)...	3.23	3.15	3.07	3.00	2.93	2.85	2.78	2.72	2.65	2.57
(8)...	1.50	1.48	1.45	1.42	1.40	1.37	1.35	1.32	1.31	1.28
(9)...	5.24	5.14	5.05	4.93	4.83	4.71	4.60	4.49	4.39	4.30
(10)...	2.87	2.81	2.75	2.69	2.64	2.58	2.52	2.46	2.42	2.37
(11)...	2.52	2.47	2.43	2.37	2.32	2.27	2.24	2.19	2.16	2.12
(12)...	5.70	5.60	5.51	5.26	5.07	4.83	4.57	4.29	4.03	3.70

(1) Water.
(2) Acetone.
(3) Acetic acid.
(4) Pyridine.
(5) Methyl Alcohol.
(6) Ethyl Alcohol.
(7) Benzaldehyde.
(8) Aniline.
(9) Amyl Acetate.
(10) Ethylene Bromide.
(11) Iso Amyl Alcohol.
(12) Chloroform.

One liter cyclohexanol ($C_6H_{11}OH$) dissolve 235.84 cc Nitrous oxide (N_2O) at 26° and 766mm pressure. Cauquil, 1927.

NITROGEN OXIDE (ic) NO.

SOLUBILITY IN WATER.

(Winkler, 1901.)

t°.	β.	β'.	q.	t°.	β.	β'.	q.
0	0.0738	0.0734	0.00984	40	0.0351	0.0325	0.00440
5	0.0646	0.0641	0.00860	50	0.0315	0.0277	0.00376
10	0.0571	0.0564	0.00757	60	0.0295	0.0237	0.00324
15	0.0515	0.0506	0.00680	70	0.0281	0.0195	0.00267
20	0.0471	0.0460	0.00618	80	0.0270	0.0144	0.00199
25	0.0430	0.0419	0.00564	90	0.0265	0.0082	0.00114
30	0.0400	0.0384	0.00517	100	0.0263	0.0000	0.00000

β is the Bunsen Absorption Coefficient which shows the volume of gas (reduced to 0° and 760 mm) absorbed by one volume of the liquid when the pressure of the gas less that of the liquid is 760mm.

β' is the volume of gas (reduced to 0 and 760mm) which is absorbed by one volume of the liquid when the total pressure is 760 mm.

q is the weight of gas in grams dissolved by 100 gms. of solvent at the indicated temperature and total pressure of 760 mm.

SOLUBILITY OF NITRIC OXIDE IN AQUEOUS SULPHURIC ACID SOLUTIONS AT 18°.

(Lunge, 1885; Tower, 1906.)

Wt. per cent H_2SO_4 in Solution.	Sp. Gr. at 15°.	Tension of H_2O Vapor.	Solubility Coefficient * of NO at 18°.	
98	1.84	...	0.0227	(0.035, L.)
90	1.82	0.1 mm.	0.0193	
80	1.733	0.4 "	0.0117	
70	1.616	1.5 "	0.0113	
60	1.503	3.1 "	0.0118	(0.017, L.)
50	1.399	6.2 "	0.0120	

* Volume of NO (at 760 mm.) per 1 volume of aqueous H_2SO_4.

Subsequent determinations at 20° by Pinkus and Jacobi, 1927, gave the following results:

Wt. percent H_2SO_4	cc NO (at 0° and 760 mm.) per 1.0cc aq. H_2SO_4
43.8	0.0136
54.6	0.0125
64.1	0.0006

NITROGEN OXIDE (ic) NO.

SOLUBILITY OF NITRIC OXIDE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 0°.

(Manchot and Reinburger, 1926.)

Gms. H_2SO_4 per 100 gms. sol.	Cc. NO dissolved per		Gms. H_2SO_4 per 100 gms. sol.	Cc. NO dissolved per	
	100 gms. sol.	100 cc. sol.		100 gms. sol.	100 cc. sol.
0.0	7.38	7.38	76.7	1.8	3.1
8.8	6.5	6.9	78.0	1.9	3.2
18.2	5.2	5.9	88.3	2.0	3.5
28.0	4.5	5.4	89.1	2.1	3.7
38.6	3.8	4.9	90.0	2.3	4.1
48.0	2.9	4.0	90.4	2.4	4.3
52.6	2.4	3.4	91.9	2.4	4.3
58.7	2.2	3.3	92.4	2.5	4.6
66.5	1.9	3.0	95.0	3.8	7.1
70.8	1.9	3.0	95.9	4.2	7.7

The values are given with reference to the Dalton law.

SOLUBILITY OF NITRIC OXIDE IN ALCOHOL.

(Bunsen.)

t°	0°	5°	10°	15°	20°	24°
Vols. NO* absorbed by 1 vol. Alc.	0.316	0.300	0.286	0.275	0.266	0.261

* At 0° and 760 mm.

Data for the solubility of nitric oxide in aqueous solutions of $FeSO_4$, $NiSO_4$, $CoSO_4$ and $MnCl_2$ at 20° are given by Usher (1908); Hüfner (1907) and Manchot and Zecheulmayer (1906).

The abs. coef. β for N in sat. aq. $NiSO_4$ at 20° is 0.0245; for sat. $CoSO_4$ it is 0.0288 and for sat. aq. $MnCl_2$ it is 0.0082.

NITROGEN OXIDE

SOLUBILITY OF NITRIC OXIDE IN ORGANIC SOLVENTS, IN TERMS OF THE OSTWALD SOLUBILITY EXPRESSION.*

(Klemenc and Spitzer-Neumann, 1929.)

Results for:

Benzene		Nitrobenzene		Carbon Tetrachloride	
t°	l	t°		t°	l
8.8	0.275	20	0.188	8.8	0.339
14.6	0.284	40	0.190	19.6	0.345
24.6	0.300	60	0.193	34.0	0.375
34.6	0.318	90	0.188		

Data for the Solubility of Nitric Oxide in nitrosyl chloride (NOCl), pentane and in toluene are given by Trantz and Gerwig, 1925.

Freezing-point data are given for mixtures of:

Nitric Oxide + Methyl Ether (Baume and Germann, 1914.)
" " + Brom benzene (Pascal and Garnier, 1923.)
" " + Nitrogen Tetroxide (NO_2) (v. Wittorff, 1904.)

Results for vapor pressures and the temperature - composition equilibrium in the system NO + NO_2 are given by Purcell and Cheesman, 1932.

0

Data for equilibrium between nitrogen monoxide, dioxide and trioxide, showing the range of existance of N_2O_3 in the stoichiometric gas mixture, are given by Abel and Proisl, 1929.

---

*see page 1136

NITROGEN PEROXIDE N_2O_4.

FREEZING-POINTS OF MIXTURES OF NITROGEN PEROXIDE AND NITROGEN TRIOXIDE.

(Baume and Robert, 1919.)

An apparatus made entirely of glass was used. The vapor tension of the mixture $N_2O_4 + N_2O_3 + NO$ was also determined. Pure nitrous anhydride (N_2O_3) exists in the solid or liquid state under pressure of NO only at very low temperatures. Above — 100° it dissociates and the liquid phase gets richer in N_2O_4 and the gaseous in NO. A single eutectic, near the freezing-point of N_2O_3 was found for the system $N_2O_4 + N_2O_3$.

t° of f. pt.	Wt. per cent N_2O_3 in mixture.	t° of f. pt.	Wt. per cent N_2O_3 in mixture.	t° of f. pt.	Wt. per cent N_2O_3 in mixture.
—11.5....	0.0	—27.1....	33.8	— 50......	59.7
—15.6....	10.9	—31.0....	37.6	— 75.0....	73.4
—19.9....	18.9	—34.0....	42.9	— 92......	80.1
—20.5....	20.2	—37.5....	45.9	—107......	86.3
—22.0....	23.5	—41.5....	51.9	—107......	91.8
—26.0....	30.4	—43.0....	53.4	—100.....	97.0

Results for the temperatures of the freezing-points and the region of separation into two liquid layers in the system $N_2O_3 + H_2O$ and the pseudo binary system $N_2O_4 + H_2O$ are given by Lowry and Lemon, 1936. Similar results for the formation of two liquid layers in Mixtures of Nitrogen Peroxide and water ($N_2O_4 + H_2O$) are given by Lowry, Lloyd and Lloyd, 1936.

Freezing-point data for the system $N_2O_4 + N_2O_5$ are given by Lowry and Lemon, 1935.

Freezing-point data for the system $N_2O_4 + HNO_3$ are given by Berl and Saenger, 1929.

Results for the solubility of nitrogen tetroxide in aqueous ferrous bromide solutions are given by Thomas, 1896.

Freezing-points are given for mixtures of:

N_2O_4 + Bromoform ($CHBr_3$) (Pascal, 1923.)
" + Chloroform ($CHCl_3$) " "
" + Methyl Iodide (CH_3I) " "
" + Carbon Tetrachloride (CCl_4) " "
" + Nitro Trichlor Methane (CCl_3NO_2) " "
" + Brom benzene (C_6H_5Br) " "
" + 2.4.6 Tri nitro toluene ($C_6H_2CH_3(NO_2)_3$) (Pascal, 1923.)
" + o Nitro toluene ($C_6H_4CH_3NO_2$) (Breithaupt.)
" + Camphor ($C_{10}H_{16}O$ (Pascal, 1923; Pascal and Garnier, 1923.)
NO_2 + Sulfur Dioxide (SO_2) Terres and Constantinescu, 1934.)

NITROSYL SULFURIC ACID $HO.SO_2.O.NO$.

SOLUBILITY OF NITROSYL SULFURIC ACID IN STRONG SOLUTIONS OF SULFURIC ACID:

(Elliott, Kleist, Wilkins and Webb, 1926.)

Constant agitation in a thermostat was employed.

t°.	Gms. $HO.SO_2.O.NO$ per 100 gms. sat. solution in aq. H_2SO_4 of 56.7 %.	62.1 %.	73.1 %.	74.9 %.	84.1 %.	90.4 %.	99.8 %.
0.....	-	11.9	17.3	19.7	30.5	35.1	-
20.9...	19.3	22.6	27.0	31.4	42.4	49.2	62.0
37.3...	29.9	34.3	39.4	40.8	50.2	58.5	66.1
49.6...	35.6	39.3	46.4	46.2	56.5	61.6	67.8

SODIUM Na.

SOLUBILITY IN LIQUID AMMONIA.

(Ruff and Geisel, 1906.)

t°.	Mols. NH_3 Required to Dissolve 1 Gm. Atom Na.	t°.	Mols. NH_3 Required to Dissolve 1 Gm. Atom Na.
−105	4.98	−30	5.52
− 70	5.20	0	5.87
− 50	5.39	+22	6.14

SOLUBILITY OF SODIUM IN MELTED SODIUM HYDROXIDE.

(von Hevesy, 1909.)

t°.	480°	600°	610°	670°	760°	800°
Gms. Na per 100 Gms. NaOH	25.3	10.1	9.9	9.5	7.9	6.9

Saturation could not be reached at temperatures below 480°. The saturated mixtures were cooled by plunging the container in water and the solidified contents analyzed.

SOLUBILITY OF SODIUM IN MELTED SODIUM HYDROXIDE CONTAINING OTHER METALS AT 480°.

(von Hevesy, 1909)

Added Metal.	Gms. Added Metal per 100 Gms. NaOH.	Gms. Dissolved Na per 100 Gms. Solvent.	Added Metal.	Gms. Added Metal per 100 Gms. NaOH.	Gms. Dissolved Na per 100 Gms. Solvent.
Thallium	5.40	23.13	Cadmium	2.87	24.34
"	8.30	23.54	"	3.16	24.29
"	12.42	21.29	Gold	6.03	23.92
"	31.37	20.91	"	8.22	23.39
			Zinc	30.37	25.38

SODIUM Na.

SOLUBILITY OF SODIUM IN AMMONIA.

(Kraus and Lucasse, 1922)

t°	Mol % Na.	t°	Mol % Na.	t°	Mol % Na	t°	Mol. % Na.
−59.7	1.62	−47.5	2.50	−41.7	3.83	−44.4	5.47
−55.9	1.81	−46.4	2.64	−41.6	4.18	−47.4	6.27
−51.9	2.09	−44.6	2.87	−41.8	4.46	−51.0	7.09
−48.6	2.38	−42.8	3.18	−42.5	4.97	−60.0	8.34

Data for the system Na + Sn are given by Hume-Rothery, 1908.

SODIUM AMIDE $NaNH_2$

100 gms. Liquid Ammonia dissolve 0.004 gm. $NaNH_2$ at 0°. (Hunt and Boncyk, 1933.)

SODIUM ALUMINATES $4Na_2O.3Al_2O_3.16H_2O$, $4Na_2O.Al_2O_3.10H_2O$.

EQUILIBRIUM IN THE SYSTEM Na_2O, Al_2O_3 AND H_2O AT 30°.

(Goudriaan, 1922)

Three samples of highly purified hydrated aluminium hydroxide were prepared, and from these three dehydrated samples were made by prolonged heating at 300° to 400°. Great difficulty was experienced in obtaining equilibrium due to the different forms of the hydroxide and to the viscosity of the Na OH solutions. An effort was made to determine the solid phase in each case by the « rest » method. The mixtures were agitated in many cases for periods of 2 to 3 months. At the lower concentrations of Na OH quite irregular results were obtained. The authors results were plotted and the following approximate values obtained from the curve.

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
Na_2O	Al_2O_3	Solid Phase	Na_2O.	Al_2O_3	Solid Phase.
20.0	10—13	$4Na_2O.3Al_2O_3.16H_2O$	32.0	3.7	$4Na_2O.3Al_2O_3.16H_2O$
22.0	9.0	"	34.0	5.3	" + $4Na_2O.Al_2O_3.10H_2O$
24.0	6.0	"	36.0	3.0	$4Na_2O.Al_2O_3.10H_2O$
26.0	2.5	"	38.0	1.3	"
28.0	1.0	"	40.0	0.2	"
30.0	2.5	"	40.8	0.1	" + $Na_2O.3H_2O$

The aluminium hydroxide existing as a gel may be considered as a metastable phase retaining variable quantities of alkali. There is probably a continuous transition between the hydroxide gels and the crystalline hydrate. Aluminium oxide is metastable in regard to the hydrate.

The following data for this system are given by Jucatis, 1934. The mixtures were prepared from crystalline $Al(OH)_3$ pure NaOH and H_2O. They were shaken continually for some 3 months. The saturated solutions and ~~and~~ moist residues were analyzed and the composition of the solid phase identified by plotting according to the Schreinemaker method. The original results were plotted and the following values read from the curve.

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
Na_2O	Al_2O_3		Na_2O	Al_2O_3	
21.3	22.0	$Na_2O.Al_2O_3.2\frac{1}{2}H_2O$	37.5	1.0	$Na_2O.Al_2O_3.2\frac{1}{2}H_2O$
21.7	16.0	"	37.7	1.4	" $+3Na_2O.Al_2O_3.6H_2O$
22.3	12.0	"	38.0	0.9	$3Na_2O.Al_2O_3.6H_2O$
23.5	8.0	"	39.5	0.5	"
26.7	4.0	"	40.5	0.4	"
30.0	2.2	"	42.0	0.3	"
35.0	0.9	"	43.0	0.3	"
36.5	0.7	"	44.7	1.0	"

EQUILIBRIUM IN THE SYSTEM SODIUM OXIDE, ARSENIC TRIOXIDE, WATER AT 25°.

(Schreinemakers and de Baat, 1917.)

AsO

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
As_2O_3	Na_2O.		As_2O_3.	Na_2O.	
2.019	0	As_2O_3	31.05	21.82	$Na_4As_2O_5.9H_2O$
14.45	2.45	"	±29	±22.7	" $+Na_{10}As_4O_{11}.26H_2O$
24.42	4.23	"	21.92	24.04	$Na_{10}As_4O_{11}.26H_2O$
37.73	6.46	"	17.50	25.64	"
58 54	9 60	"	14.26	29.16	"
±73	±12	" $+NaAsO_2$	14.63	30.24	"
63 01	12.73	$NaAsO_2$	19.32	32.04	" $+Na_4As_2O_5$
57.90	13.24	"	15.53	33.57	$Na_4As_2O_5$
48.05	14.27	"	10.49	36.21	"
36.32	18.74	"	6.59	39.39	" $+NaOH.H_2O$
±34	±21.1	" $+Na_4As_2O_5.9H_2O$	5 11	39.69	$NaOH.H_2O$
32.24	21.6	$Na_4As_2O_5.9H_2O$	0	41.2	"

SODIUM ARSENATES

EQUILIBRIUM IN THE SYSTEM SODIUM OXIDE, ARSENIC PENTOXIDE AND WATER AT 0°.

(Rosenheim and Thon, 1927.)

Purest NaOH and As_2O_5 were used. Considerable difficulty was experienced in filtering the syrupy solutions which contained finely divided, almost colloidal particles. Filtration was accomplished by means of porcelain filter discs and suction.

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
As_2O_5	Na_2O		As_2O_5	Na_2O	
66.09	0.0	$H_3AsO_4.\frac{1}{2}H_2O$	38.33	10.98	$NaH_2AsO_4.H_2O$
63.03	2.17	"	39.34	12.95	"
60.14	3.11	"	39.03	13.15	"
57.26	3.77	"	35.89	13.04	"
54.15	5.36	$NaH_2AsO_4.H_2O$	30.87	10.65	$Na_2HAsO_4.12H_2O$
52.14	7.01	"	19.15	6.29	"
47.11	7.91	"	14.95	4.99	"
44.48	8.51	"	11.92	4.18	"
38.01	9.34	"	5.80	2.62	"
			3.35	1.81	"

EQUILIBRIUM IN THE SYSTEM SODIUM OXIDE, ARSENIC PENTOXIDE AND WATER AT 20°.

(Mensel and Hagen, 1937.)

Gms. per 100 gms. sat. sol. Na_2O	Gms. per 100 gms. sat. sol. As_2O_5	Solid Phase	Gms. per 100 gms. sat. sol. Na_2O	Gms. per 100 gms. sat. sol. As_2O_5	Solid Phase
10.70	39.70	$NaH_2AsO_4 \cdot H_2O$	9.14	13.45	$\underline{o}$ $Na_3AsO_4 \cdot 12H_2O$
12.22	39.80	"	8.16	11.23	
13.72	40.59	"	7.73	10.24	
14.99	41.52	"+$Na_2HAsO_4 \cdot 12H_2O$	5.99	7.31	$Na_3AsO_4 \cdot 12H_2O$
(17.32	50.47)	" "	4.78	3.89	
13.71	36.81	$NaH_2AsO_4 \cdot 12H_2O$	5.33	2.05	
13.03	34.07	"	7.74	0.71	
11.77	29.08	"	11.46	0.29	
11.29	26.93	"	15.08	0.15	
10.12	22.32	"	21.10	0.10	
9.09	18.31	"	25.43	0.15	
8.70	16.70	"	27.22	0.27	(tr.pt.)
8.25	15.35	"	28.51	0.27	
9.21	16.32	"	30.25	0.31	
11.25	18.35	"+$\underline{o}$ $Na_3AsO_4 \cdot 12H_2O$	32.12	0.44	
			35.21	0.33	lower hydrate

AsO

Di SODIUM ARSENATE $Na_2HAsO_4 \cdot 12H_2O$.

SOLUBILITY OF DISODIUM ARSENATE IN WATER.

(Mensel and Hagen, 1937.)

The previous results of Rosenheim and Thom, 1927, for this system are considered to be slightly in error due to inaccuracy of the analytical method.

t°	Gms. Na_2HAsO_4 per 100 gms. sat. sol.	Solid Phase	t°	Gms. Na_2HAsO_4 per 100 gms. sat. sol.	Solid Phase
-0.210	0.94	Ice	64	61.4	$Na_2HAsO_4 \cdot 5H_2O$
-0.615	2.67	"	67	63.8	"
-0.968	4.32	"	68tr.pt.	67.3	" + Na_2HAsO_4
-1.138	5.12	" + $Na_2HAsO_4 \cdot 12H_2O$	67.4 "	64.8	" + $NaHAsO_4 \cdot H_2O$
+0.1	5.59	$Na_2HAsO_4 \cdot 12H_2O$	69	64.8	$NaHAsO_4 \cdot H_2O$
5.0	7.93	"	75.1	64.9	"
10	11.52	"	80	65.1	"
15.0	16.92	"	85.6	65.1	"
20	25.31	"	91.7	65.4	"
20.5tr.pt.	26.1	" + $Na_2HAsO_4 \cdot 7H_2O$	96.0	65.9	"
22.2	27.27	$Na_2HAsO_4 \cdot 7H_2O$	99.5	66.5	" + Na_2HAsO_4
25	29.33	"	69.3	67.2*	Na_2HAsO_4
34.9	36.73	"	81.6	66.5*	"
45.1	45.31	"	98.5	66.5*	"
50.1	49.83	"	103.1	66.7	"
56.2tr.pt.	57.1	" + $Na_2HAsO_4 \cdot 5H_2O$	108.1	66.0	"
60.3	58.99	Na HAsO .5H O	115.9b.pt.	66.9	"

* Metastable

100 gms. sat. solution of Disodium Arsenate in 93.5 Wt. % Ethyl Alcohol contain 0.02465 gm. Na_2HAsO_4 at about 18°, Wohlk, 1934.

Tri SODIUM ARSENATE $Na_3AsO_4.12H_2O$.

100 gms. aqueous solution contain 21.1 gms. $Na_3AsO_4.12H_2O$ (= 10.4 gms. Na_3AsO_4) at 17°. Sp. Gr. of solution = 1.1186. (Schiff, 1860.)

100 gms. glycerol dissolve 50 gms. sodium arsenate at 15.5°. (Ossendowski, 1907.)

SODIUM Meta BORATE $Na_2B_2O_4.8H_2O$.

SOLUBILITY OF SODIUM META BORATE IN WATER.

(Teeple, 1929.)

t°	Gms. $Na_2B_2O_4$ per 100 gms. H_2O	Solid Phase
20	25.75	$Na_2B_2O_4.8H_2O$
35	35.7	"

SODIUM Tetra BORATE (Borax) $Na_2B_4O_7.10H_2O$.

SOLUBILITY OF SODIUM TETRA BORATE IN WATER.

(Horn and Van Wagener, 1903; Sborgi, 1924; Sborgi, Bovalini and Cappelini, 1924.)

t°	Gms. $Na_2B_4O_7$. per 100 gms. H_2O	Solid Phase	t°	Gms. $Na_2B_4O_7$ per 100 gms. H_2O	Solid Phase
-0.45 Eutec.	1.10	Ice + $Na_2B_4O_7.10H_2O$	60	19.0	$Na_2B_4O_7.10H_2O$
0	1.11	$Na_2B_4O_7.10H_2O$	61.5	20.5	" + $Na_2B_4O_7.5H_2O$
10	1.60	"	65	21.9	$Na_2B_4O_7.5H_2O$
18	2,32(1)	"	70	24.4	"
25	3.15(1)	"	80	31.4	"
30	3.86	"	90	41.0	"
40	6.67	"	100	52.5	"
50	10.4	"	102.9	58.9	"

BO

(1) Menzel, 1927.

SODIUM Penta BORATE $Na_2B_{10}O_{16}.10H_2O$.

SOLUBILITY OF SODIUM PENTA BORATE IN WATER.

(Rollet and Peng, 1935.)

t°	Gms. $Na_2B_{10}O_{16}$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Na_2B_{10}O_{16}$ per 100 gms. sat. sol.	Solid Phase
-0.53	1.36	Ice	85	41.9	$Na_2B_{10}O_{16}.10H_2O$
-0.91	2.68	"	90	45.5	"
-1.24	3.94	"	93	47.3	"
-1.70 Eutec.	5.8	" + $Na_2B_{10}O_{16}.10H_2O$	96	49.0	"
0	6.0	$Na_2B_{10}O_{16}.10H_2O$	99	50.9	"
13.5	8.6	"	100	51.8	" + $Na_2B_{10}O_{16}.2H_2O$
20	10.7	"	102	53.5*	"
35	15.9	"	104.5	55.5*	"
50	22.7	"	103	52.7	$Na_2B_{10}O_{16}.2H_2O$
59.6	27.45	"	107	54.3	"
70.8	33.7	"	108.3	54.8	"
80.0	38.8	"	109.6 b.pt.	55.3	"

* Unstable

SOLUBILITY OF SODIUM BORATES IN WATER AT 30°.

(Dukelski, 1906, complete references given.)

Gms. per 100 Gms. Solution.		Gms. per 100 Gms. Residue.		Solid Phase.
Na_2O.	B_2O_3.	Na_2O.	B_2O_3.	
42.0	...	...	...	$NaOH\ H_2O$
41.37	5.10	43.54	4.19	"
38.85	5.55	37.20	11.18	$Na_2O.B_2O_3.4H_2O$
34.44	3.73	33.52	10.80	"
29.39	2.51	29.63	10.11	"
26.13	2.75	27.85	15.21	"
23.00	3.82	24.91	11.60	"
16.61	13.69	21.29	20.64	"
21.58	4.63	24.52	19.04	$Na_2O.B_2O_3.4H_2O + Na_2O.B_2O_3.8H_2O$
20.58	4.69	21.61	16.59	$Na_2O.B_2O_3\ 8H_2O$
15.32	6.21	19.70	17.84	"
12.39	9.12	18.05	18.17	"
8.85	10.49	11.72	20.62	$Na_2O.2B_2O_3.10H_2O$
5.81	6.94	10.82	21.31	"
1.88	2.41	7.31	15.50	"
1.38	5.16	7.16	17.44	"
2.02	7.79	6.24	16.38	"
4.08	17.20	8.96	29.20	$Na_2O.2B_2O_3.10H_2O + Na_2O.5B_2O_3.10H_2O$
3.79	15.84	5.68	28.19	$Na_2O.5B_2O_3.10H_2O$
2.26	12.14	5.21	29.19	"
1.99	11.84	5.74	39.66	$Na_2O.2B_2O_3.10H_2O + B(OH)_3$
1.86	11.18	1.06	28.78	$B(OH)_3$
0.64	6.11	0.31	31.19	"
...	3.54	...	...	"

EQUILIBRIUM IN THE SYSTEM SODIUM OXIDE, BORIC OXIDE, WATER AT 60°.

(Sborgi and Mecacci, 1915, 1916.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
Na_2O.	B_2O_3.		Na_2O.	B_2O_3.	
49.25	0	$NaOH.H_2O$	19.29	22.78	$Na_2O.B_2O_3.4H_2O$
48.44	0.81	"	20.30	25.50	"
49.28	1.53	" $+2Na_2O.B_2O_3.H_2O$	22.21	32.17	" $+Na_2O.2B_2O_3.5H_2O$
47.38	2.24	$2Na_2O.B_2O_3.H_2O$	19.43	27.09	$Na_2O.2B_2O_3.5H_2O$
44.74	3.78	"	16.13	23.05	"
42.94	5.67	" $+Na_2O.B_2O_3.H_2O$	13.51	19.10	"
40.14	5.41	$Na_2O.B_2O_3.H_2O$	11.58	16.62	"
38.70	5.56	"	6.95	11.50	"
35.76	6.29	"	5.65	14.89	"
34.93	6.80	"	6.84	20.40	"
31.88	9.85	" (unstable)	8.42	28.05	"
29.56	11.83	" "	11.29	41.47	" $+Na_2O.5B_2O_3.10H_2O$
28.07	14.65	" "	8.29	33.57	$Na_2O.5B_2O_3.10H_2O$
33.12	7.47	" $+Na_2O.B_2O_3.4H_2O$	6.29	28.77	"
28.64	6.51	$Na_2O.B_2O_3.4H_2O$	3.22	21.94	"
22.06	10.29	"	3.40	22.59	" $+H_3BO_3$
18.72	17.33	"	1.39	13.92	H_3BO_3
18.32	19.17	"	0	7.39	"

SODIUM BORATES

EQUILIBRIUM IN THE SYSTEM Na_2O, B_2O_3 AND H_2O AT SEVERAL TEMPERATURES.

(Sborgi and Amelotti, 1930; Sborgi, 1932.)

The mixtures were constantly shaken for periods of 2 to 45 days.

Gms. per 100 gms. sat. sol.		Solid
Na_2O	B_2O_3	Phase
Results at 0°		
0.0	1.49	H_3BO_3
0.88	4.74	" + 1.2.10
0.34	0.76	1.2.10
0.46	0.65	"
3.05	3.33	"
6.45	7.09	"
7.22	7.66	" + 1.1.8
8.32	4.98	1.1.8
10.71	3.26	"
16.04	1.66	"
20.82	1.15	"
24.12	1.67	" + 1.1.4
22.81	2.00	1.1.4
26.66	1.50	"
29.43	1.21	"
32.50	1.69	" + $NaOH.4H_2O$
28.33	0.45	$NaOH.4H_2O$
22.84	0.0	"
Results at 20°		
0.0	2.70	H_3BO_3
1.50	8.70	" + 1.5.10
2.18	10.37	1.2.10 + "
0.78	1.75	"
4.60	5.26	"
7.20	8.35	"
8.95	10.50	" + 1.1.8
9.75	8.94	1.1.8
15.78	4.40	"
19.40	2.95	"
23.19	3.32	" + 1.1.4
24.65	2.69	1.1.4
30.71	2.31	"
34.30	2.71	"
39.56	3.93	$NaOH.H_2O$
40.00	0.0	"

Gms. per 100 gms. sat. sol.		Solid
Na_2O	B_2O_3	Phase
Results at 35°		
0.0	4.04	H_3BO_3
2.05	12.86	" + 1.5.10
3.36	16.23	1.5.10
4.47	18.74	" + 1.2.10
2.60	10.34	1.2.10
1.48	3.32	"
7.43	9.75	"
13.04	15.40	" + 1.1.8
13.59	10.13	1.1.8
18.01	6.68	"
20.64	6.46	" + 1.1.4
24.53	3.98	1.1.4
33.79	3.87	"
37.60	5.07	"
40.54	5.82	" + 2.1.1
41.83	5.54	2.1.1
42.76	4.73	" + $NaOH.H_2O$
42.73	3.96	$NaOH.H_2O$
42.48	3.09	"
43.00	0.0	"
Results at 45°		
2.55	16.43	H_3BO_3 + 1.5.10
7.50	28.85	1.5.10 + 1.2.10
15.32	20.10	1.1.8 + "
18.50	14.0	" + 1.1.4
37.0	5.50	1.1.1 + "
40.46	4.68	" + 2.1.1
44.73	3.51	$NaOH.H_2O$ + "
Results at 90°		
5.86	37.46	H_3BO_3 + 1.5.10
13.0	58.0	1.2.3 + "
23.74	39.65	" + 1.1.4
30.03	16.26	1.1.1 + "
43.0	7.0	" + 2.1.1
57.88	1.26	NaOH + "

BO

1.5.10 = $Na_2O.5B_2O_3.10H_2O$; 1.2.10 = $Na_2O.2B_2O_3.10H_2O$; 1.1.8 = $Na_2O.B_2O_3.8H_2O$; 1.1.4 = $Na_2O.B_2O_3.4H_2O$; 1.1.1 = $Na_2O.B_2O_3.H_2O$; 2.1.1 = $2Na_2O.B_2O_3.H_2O$.

EQUILIBRIUM IN THE SYSTEM Na_2O, B_2O_3 AND H_2O AT 0°.

(Rosenheim and Leyser, 1921.)

The mixtures were constantly stirred for 1 to 2 days. The curve plotted from the results is somewhat irregular.

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
NaOH.	H_3BO_3.	Solid Phase.	NaOH.	H_3BO_3.	Solid Phase.
0.639	5.84	–	0.416	1.97 (³)	$Na_2O.2B_2O_3.10H_2O$
1.27	9.2	–	5.143	8.06	»
1.62	11.2	–	7.349	11.44	»
1.65	9.3	$Na_2O.2B_2O_3.10H_2O$ + $Na_2O.5B_2O_3.10H_2O$	8.921	13.76	»
1.23	9.20		9.160	14.07	$Na_2O.2B_2O_3.10H_2O$ + $Na_2O.B_2O_3.8H_2O$
1.16	8.96 (¹)		8.794	13.63	
1.29	9.55		8.989	13.65	
1.37	9.79		9.265	12.83	$Na_2O.B_2O_3.8H_2O$
1.09	8.78 (²)		9.845	11.45	»
1.10	8.73		11.130	8.35	»

(¹) By analysis the solid phase had the composition $Na_2O.4.54B_2O_3.10.1H_2O$.
(²) » » » » » » » » $Na_2O.3.34B_2O_3.9.71H_2O$.
(³) » » » » » » » » $Na_2O.2.01B_2O_3.10.1H_2O$.

SODIUM Penta BORATE

BO

EQUILIBRIUM IN THE SYSTEM SODIUM PENTA BORATE SODIUM CHLORIDE AND WATER.

(Peng, Chung-Ming, 1935.)

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms. sat. sol.		Solid Phase
	$Na_2O.5B_2O_3$	NaCl			$Na_2O.5B_2O_3$	NaCl	
0	1.1	25.6	1.5.10 + NaCl	70	4.6	25.1	NaCl
20	10.31	0.97	1.5.10	"	7.8	23.8	"
"	8.34	2.84	"	80	35.3	2.8	1.5.10
"	6.77	6.17	"	"	33.2	4.8	"
"	6.12	7.09	"	"	29.1	8.6	" + 1.5.2
"	4.5	14.8	"	"	26.5	10.5	1.5.2
"	3.85	21.75	"	"	22.6	13.8	"
"	3.52	24.92	" + NaCl	"	17.1	18.9	"
"	1.52	25.7	NaCl	"	15.2	20.5	" + NaCl
"	0.85	26.04	"	"	10.44	22.8	NaCl
35	10.48	5.95	1.5.10	"	4.2	25.6	"
"	9.60	7.35	"	93	44.2	2.1	1.5.10 + 1.5.2
"	7.26	13.84	"	"	42.1	3.1	1.5.2
"	6.68	16.80	"	"	34.0	7.3	"
"	5.50	24.29	" + NaCl	"	25.5	13.4	"
"	4.07	25.02	NaCl	"	19.0	19.1	" + NaCl
"	1.65	25.89	"	"	13.7	21.6	NaCl
"	0.98	26.18	"	"	5.6	25.6	"
70	25.7	6.2	1.5.10	100	43.3	3.5	1.5.2
"	24.3	7.25	"	"	42.1	4.2	"
"	22.7	9.3	"	"	35.1	8.26	"
"	21.6	11.1	"	"	30.1	11.50	"
"	20.2	12.7	"	"	28.4	13.1	"
"	19.2	14.8	" + 1.5.2	"	25.8	15.1	"
"	15.6	17.5	1.5.2	"	24.9	16.35	"
"	14.8	18.2	"	"	24.2	17.2	" + NaCl
"	13.3	20.4	"	"	16.4	20.6	NaCl
"	11.6	21.9	" + NaCl	"	7.1	25.0	"

1.5.10 = $Na_2O.5B_2O_3.10H_2O$; 1.5.2 = $Na_2O.5B_2O_3.2H_2O$.

SOLUBILITY IN WATER OF SODIUM META BORATE AND OF SODIUM TETRA BORATE, EACH SEPARATELY, IN PRESENCE OF SODIUM CHLORIDE AND OF SODIUM CARBONATE AT 35°.

(Teeple, 1929.)

Gms. per 100 gms. H_2O					Solid Phase
$Na_2B_2O_4$	$Na_2B_4O_7$	NaCl	Na_2CO_3	$NaHCO_3$	
8.3	—	33.5	—	—	D.S. + NaCl
24.0	—	—	33.0	—	1.1.8 + $Na_2CO_3.H_2O$
32.8	—	13.7	—	—	" + D. S.
6.8	—	23.2	22.8	—	D.S. + NaCl + $Na_2CO_3.H_2O$
26.9	—	6.9	26.2	—	" + 1.1.8 + "
—	2.2	35.2	—	—	NaCl + 1.2.10
—	4.6	—	—	12.6	NaHCO + "
—	2.5	34.8	—	2.1	" + " + NaCl

1.1.8 = $Na_2O.B_2O_3.8H_2O$; 1.2.10 = $Na_2O.2B_2O_3.10H_2O$; D.S. = $Na_2OB_2O_3.2NaCl.4H_2O$.

SOLUBILITY IN WATER OF MIXTURES OF SODIUM META BORATE, SODIUM TETRA BORATE AND SODIUM CHLORIDE.

(Teeple, 1929.)

Results at 20°

Gms. per 100 gms. H_2O			Solid Phase
$Na_2B_2O_4$	$Na_2B_4O_7$	NaCl	
—	2.5	—	1.2.10
0.5	1.95	—	"
4.9	0.5	—	"
11.3	0.4	—	"
25.75	—	—	1.1.8
25.1	0.5	—	" + 1.2.10
23.0	—	19.2	D.S. + NaCl
8.0	—	33.3	" + "
—	0.9	36.0	1.2.10 +"
0.5	0.5	35.8	" +"
2.3	0.3	34.7	" +"
23.2	0.4	19.3	" + 1.1.8 + D.S.
8.0	0.2	33.2	" + NaCl + "

Results at 35°

Gms. per 100 gms. H_2O			Solid Phase
$Na_2B_2O_4$	$Na_2B_4O_7$	NaCl	
—	5.3	—	1.2.10
35.7	—	—	1.1.8
—	2.2	35.5	NaCl + 1.2.10
8.3	—	33.5	" + D.S.
34.8	5.6	—	1.1.8 + 1.2.10
32.8	—	13.7	" + D.S.
8.0	2.0	33.1	NaCl+ "+1.2.10
32.7	5.2	12.9	1.1.8+"+ "

1.1.8 = $Na_2O.B_2O_3.8H_2O$.
1.2.10 = $Na_2O.2B_2O_3.10H_2O$.
D.S. = $Na_2O.B_2O_3.2NaCl.4H_2O$.

SOLUBILITY IN WATER OF MIXTURES OF SODIUM META BORATE, TRI SODIUM PHOSPHATE AND SODIUM CHLORIDE AT 20°.

(Teeple, 1929.)

Gms. per 100 gms. H_2O			Solid Phase
$Na_2B_2O_4$	Na_3PO_4	NaCl	
1.17	11.2	—	$Na_3PO_4.12H_2O$ + $Na_2O.B_2O_3.2Na_3PO_4.36H_2O$
0.2	2.9	—	$Na_2O.B_2O_3.2Na_3PO_4.36H_2O$
25.5	0.03	—	" + 1.1.8
23.0	—	19.2	$Na_2O.B_2O_3.2NaCl.4H_2O$ + "
8.0	—	33.0	" + NaCl
—	1.9	35.0	$Na_3PO_4.12H_2O$ + "
23.0	0.2	19.2	1.1.8 + $Na_2O.B_2O_3.2NaCl.4H_2O$ + $Na_2O.B_2O_3.2Na_3PO_4.36H_2O$
8.0	0.15	33.0	" + "
0.6	1.5	35.0	NaCl + "
0.4	2.0	35.0	$Na_3PO_4.12H_2O$ + " + "

Results are also given for the systems:

$Na_2B_2O_4$ + $Na_2B_4O_7$ + Na_2HPO_4 + Na_3PO_4 at 20°
and " + " + " + " + NaCl at 20°.

SOLUBILITY IN WATER OF MIXTURES OF SODIUM TETRA BORATE, DI SODIUM PHOSPHATE AND SODIUM CHLORIDE AT 20°.

(Teeple, 1929.)

Gms. per 100 gms. H_2O			Solid Phase
$Na_2B_4O_7$	Na_2HPO_4	NaCl	
2.0	2.6	—	1.2.10
1.5	6.7	—	" + $Na_2HPO_4.12H_2O$
—	7.0	33.8	NaCl + "
0.85	—	36.5	" + 1.2.10
0.8	0.7	35.7	" + "
0.8	2.7	34.8	" + "
1.0	7.2	33.3	" + "
1.0	7.8	32.5	" + " + $Na_2HPO_4.12H_2O$.

1.2.10 = $Na_2O.2B_2O_3.10H_2O$.

EQUILIBRIUM IN THE SYSTEM SODIUM TETRABORATE, SODIUM SULFATE AND WATER AT VARIOUS TEMPERATURES.

(Sborgi, Bovalini and Cappellini, 1924.)

Constant agitation in a thermostat was employed for securing equilibrium.

BO

t°.	Gms. per 100 gms. sat. sol.		Solid Phase.
	$Na_2B_4O_7$.	Na_2SO_4.	
− 0.45	1.086	0.0	$Na_2B_4O_7.10H_2O$+Ice
− 1.38	0.631	3.82	»+$Na_2SO_4.10H_2O$+Ice
−1.2	0.0	3.85	$Na_2SO_4.10H_2O$+Ice
+10.0	1.603	0.0	$Na_2B_4O_7.10H_2O$
10.0	1.086	1.843	»
10.0	0.806	4.383	»
10.0	0.704	8.36	»+$Na_2SO_4.10H_2O$
10.0	0.0	8.43	$Na_2SO_4.10H_2O$
20.0	2.52	0.0	$Na_2B_4O_7.10H_2O$
20.0	1.108	9.238	»
20.0	1.00	16.11	»$Na_2SO_4.10H_2O$
20.0	0.0	16.23	$Na_2SO_4.10H_2O$
25.0	3.087	0.0	$Na_2B_4O_7.10H_2O$
25.0	2.626	1.187	»
25.0	2.057	3.22	»
25.0	1.442	9.645	»
25.0	1.300	12.66	»
25.0	1.248	15.57	»
25.0	1.229	16.76	»
25.0	1.220	17.38	»
25.0	1.131	21.926	»+$Na_2SO_4.10H_2O$
25.0	0.326	21.91	$Na_2SO_4.10H_2O$
25.0	0.0	21.90	»
30.0	3.75	0.0	$Na_2B_4O_7.10H_2O$
30.0	1.27	28.78	» +$Na_2SO_4.10H_2O$
30.0	0.0	28.6	$Na_2SO_4.10H_2O$
31.9	1.41	32.38	»+Na_2SO_4+$Na_2B_4O_7.10H_2O$
35.0	4.829	0.0	$Na_2B_4O_7.10H_2O$
35.0	3.405	3.665	»
35.0	1.798	24.18	»
35.0	1.73	26.95	»
35.0	1.603	31.64	»
35.0	1.579	32.25	»+Na_2SO_4
35.0	1.263	32.60	Na_2SO_4
35.0	0.554	32.91	»
35.0	0.00	33.07	»
45.0	7.49	0.00	$Na_2B_4O_7.10H_2O$
45.0	6.361	4.258	»
45.0	4.112	13.992	»
45.0	3.124	30.15	» +Na_2SO_4
45.0	1.145	31.273	Na_2SO_4
45.0	0.600	41.649	»
49.3	4.584	29.245	»+$Na_2B_4O_7.10H_2O$ +$Na_2B_4O_7.5H_2O$
50.0	9.52	0.0	$Na_2B_4O_7.10H_2O$
50.0	6.936	7.978	»
50.0	5.116	21.171	»
50.0	4.760	25.482	»
50.0	4.61	29.00	» +Na_2SO_4
50.0	1.872	30.62	Na_2SO.
50.0	0.92	31.09	»
50.0	0.0	31.9	»

EQUILIBRIUM IN THE SYSTEM SODIUM TETRABORATE, SODIUM SULFATE AND WATER (CON.).

t°.	Gms. per 100 gms. sat. sol. $Na_2B_4O_7$.	Gms. per 100 gms. sat. sol. Na_2SO_4.	Solid Phase.	t°.	Gms. per 100 gms. sat. sol. $Na_2B_4O_7$.	Gms. per 100 gms. sat. sol. Na_2SO_4.	Solid Phase.
55.0..	12.37	0.0	$Na_2B_4O_7.10H_2O$	65.0....	17.953	0.0	$Na_2B_4O_7.5H_2O$
55.0..	8.473	13.05	"	65.0....	16.10	3.71	"
55.0..	8.06	16.97	"+$Na_2B_4O_7.5H_2O$	65.0....	15.98	3.94	"
55.0..	7.884	17.646	$Na_2B_4O_7.5H_2O$	65.0....	10.46	17.08	"
55.0..	7.58	18.31	"	65.0....	7.90	26.47	"+Na_2SO_4
55.0..	7.68	20.97	"	65.0....	2.86	29.37	Na_2SO_4
55.0..	7.44	21.21	"	80.0....	23.9	0.0	$Na_2B_4O_7.5H_2O$
55.0..	6.49	26.23	"	80.0....	14.57	22.38	"+Na_2SO_4
55.0..	5.99	28.08	"+Na_2SO_4	102.9 b. pt..	37.07	0.0	$Na_2B_4O_7.5H_2O$
55.0..	0.0	31.575	Na_2SO_4	104......	28.15	15.89	"+Na_2SO_4

In addition to the above results Sborgi and his associates give all other necessary data for constructing the space diagram of the system $Na_2B_4O_7 + (NH_4)_2SO_4 \rightleftarrows (NH_4)_2B_4O_7 + Na_2SO_4$.

100 gms. 86.5% glycerol ($d = 1.2326$ dissolve 89.0 gms. $Na_2B_4O_7.10H_2O$ at 20°.
" 98.5% " ($d = 1.2645$ " 111.0 " "

(Holm, 1921, 1921 *a*, 1922.

SOLUBILITY OF SODIUM BORATES IN SEVERAL SOLVENTS.

Borate.	Solvent.	t°.	Gms. Salt per 100 Gms Solvent.	Authority.
Sodium borate	Alcohol ($d = 0.941$)	15.5	2.48	(U. S. P. VIII.)
" "	Glycerol	15.5	60.3	(U. S. P. VIII.)
" "	"	80	100	(U. S. P. VIII.)
Sodium Biborate	Trichlorethylene	15	0.011	(Wester and Bruins, 1914.)

Fusion-point data for mixtures of $NaBO_2+NaPO_3$ and $NaBO_2+Na_2SiO_3$ are given by Van Klooster (1910–11). Results for $Na_2B_4O_7+Na_4P_2O_7$ are given by Le Chatelier (1894).

SODIUM BROMIDE $NaBr.2H_2O$.

Br

SOLUBILITY OF SODIUM BROMIDE IN WATER.

The results of Rüdorff, 1862; Guthrie, 1875; de Coppet, 1883; Richards and Churchill, 1899; Etard, 1894; Cocheret, 1911; Greenish, 1900; Scott and Frazier, 1927; Scott and Durham, 1930; Nikolaew and Rawitch, 1931; and Ricci, 1934, were plotted and the following values taken from the average curve.

t°	Gms. NaBr per 100 gms. sat. sol.	Solid Phase	t°	Gms. NaBr per 100 gms. sat. sol.	Solid Phase
-5	12.5	Ice	30	49.6	$NaBr.2H_2O$
-10	21.0	"	35	50.48(1.5655)	"
-15	27.5	"	45.21	52.66(1.5950)	"
-20	33.0	"	50.21	53.80(1.6108)	"
-25	37.7	"	51.0	53.9	" + NaBr
-28	40.3	" + $NaBr.2H_2O$	60.17	54.10(1.6073)	NaBr
-20	41.8	$NaBr.2H_2O$	75.44	54.41(1.5986)	"
-10	42.9	" "	91.95	54.83(1.5915)	"
0	44.47(1.4954)	"	100	53.8-54.8	"
+10	46.0	"	140	55.5-56.5	"
16.4	47.0 (1.523)	"	180	57.4-59.5	"
20	47.6	"	210	58.8-60.9	"
25	48.61(1.5418)	"	230	59.8-62.0	"
			250	61.0- —	"

The figures in parentheses are densities of the sat. solutions.

The lower of the two values given for the temperatures above 100° are taken from a curve plotted from the results of Distanow, 1937.

SOLUBILITY OF SODIUM BROMIDE IN AQUEOUS SOLUTIONS OF HYDROBROMIC ACID AT 25°.

(Scott and Durham, 1930.)

Gms. per 100 gms. sat. sol.	
HBr	NaBr
0.0	48.22
4.61	42.55
9.04	37.19
12.98	32.62
17.65	27.31

SOLUBILITY OF SODIUM BROMIDE IN AQUEOUS SOLUTIONS OF HYDROBROMIC ACID AT SEVERAL TEMPERATURES.

(Nikolaew and Rawitch, 1931.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	HBr	NaBr			HBr	NaBr	
Results at 25°				Results at 44.5°			
1.5426	0.0	48.56	NaBr.2H$_2$O	1.5912	0.0	52.56	NaBr.2H$_2$O
1.5245	3.03	44.97	"	1.5782	3.94	47.87	"
1.4989	8.84	38.20	"	1.5560	10.21	40.76	"
1.4789	14.22	31.68	"	1.5455	11.49	39.51	NaBr
1.4642	18.69	27.24	"	1.5361	12.76	37.62	"
1.4534	23.10	22.21	"	1.5121	17.89	31.36	"
1.4468	28.77	16.38	"	1.4961	21.91	26.74	"
1.4484	33.16	12.84	"				
—	37.21	9.81	"	Results at 65			
—	41.38	6.33	NaBr	1.5850	4.04	47.67	NaBr
1.4825	43.41	4.62	"	1.5596	13.30	33.80	"
1.5260	49.25	1.59	"	1.5689	18.29	27.50	"
1.6171	55.78	0.40	"	1.5689	23.51	22.37	"

Br

SOLUBILITY OF SODIUM BROMIDE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE AT SEVERAL TEMPERATURES.

(Nikolaew and Rawitch, 1931.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	Na$_2$O	NaBr			Na$_2$O	NaBr	
Results at 25°				Results at 44.5°			
1.5421	0.87	47.22	NaBr.2H$_2$O	1.5955	1.71	50.21	NaBr.2H$_2$O
1.5404	2.50	44.51	"	1.5958	3.98	47.20	" + NaBr
1.5402	4.41	41.94	"	1.5835	6.40	43.22	NaBr
1.5502	8.96	36.73	"	1.5615	12.35	33.94	"
1.5634	11.37	34.61	"	—	16.68	28.32	"
—	12.32	33.47	NaBr				
—	14.56	29.89	"	Results at 65°			
1.5535	19.78	23.42	"	1.5850	4.04	47.67	NaBr
1.5611	24.66	18.71	"	1.5596	13.30	33.80	"
1.5770	27.87	16.10	"	1.5589	18.29	27.50	"
1.6112	32.31	13.35	"	1.5689	23.51	22.37	"

The authors also give f. pt. determinations of mixtures of NaBr + HBr and of NaBr + NaOH. The existance of NaBr.5H$_2$O is shown.

SOLUBILITY OF SODIUM BROMIDE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE AT 17°.

(Ditte, 1897.)

Gms. per 100 Gms. H_2O.	
NaOH.	NaBr.
0.0	91.38
3.26	79.86
9.24	68.85
13.43	64.90
17.17	63.06
19.12	62.51
22.35	59.60
24.74	55.03
28.43	48.00
36.61	38.41
46.96	29.37
54.52	24.76

EQUILIBRIUM IN THE SYSTEM SODIUM BROMIDE, SODIUM BROMATE AND WATER.

(Ricci, 1934.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	NaBr	$NaBrO_3$	
Results at 10°			
1.492	45.80	0.0	$NaBr.2H_2O$
1.517	44.51	2.58	" + $NaBrO_3$
1.498	43.09	2.83	$NaBrO_3$
1.452	39.40	3.55	"
1.240	11.10	14.46	"
1.220	5.33	18.73	"
1.211	0.0	23.24	"
Results at 25°			
1.530	48.41	0.0	$NaBr.2H_2O$
1.546	47.37	1.90	"
1.555	46.82	2.94	" + $NaBrO_3$
1.542	45.62	3.15	$NaBrO_3$
1.462	39.24	4.61	"
Results at 25° (Con.)			
1.457	38.66	4.78	$NaBrO_3$
1.377	29.83	7.86	"
1.320	21.27	12.04	"
1.282	13.82	16.72	"
1.270	6.46	22.38	"
1.257	0.0	28.29	"
Results at 45°			
—	52.55	0.0	$NaBr.2H_2O$
—	50.68	3.51	" + $NaBrO_3$
—	44.39	3.72	$NaBrO_3$
—	28.69	11.17	"
—	7.91	26.65	"

EQUILIBRIUM IN THE SYSTEM SODIUM BROMIDE, SODIUM CHLORIDE AND WATER AT 8°-10°.

(Rakowkij and Polanskij, 1927.)

Gm. Mols. per 100 gms. sat. sol.	
NaCl	NaBr
0.0	12.80
1.02	12.02
1.34	11.70
1.73	11.45
2.14	10.94
2.24	10.87
2.54	10.47
2.53	10.26
2.62	10.34
2.65	10.36
2.94	9.93
3.05	9.90
3.38	9.49
3.61	9.39
2.74	11.18
3.30	10.08
3.59	9.53
3 83	8.97
4.27	8.30
4.70	7.88
4.87	7.05
5.45	6.15
5.89	5.75
6.49	4.62
6.93	3.99
7.17	3.68
8.63	1.70
9.91	0.0

EQUILIBRIUM IN THE SYSTEM SODIUM BROMIDE, SODIUM IODATE AND WATER.

(Ricci, 1934.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	NaBr	$NaIO_3$	
	Results at 5°		
1.489	45.08	0.0	$NaBr.2H_2O$
1.492	45.04	0.075	" + D.S.15
1.473	43.99	0.084	D.S.15
1.415	39.98	0.124	"
1.287	29.50	0.584	"
1.238	24.56	1.09	"
1.230	23.51	1.28	" + $NaIO_3.5H_2O$
1.225	22.95	1.25	$NaIO_3.5H_2O$
1.132	14.13	1.09	"
1.052	4.97	1144	"
1.027	0.0	3.297	"
1.227	23.30	1.34•	D.S.15
1.215	21.71	1.78•	" + $NaIO_3.5H_2O$
1.204	20.78	1.74•	$NaIO_3.5H_2O$
1.123	12.26	2.03•	"
1.079	6.97	2.52•	"
1.050	0.0	5.479•	"
	Results at 25°		
1.530	48.41	0.00	$NaBr.2H_2O$
1.537	48.21	0.42	" + D.S.15
1.509	46.73	0.45	D.S.15
1.417	39.55	0.86	"
1.367	35.23	1.51	"
1.343	32.68	2.16	" + $NaIO_3.H_2O$
1.266	26.39	2.35	$NaIO_3.H_2O$
1.172	16.40	3.00	"
1.104	7.78	4.46	"
1.075	0.0	8.569	"

Gms. per 100 gms. sat. sol.		Solid Phase
NaBr	$NaIO_3$	
Results at 40°		
51.55	0.0	$NaBr.2H_2O$
50.84	1.37	" + D.S.10
49.38	1.53	D.S.10
47.95	1.77	" + D.S.15
46.82	1.89	D.S.15
44.86	2.13	"
43.77	2.48	"
41.96	2.69	" + $NaIO_3$
42.44	2.52•	$NaIO_3$
40.05	2.63	"
39.5	2.65	" + $NaIO_3.H_2O$
37.29	2.80•	$NaIO_3$
39.06	2.68	$NaIO_3.H_2O$
32.08	2.77	"
20.65	3.65	"
0.0	11.70	"
Results at 50°		
53.63	0.0	$NaBr.2H_2O$
53.0	1.57	" + NaBr
52.57	2.37	" + D.S.10
51.40	2.49	D.S.10
50.93	2.63	" + $NaIO_3$
44.74	2.50	$NaIO_3$
32.41	3.41	"
21.46	5.15	" + $NaIO_3.H_2O$
13.28	6.28	$NaIO_3.H_2O$
6.63	9.03	"
0.0	13.49	"

• = Metastable

D.S. 15 = $3NaBr.2NaIO_3.15H_2O$; D.S.10 = $3NaBr.2NaIO_3.10H_2O$.

Similar results are also given for the 15°, 35°, and 45° isotherms.

EQUILIBRIUM IN THE SYSTEM SODIUM BROMIDE, SODIUM NITRATE AND WATER AT 25°.

(Ricci, Budiah and Borodulia, 1937.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$NaNO_3$	NaBr		$NaNO_3$	NaBr	
0.0	48.41	$NaBr.2H_2O$	15.72	37.11	$NaNO_3$
8.41	44.08	"	19.80	31.54	"
11.36	42.26	"	25.14	24.63	"
13.62	41.05	" + $NaNO_3$	31.67	17.02	"
14.42	39.74	$NaNO_3$	47.87	0.0	"

SOLUBILITY OF SODIUM BROMIDE IN AQUEOUS ETHYL ALCOHOL AT 30°.

(Cocheret, 1911.)

Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	Gms. per 100 Gms. Sat. Sol. NaBr.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	Gms. per 100 Gms. Sat. Sol. NaBr.	Solid Phase.
0	49.4	$NaBr.2H_2O$	65.51	16.08	$NaBr.2H_2O$
11.79	42.9	"	72.36	13.41	"
31.78	32.12	"	76.92	12.03	" +NaBr
43.22	26.79	"	87.35	7.44	NaBr
54.59	20.83	"	97.08	3.01	"

SOLUBILITY OF SODIUM BROMIDE IN AQUEOUS ETHYL ALCOHOL AT 25°.

(Flatt and Jordan, 1953.)

Wt. % C_2H_5OH in solvent	Gms. NaBr per 100: gms. solvent	Gms. NaBr per 100: gms. sat. sol.	Gms. NaBr per 100: cc. sat. sol.	Solid Phase
0.0	93.55	48.32	93.45	$NaBr.2H_2O$
20.4	77.26	43.59	75.21	"
42.5	57.43	36.48	54.18	"
67.9	33.75	25.24	29.95	"

SOLUBILITY OF SODIUM BROMIDE IN 95% ETHYL ALCOHOL SOLUTIONS OF HYDROBROMIC ACID AT 25°.

(Yagoda, 1930.)

Normality of HBr in 95% C_2H_5OH	d. of solvent	Gms. NaBr per 100 gms. solvent	Normality of HBr in 95% C_2H_5OH	d. of solvent	Gms. NaBr per 100 gms. solvent
0.0	0.7997	3.97	0.337	0.833	4.48
0.100	0.810	4.04	0.629	0.862	4.50
0.162	0.815	4.25	0.800	0.878	4.35
0.304	0.820	4.25	0.954	0.893	4.55

SOLUBILITY OF SODIUM BROMIDE IN PURE METHYL ALCOHOL.

(Brown, Olynwyn, Bonnel and Jones, 1928.)

t°	Gms. NaBr per 100 gms. CH_3OH	t°	Gms. NaBr per 100 gms. CH_3OH	t°	Gms. NaBr per 100 gms. CH_3OH
0	17.3	20	16.8	50	15.8
10	17.0	30	16.5	16	15.3
15	16.9	40	16.1		

SOLUBILITY OF SODIUM BROMIDE IN ABSOLUTE ETHYL ALCOHOL.

(Bonnell and Jones, 1926.)

The materials were carefully purified and especial attention paid to removal of traces of water from the alcohol. The mixtures were kept in a thermostat and shaken by hand at intervals during a long period. In some cases saturation was approached from above.

t°.	Gms. NaBr per 100 gms. C_2H_5OH.	t°.	Gms. NaBr per 100 gms. C_2H_5OH.	t°.	Gms. NaBr per 100 gms. C_2H_5OH.
0.0......	2.445	20.0.....	2.322	50.0.....	2.259
10.0.....	2.379	25.0.....	2.314	60.0.....	2.312
15.0......	2.343	30.0.....	2.292	70.0.....	2.345
		40.0.....	2.276		

SOLUBILITY OF SODIUM BROMIDE IN ALCOHOLIC SOLUTIONS.

(Rohland, 1898–05; de Bruyn, 1892; Eder, 1876.)

Alcohol.	Concentration of Aq. Alcohol.	t°.	Gms. NaBr per 100 Gms. Alcohol.	
Methyl Alcohol	$d_{15}=0.799$	room temp.	21.7	(R.)
Ethyl "	$d_{15}=0.810$	"	7.14	"
Propyl "	$d_{15}=0.816$	"	2.01	"
Ethyl "	90% by vol.	?	4.0	(hydrated NaBr)
Methyl "	Absolute	19.5	17.35	(de Bruyn.)
Ethyl "	"	15	6.3	($NaBr_2H_2O$) (Eder.)
Ethyl Ether	"	15	0.08	"

A sat. solution of NaBr in CH_3OH contains 0.9 gm. NaBr per 100 gms. solution at the critical temperature. (Centnerszwer, 1910.)

100 cc. of ethyl alcohol of $d = 0.8327$ dissolve 7.37 gms. NaBr at 16.4°, d_{16} of sat. sol. = 0.889. (Greenish, 1900.)

100 gms. propyl alcohol dissolve 2.05 gms. NaBr at ord. temp. (Schlamp, 1894.)

SOLUBILITY OF SODIUM BROMIDE IN MIXTURES OF ALCOHOLS AT 25°.

(Herz and Kuhn, 1908).

In $CH_3OH + C_2H_5OH$.			In $CH_3OH + C_3H_7OH$.			In $C_2H_5OH + C_3H_7OH$.		
Per cent CH_3OH in Mixture.	d_{25} of Sat. Sol.	Gms. NaBr per 100 cc. Sat. Sol.	Per cent C_3H_7OH in Mixture.	d_{25} of Sat. Sol.	Gms. NaBr per 100 cc. Sat. Sol.	Per cent C_3H_7OH in Mixture.	d_{25} of Sat. Sol.	Gms. NaBr per 100 cc. Sat. Sol.
0	0.8189	2.93	0	0.9238	14.40	0	0.8189	2.93
4.37	0.8265	3.65	11.11	0.9048	12.43	8.1	0.8147	2.49
10.4	0.8273	4.04	23.8	0.8887	10.53	17.85	0.8145	2.47
41.02	0.8593	7.24	65.2	0.8390	4.42	56.6	0.8107	1.90
80.69	0.9079	12.51	91.8	0.8153	1.47	88.6	0.8116	1.11
84.77	0.9104	12.86	93.75	0.8144	1.26	91.2	0.8083	0.83
91.25	0.9235	14.32	100	0.8093	0.74	95.2	0.8090	0.82
100	0.9238	14.40				100	0.8093	0.74

SOLUBILITY OF SODIUM BROMIDE IN ACETAMIDE AT VARIOUS TEMPERATURES.

(Menschutkin, 1908.)

t°.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.	t°.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
	$NaBr.2CH_3CONH_2$	= NaBr.			$NaBr.2CH_3CONH_2$	= NaBr.	
82*	...	...	CH_3CONH_2	90	29.4	13.7	$NaBr.2CH_3CONH_2$
80	6	2.8	"	100	32.2	15	"
78	11.5	5.36	"	110	35.3	16.4	"
76	16.3	7.6	"	120	38.7	18	"
74	20.2	9.4	"	130	42.6	19.8	"
72	23	10.7	"	135†	45.3	21.1	" +NaBr
70‡	25	11.6	" $+NaBr.2CH_3CONH_2$	155	46.4	21.6	NaBr
80	27	12.6	$NaBr.2CH_3CONH_2$	175	47.5	22.1	"

* M. pt. † Tr. pt. ‡ Eutec.

100 gms. 95% formic acid dissolve 22.3 gms. NaBr at 18.5°. (Aschan, 1913.)

100 cc. anhydrous hydrazine dissolve 37 gms. NaBr at room temp. (Welsh and Broderson, 1915.)

100 gms. 86.5 % glycerol ($d = 1.2326$) dissolve 44.7 gms. NaBr at 20°.
» 98.5 » ($d = 1.2645$) » 38.7 » »
(Holm, 1921, 1922.)

100 cc. sat. solution of sodium bromide in ethyl urethan contain 5.081 gms. NaBr at 60°. (Stuckgold, 1917.)

SOLUBILITY OF SODIUM BROMIDE IN ACETONE.

t°	Gms. NaBr per liter sat. solution	Authority
18	0.095	(Lannung, 1932.)
25	0.079	(Kraus and Seward, 1927.)
25	0.122	(Swearingen and Florence, 1935.)
25	0.63(?)	(Koch, 1930a.)
37	0.075	(Lannung, 1932.)

The results of Lannung were calculated from specific conductivity measurements in solutions prepared with highly purified acetone.

SOLUBILITY OF SODIUM BROMIDE IN ACETONE SOLUTIONS OF LITHIUM PERCHLORATE AND OF CALCIUM PERCHLORATE AT 25°.

(Swearingen and Florence, 1935.)

Results for acetone solutions of:

Lithium Perchlorate				Calcium Perchlorate	
Gm. Mols. per liter sat. sol.		Gm. Mols. per liter sat. sol.		Gm. Mols. per liter sat. sol.	
$LiClO_4$	NaBr	$LiClO_4$	NaBr	LiClO.	NaBr
0.0000	0.00190	0.003591	0.002246	0.000306	0.001612
0.000310	0.001379	0.019239	0.003575	0.000554	0.001907
0.000547	0.001452	0.038147	0.005207	0.000772	0.002225
0.000785	0.001582	0.078221	0.008243	0.001968	0.003643
0.001974	0.001926	0.392690	0.021575	0.004129	0.005997
				0.008421	0.009477

SOLUBILITY OF SODIUM BROMIDE IN ACETONE SOLUTIONS OF SODIUM NITRATE AT 25°.

(Kraus and Seward, 1927, 1928.)

Gm. Mols. per liter sat. solution	
$NaNO_3$	NaBr
0.0000	0.000768
0.000137	0.000760
0.000229	0.000746
0.000660	0.000713

SOLUBILITY OF SODIUM BROMIDE IN WATER AND IN SEVERAL ALCOHOLS AT 25°.

(Larson and Hunt, 1939.)

Solvent	Formula	d. of sat. solution	Gms. NaBr per 100 gms. solvent
Water	H_2O	—	93.50
Methanol	CH_3OH	0.9073	17.36
Ethanol	C_2H_5OH	0.8019	2.406
1-Propanol	$CH_3CH_2CH_2OH$	0.8026	0.4562
1-Butanol (n)	$CH_3(CH_2)_2CH_2OH$	0.8075	0.246
2-Propanol (iso)	$CH_3CHOHCH_3$	0.7818	0.1313
2-Methyl-1-Propanol	$(CH_3)_2CHCH_2OH$	0.7986	0.0951
1-Pentanol	$CH_3(CH_2)_3CH_2OH$	0.8106	0.1103
2 Butanol (sec.)	$CH_3CH_2CHOHCH_3$	0.8025	0.0341

SODIUM BROMIDE

EQUILIBRIUM IN THE SYSTEM SODIUM BROMIDE, ISO PROPYL ALCOHOL AND WATER AT 25°.

(Ginnings and Chen, 1931.)

Points on the binodal curve of the system were determined by the titration method and a tie line, *, located by estimation of the NaBr in layers in contact with each other. The plait point, PP, was found by plotting.

Gms. per 100 gms. sat. sol. Iso C_3H_7OH	Gms. per 100 gms. sat. sol. NaBr	Gms. per 100 gms. sat. sol. Iso C_3H_7OH	Gms. per 100 gms. sat. sol. NaBr
62.10	11.30 *	20.40	27.20
53.10	13.70	8.70	35.0
41.50	18.00	4.10	42.60 *
29.5	23.6 PP.		

The composition of the homogeneous mixture (plait point) at 25° of the system NaBr + Tertiary Butyl Alcohol + H_2O was found by Ginnings, Herring and Webb, 1933 to be

11.0 percent NaBr + 36.3 percent ter. $(CH_3)_3COH$ + 52.7 percent H_2O.

The original results for the remaining points on the binodal curve are not given but only the values corresponding to derived empirical equations for the curve.

Br

SOLUBILITY OF SODIUM BROMIDE IN ISO AMYL ALCOHOL SOLUTIONS OF HYDROBROMIC ACID AT 25°.

(Yagoda, 1930.)

Normality of HBr in iso $C_5H_{11}OH$	d. of solvent	Gms. NaBr per 100 cc. solvent	Normality of HBr in iso $C_5H_{11}OH$	d. of solvent	Gms. NaBr per 100 cc. solvent
0.0	0.805	0.085	0.463	0.850	0.274
0.066	0.8166	0.124	0.764	0.8754	0.390
0.181	0.8262	0.174			

SOLUBILITY OF SODIUM BROMIDE IN LIQUID AMMONIA.

The results of Scherer, 1931; Hunt, 1932; Johnson and Krumboltz, 1933; Linhard and Stephan, 1933, 1934; Distanow, 1937 and Portnow and Rawdine, 1937, were calculated to a common basis, plotted, and the following values read from the average curve.

t°	Gms. NaBr per 100 gms. sat. sol.	Solid Phase	t°	Gms. NaBr per 100 gms. sat. sol.	Solid Phase
-45	9.1	$NaBr.5NH_3$	25	58	$NaBr.5NH_3$
-40	12.0	"	35	57.5	NaBr
-34 (d= 7906)	16.0	"	50	57	"
-30	19.0	"	75	54.5	"
-20	26.5	"	100	52.5	"
-10	34.0	"	120	52	"
0	41.5	"	140	50	"
+10	49.0	"	160	41	"

EQUILIBRIUM IN THE SYSTEM SODIUM BROMIDE, SODIUM CHLORIDE AND LIQUID AMMONIA AT 0°.

(Portnow and Rawdine, 1937.)

Gms. per 100 gms. sat. sol.			Solid	Gms. per 100 gms. sat. sol.			Solid
NaCl	NaBr	NH_3	Phase	NaCl	NaBr	NH_3	Phase
0.0	39.0	61.0	NaBr	5.39	28.32	66.29	NaCl
1.74	37.85	60.31	"	6.61	21.26	72.13	"
3.61	35.96	60.43	" + NaCl	8.19	16.07	75.74	"
4.12	35.42	63.55	NaCl	10.20	5.94	83.86	"
4.54	31.91	65.55	"	11.60	0.0	88.40	"

100 gms. liquid Sulfur Dioxide (SO_2) dissolve 0.016 gm. NaBr at 0°
(Jander and Ruppolt, 1937.)

Fusion-point data are given for:

NaBr + NaCl (Amadori, 1912(a); Ruff and Plate, 1903.)
" + NaI (Amadori, 1912a)
" + NaF (Ruff and Plate, 1903.)
" + NaOH (Scarpa, 1915.)
" + $NaNO_2$ (Meneghini, 1912.)
" + Na_2SO_4 (Ruff and Plate, 1903.)
" + $SrBr_2$ (Kellner, 1917.)

SODIUM BROMATE $NaBrO_3$. BrO

SOLUBILITY OF SODIUM BROMATE IN WATER.

(Ricci, 1934.)

t°	d. of sat. sol.	Gms. $NaBrO_3$ per 100 gms. sat. sol.	t°	d. of sat. sol.	Gms. $NaBrO_3$ per 100 gms. sat. sol.	
5	1.194	21.42	35	1.288	31.35	
10	1.211	23.24	40	1.310	32.80	
15	1.232	24.94	50	—	35.55	
20	1.248	26.69	60	—	38.5	(Kremers, 1855-56a)
25	1.257	28.29	80	—	43.1	" " "
30	1.284	29.85	100	—	47.6	

The solid phase is $NaBrO_3$ in all cases.

EQUILIBRIUM IN THE SYSTEM SODIUM BROMATE, SODIUM CHLORATE AND WATER AT 25°.

(Swenson and Ricci, 1939.)

Gms. per 100 gms. sat. sol.		Solid	Gms. per 100 gms. sat. sol.		Solid
$NaBrO_3$	$NaClO_3$	Phase	$NaBrO_3$	$NaClO_3$	Phase
28.29	0.0	$NaBrO_3$	5.33	44.64	SSII, 40.4
16.46	18.91	"	5.07	44.98	" 64.2
12.20	28.03	"	4.49	45.66	" 71.0
8.68	36.75	"	3.79	46.46	" 83.2
7.14	40.98	"	3.69	46.56	" 85.0
7.00	41.47	S.S.I 2.02	2.84	47.42	" 89.4
6.54	42.62	" 1.70	1.89	48.36	" 91.0
5.99	43.66	" 6.84	0.96	49.16	" 98.0
6.05	43.55	" 24.3 +	0.79	49.36	" 98.5
		S.S.II(?)	0.0	50.07	$NaClO_3$

S.S.I and S.S.II indicate solid solutions and the figures which follow show the percentage of $NaClO_3$ found in these by analysis. Less complete results than the above are given for the 50° isotherms.

EQUILIBRIUM IN THE SYSTEM SODIUM BROMATE, SODIUM CHLORIDE AND WATER.

(Ricci, 1934.)

Results at 10°				Results at 25°			
d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	NaCl	$NaBrO_3$			NaCl	$NaBrO_3$	
1.211	0.00	23.24	$NaBrO_3$	1.241	3.76	23.73	$NaBrO_3$
1.193	4.85	17.28	"	1.229	6.17	20.27	"
1.192	9.84	12.75	"	1.225	9.98	16.31	"
1.199	16.15	8.58	"	1.228	12.95	13.67	"
1.213	20.75	6.41	"	1.234	17.55	10.34	"
1.229	23.61	5.32	"	1.234	20.99	8.32	"
1.235	24.52	5.02	" + NaCl	1.247	23.94	6.92	" + NaCl
—	26.32	0.0	NaCl	1.236	24.35	5.62	NaCl
				1.215	25.55	2.48	"

EQUILIBRIUM IN THE SYSTEM SODIUM BROMATE, SODIUM CHLORIDE AND WATER AT 25°.

(Ricci, 1934.)

BrO

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	NaI	$NaBrO_3$			NaI	$NaBrO_3$	
1.257	0.0	28.29	$NaBrO_3$	1.727	54.89	2.23	$NaBrO_3$
1.332	17.32	16.57	"	1.836	60.65	1.44	"
1.438	32.21	8.92	"	1.874	62.13	1.30	"
1.521	40.76	5.78	"	1.914	64.00	1.17	" + NaI
1.619	48.11	3.62	"	1.904	64.71	0.0	NaI

EQUILIBRIUM IN THE SYSTEM SODIUM BROMATE SODIUM NITRATE AND WATER AT 25°.

(Ricci, 1934.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$NaNO_3$	$NaBrO_3$			$NaNO_3$	$NaBrO_3$	
1.270	5.00	24.92	$NaBrO_3$	1.441	39.57	10.23	$NaBrO_3$
1.288	11.33	21.25	"	1.455	42.59	9.38	" + $NaNO_3$
1.314	18.48	17.79	"	1.432	44.46	6.04	$NaNO_3$
1.353	25.54	14.94	"	1.405	46.50	2.43	"
1.387	32.54	12.41	"	1.384	47.87	0.0	"

EQUILIBRIUM IN THE SYSTEM SODIUM BROMATE SODIUM SULFATE AND WATER.

(Ricci, 1934, 1935.)

Results at 10°				Results at 25°			
d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	Na_2SO_4	$NaBrO_3$			Na_2SO_4	$NaBrO_3$	
1.217	1.83	21.96	$NaBrO_3$	1.284	4.09	24.96	$NaBrO_3$
1.226	3.61	20.67	"	1.288	8.28	21.72	"
1.227	4.40	20.11	" + Na.10	1.303	12.35	18.71	"
1.230	4.41	19.93	Na.10	1.317	16.45	15.85	"
1.175	5.20	14.21	"	1.254	19.17	7.06	" + Na.10
1.112	6.96	5.40	"	1.225	20.48	3.34	Na.10
1.079	8.26	0.0	"	1.205	21.90	0.0	"

Na.10 = $Na_2SO_4 \cdot 10H_2O$.

EQUILIBRIUM IN THE SYSTEM SODIUM BROMATE, SODIUM SULFATE AND WATER AT 45°.

(Ricci, 1935.)

Gms. per 100 gms. sat. sol. Na_2SO_4	Gms. per 100 gms. sat. sol. $NaBrO_3$	Solid Phase	Gms. per 100 gms. sat. sol. Na_2SO_4	Gms. per 100 gms. sat. sol. $NaBrO_3$	Solid Phase
0.0	34.22	$NaBrO_3$	22.92	14.38	S.S. 9.66
8.10	27.14	"	24.18	12.56	" 6.72
16.54	20.38	"	25.85	10.13	" 6.66
19.81	17.93	"	26.56	9.23	"* 4.13
21.09	17.03*	"	27.76	7.53	" 3.62
21.59	16.62*	"	29.21	5.85*	" 4.21
22.47	16.00*	"	29.52	5.45*	"" 2.48
20.86	17.17	" + S.S. 19.89	29.95	5.01*	" 2.53
20.94	17.0	S.S. 17.17	30.44	4.50*	" 2.64
21.58	15.96	" 14.40	28.78	6.32	" + Na_2SO_4
22.77	14.65	" 13.80	29.18	5.64	Na_2SO_4
			30.35	3.12	"

* = Metastable. S.S. = Solid Solutions containing the indicated percentages of $NaBrO_3$.

Similar results are also given for the isotherms 30°, 37.5° and 52°.

This system provides a sixth type of solid solution in addition to the five possible types described by Roozeboom.

100 cc. anhydrous Hydrazine dissolve 1.0 gms. $NaBrO_3$ with decomposition. (Welsh and Broderson, 1915.)

CH

SODIUM METHIONATE $Na_2[CH_2(SO_3)_2] . 2\frac{1}{2}H_2O$.

SODIUM Chloro METHIONATE $Na_2[CHCl(SO_3)_2].H_2O$.

SOLUBILITY OF EACH SEPARATELY IN WATER.

(Backer and Terpstra, 1929; Backer, 1930.)

t°	Gms. anhydrous compound per 100 gms. H_2O	Solid Phase
25	38.4	$Na_2[CH_2(SO_3)_2].2\frac{1}{2}H_2O$
25	127.0	$Na_2[CHCl(SO_3)_2].H_2O$.

SODIUM FORMATE HCOONa.

THE FREEZING-POINTS OF AQUEOUS SOLUTIONS OF SODIUM FORMATE.

(Sidgwick and Gentle, 1922.)

t of f. pt.	−3.29.	−7.02.	−11.02.	−18.06.
Gms. HCOONa per 100 gms. sat. sol.	7.24	11.42	16.95	24.86

SOLUBILITY IN WATER.

(Groschuff, 1903.)

t°.	Gms. HCOONa per 100 Gms. Solution.	Mols. HCOONa per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. HCOONa per 100 Gms. Solution.	Mols. HCOONa per 100 Mols. H_2O.	Solid Phase.
−20	22.80	7.82	$HCOONa.3H_2O$	25.5	50.53	27.0	$HCOONa.2H_2O$
0	30.47	11.6	"	18	49.22	25.65	HCOONa
+15	41.88	19.1	"	29	50.44	26.9	"
18	44.92	21.6	"	54	53.80	30.8	"
18	44.73	21.4	$HCOONa.2H_2O$	74.5	56.82	34.8	"
21	46.86	23.3	"	100.5	61.54	42.35	"
23	48.22	24.65	"	123	66.20	51.8	"

Sp. Gr. of the saturated solution of the dihydrate at 18° = 1.317.

SOLUBILITY OF SODIUM ACID FORMATE (EXPRESSED AS NEUTRAL SALT) IN AQUEOUS SOLUTIONS OF FORMIC ACID.

(Groschuff.)

t°.	Gms. HCOONa per 100 Gms. Solution.	Mols. HCOONa per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. HCOONa per 100 Gms. Solution.	Mols. HCOONa per 100 Mols. H_2O.	Solid Phase.
0	22.35	19.5	$HCOONa.HCOOH$	45.5	38.85	43.1	HCOONa
25.5	29.62	28.45	"	70	41.27	47.5	"
66.5	41.08	47.1	"	85	43.09	51.2	

SOLUBILITY OF SODIUM FORMATE IN WATER.

(Elöd and Tremmel, 1927.)

The original results were plotted together with those of Groschuff and the following values taken from the average curves which coincide except in the region of the dihydrate.

CH

t°	Gms. NaHCOO per 100 gms. sat. sol.		Solid Phase	t°	Gms. NaHCOO per 100 gms. sat. sol.		Solid Phase
	E and T	Groschuff			E and T	Groschuff	
10	38.5	38.5	$NaHCOO.3H_2O$	22	46.0	47.5	$NaHCOO.2H_2O$
12.0	39.5	39.5	"	24	47.4	49.0	"
14	41.0	41.0	"	24.5 t.p.	—	49.8	" + NaHCOO
15	41.8	41.8	"	27.9 "	50.3	—	"
15.3 t.p.	42.4	—	" + $NaHCOO.2H_2O$	30	50.6	50.6	NaHCOO
15.9 "	—	44.0	" "	40	52.0	52.0	"
18	43.5	45.0	$NaHCOO.2H_2O$	50	53.4	53.4	"
20	44.8	46.2	"	60	55.0	55.0	"

EQUILIBRIUM IN THE SYSTEM SODIUM FORMATE, FORMIC ACID AND WATER.

(Elöd and Tremmel, 1927.)

Results at 13°

Gms. per 100 gms. sat. sol. HCOOH	HCOONa	Solid Phase
0.0	39.8	$NaHCOO.3H_2O$
10.6	43.7	"
11.7	43.3	$3NaHCOO.HCOOH$
12.7	43.1	"
14.1	42.4	"
24.8	40.8	"
35.4	37.8	"
39.2	37.2	$NaHCOO.HCOOH$
54.8	31.2	"
74.0	26.0	"

Results at 23.4°

Gms. per 100 gms. sat. sol. HCOOH	HCOONa	Solid Phase
0.0	46.7	$NaHCOO.2H_2O$
5.7	48.5	"
6.55	49.15	" + $3NaHCOO.HCOOH$
40.8	41.3	$NaHCOO.HCOO$ + "
71.1	28.9	$NaHCOO.HCOOH$

Results at 45°

Gms. per 100 gms. sat. sol. HCOOH	HCOONa	Solid Phase
0.0	47.3	NaHCOO
2.4	45.1	"
9.25	38.25	" + $3NaHCOO.HCOOH$
49.58	9.59	$NaHCOO.HCOOH$ + "
65.1	0.0	$NaHCOO.HCOOH$

F. pt. data for the system Sodium Formate, Formic Acid are given by Kendall and James, 1921.

SODIUM FORMATE

100 gms. Methyl Alcohol (CH_3OH) dissolve 3.52 gms. anhydrous NaHCOO at 15° and 3.68 gms. at the b. pt. (66.6°). (Henstock, 1934.)

SODIUM FORMALDEHYDE SULFOXALATE $NaHSO_2.CH_2O.2H_2O$.

100 cc. sat. solution of sodium formaldehyde sulfoxalate in glycerol of *d* = 1.262 contain 50.66 gms. sulfoxalate at 18° and the density of the saturated solution is 1.375.

100 cc. sat. solution of sodium formaldehyde sulfoxalate in methyl alcohol of *d* = 0.8 contain 8.39 gms. sulfoxalate at 18° and the density of the saturated solution is 0.845. (Heyl and Greer, 1922.)

SODIUM ACETATE $CH_3COONa.3H_2O$.

SOLUBILITY IN WATER.
(Green, 1908.)

CH

t°.	Gms. CH_3COONa per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. CH_3COONa per 100 Gms. H_2O.	Solid Phase.
−10	19	Ice	20	123.5	CH_3COONa (unstable)
−18	30.4	"	30	126	" "
−10	33	$CH_3COONa.3H_2O$	40	129.5	" "
0	36.3	"	50	134	"
+10	40.8	"	60	139.5	"
20	46.5	"	70	146	"
30	54.5	"	80	153	"
40	65.5	"	90	161	"
50	83	"	100	170	"
58	138	"	110	180	"
0	119	CH_3COONa (unstable)	120	191	"
10	121	" "	123 b. pt.	193	"

Results differing somewhat from the above are given by Köhler (1897); Enklaar (1901) and Schiavon (1902).

SODIUM ACETATE $CH_3COONa.3H_2O$.

FREEZING-POINTS OF AQUEOUS SOLUTIONS OF SODIUM ACETATE.

Results by Klein and Svanberg, 1920.

t° of f. pt.	Gms. CH_3COONa per 100 cc. sat. sol.	Solid Phase.
−0.36	0.82	Ice
−0.91	2.05	"
−1.85	4.10	"

Results by Sidgwick and Gentle, 1922.

t° of f. pt.	Gms. CH_3COONa per 100 gms sat. sol.	Solid Phase.
−2.96	6.107	Ice
−6.42	11.27	"
−11.12	16.69	"
−15.17	20.57	"

SOLUBILITY OF SODIUM ACETATE IN AQUEOUS SOLUTIONS OF ACETIC ACID AT VARIOUS TEMPERATURES.

(Dunningham, 1912.)

Results at 0°.		Results at 15°.		Results at 30°.		Results at 75°.		
Gms. per 100 Gms. Sat. Solution.		Gms. per 100 Gms. Sat. Solution.		Gms. per 100 Gms. Sat. Solution.		Gms. per 100 Gms. Sat. Solution.		Solid Phase in Each Case.
Na_2O.	$(CH_3CO)_2O$.	Na_2O.	$(CH_3CO)_2O$.	Na_2O.	$(CH_3CO)_2O$.	Na_2O.	$(CH_3CO)_2O$.	
...	...	29.34	0.15	35.31	0.77	44.45	0.76	CH_3COONa
...	...	...	...	26.25	8.92	32.47	5.03	"
...	...	...	...	...	...	22.30	36.69	"
24.12	2.04	25.94	4.19	25.98	9.06	...	...	$CH_3COONa.3H_2O$
14.46	8.55	15.49	12.01	18.09	13.62	...	...	"
9.72	31	11.45	23.54	13.53	21.88	...	...	"
9.77	41.23	11.25	34.56	13.24	33.05	...	...	" +1.1
9.04	43.94	10.33	39.08	13.14	32.90	17.85	43.06	1.1
...	...	10.22	39.73	7.64	65.07	11.05	65.71	"
...	...	9.16	49.32	...	...	7.63	81.49	"
...	...	...	...	...	...	0.44	98.35	"
8.96	44.80	8.56	54.34	7.67	66.42	...	...	" +1.2
8.72	45.10	7.06	61.63	7.33	69.68	...	...	1.2
7.83	50.03	5.95	70.55	6.61	72.85	...	...	"
6.19	62.44	4.84	77.60	5.52	77.76	...	...	"
4.02	79.29	2.87	86.61	3.78	83.92	...	...	"
1.05	92.29	1.02	95.87	2.94	86.73	...	...	"
0.42	97.51	0.79	98.09	1.27	94.78	...	...	"

CH

1.1 = $CH_3COONa.CH_3COOH$. 1.2 = $CH_3COONa.2CH_3COOH$.

Additional data for 5°, 20°, 45° and 60° are also given.

Similar data for 30° are given by Dukelski (1909), and for 20° by Abe (1911-12). One determination at 25°, expressed in terms of volume of solution, is given by Herz (1911-12). Two determinations at 10° similarly expressed, are given by Enklaar (1901).

SOLUBILITY OF SODIUM ACETATE IN PURE ACETIC ACID, DETERMINED BY THE FREEZING-POINT METHOD.

(Kendall and Adler, 1921.)

t°	Mol. % CH_3COONa in sat. solution	Solid Phase	t°	Mol. % CH_3COONa in sat. solution	Solid Phase
16.5	0.0	CH_3COOH	96.1	30.72	$CH_3COONa.2CH_3COOH$
16.1	0.83	"	96.25	33.03	"
14.3	3.59	"	96.3	33.16	"
13.1	5.40	"	112.0	34.03	$CH_3COONa.CH_3COOH$
25.3	7.11	$CH_3COONa.2CH_3COOH$	(128.5)	41.1	"
(9.0)	(7.51)	"	132.0	36.87	"
36.7	8.92	"	145.2	39.06	"
54.3	12.17	"	157.0	42.54	"
(55.0)	(14.99)	"	160.6	44.25	"
66.9	15.27	"	162.3	46.28	"
71.9	16.58	"	174.0	48.76	CH_3COONa
(81.0)	(23.46)	"	195.5	49.49	"
85.7	21.55	"			
(92.0)	(33.01)	"			
93.2	26.86	"			

The results in parenthes, differing somewhat from those of Kendall and Adler are by Bakunin and Vitale, 1935.

Results for this system are also given by Vasilev, 1909.

Data for equilibrium in the system

Sodium Acetate + Lead Acetate + Acetic Acid at 30°

are given by Griswold and Olson, 1934.

Data for equilibrium in the system

Sodium Acetate + Zinc Acetate + Acetic Acid, Determined by the Freezing-point method, are given by Davidson and McAllister, 1930.

Solubility of Sodium Acetate in Aqueous Ethyl Alcohol at 25°.

(Seidell, 1910)

Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $CH_3COONa.3H_2O$ per 100 Gms. Sat. Sol.	Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $CH_3COONa.3H_2O$ per 100 Gms. Sat. Sol.
0	1.209	55.7	60	0.990	30.4
10	1.160	53	70	0.942	22.8
20	1.135	49.8	80	0.882	13
30	1.108	46.5	90	0.838	6.7
40	1.072	42	95	0.828	6.1
50	1.038	37	100	0.823	7.3

The solid phase in contact with the solution was $CH_3COONa.3H_2O$ in all cases.

100 gms. absolute alcohol dissolve 7.49 gms. $CH_3COONa.3H_2O$ at room temp. (Bödtker, 1897.)

Solubility of Sodium Acetate in Aqueous Alcohol:

At 18°.
(Gerardin, 1865.)

Wt. Per cent Alcohol.	Gms. CH_3COONa per 100 Gms. Aq. Alcohol.
5.2	38
9.8	35.9
23	29.8
29	27.5
38	23.5
45	20.4
59	14.6
86	3.9
91	2.1

At Different Temperatures.
(Schiavor, 1902.)

t°.	Degree of Alcohol.	Gms. per 100 Gms. Alcohol.	
		CH_3COONa.	$CH_3COONa.3H_2O$.
8	98.4	2.08	3.45
12	98.4	2.12	3.51
19	98.4	2.33	3.86
11	90	2.07	3.42
13	90	2.13	3.52
15	63	13.46	22.32
18	63	13.88	23.03
21	63	14.65	24.30
23	40	28.50	47.27

100 gms. H_2O dissolve 237.6 gms. sugar + 57.3 gms. CH_3COONa, or 100 gms. of the saturated solution contain 58.93 gms. sugar + 14.44 gms. CH_3COONa at 31.25°. (Kohler, 1897.)

100 cc. anhydrous hydrazine dissolve 6 gms. sodium acetate at room temp. (Welsh and Broderson, 1915.)

100 gms. propyl alcohol dissolve 0.97 gm. sodium acetate. (Schlamp, 1894.)

100 gms. Methyl Alcohol (CH_3OH) dissolve 16.0 gms. anhydrous sodium acetate at 15° and 16.55 gms. at 67.7°. (b.pt.)

100 gms. Acetone ($(CH_3)_2CO$) dissolve 0.05 gms. anhydrous sodium acetate at 15°. (Henstock, 1934.)

The composition of the homogeneous mixture (plait point) of the system Sodium Acetate, Tertiary Butyl Alcohol and Water at 25° was found by Ginnings, Herring and Webb, 1933, to be

4.7 percent CH_3COONa + 38.0 percent t $(CH_3)_3COH$ + 57.3 percent H_2O.

The original results for other points on the binodal curve are not given but only the values corresponding to derived empirical equations for the curve. The triangular diagram but no numerical values are given by Jencie, 1934, for the system Sodium Acetate + Phenol + Water at 25°.

100 gms. liquid Sulfur Dioxide (SO_2) dissolve 0.073 gm. $NaCH_3COO$ at 0°. (Jander and Ruppolt, 1937.)

SODIUM Phenyl **ACETATE** $CH_2C_6H_5COONa$.

Freezing-point data for the systems:

Sodium Phenyl Acetate + Phenyl Acetic Acid
" " " + Phenyl Acetic Anhydride
and " " " + Ethyl Phenyl Acetate

are given by Bakunin and Vitale, 1935.

SODIUM PROPIONATE CH_3CH_2COONa.

100 gms. Methyl Alcohol (CH_3OH) dissolve 13.28 gms. CH_3CH_2COONa at 15° and 13.77 gms. at 68.0°. (b.pt.) (Henstock, 1934.)

The triangular diagram but no numerical values are given by Jencic, 1934, for the system Sodium Propionate + Phenol + Water at 25°.

SODIUM BUTYRATE n C_3H_7COONa.

EQUILIBRIUM IN THE SYSTEM SODIUM HYDROXIDE, BUTYRIC ACID AND WATER AT 25°.

(Bury and Owens, 1935.)

CH

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
Na_2O	$(C_4H_7O)_2O$		Na_2O	$(C_4H_7O)_2O$	
40.56	0.0	$NaOH.H_2O$	15.90	27.22	$C_3H_7CO_2Na.H_2O$
40.62	0.77	" + $C_3H_7CO_2Na$	15.10	32.97	"
39.01	0.50	$C_3H_7CO_2Na$	14.31	37.77	"
33.88	0.76	"	14.27	41.34	"
29.05	0.58	"	14.19	43.55	"
23.81	1.00	"	13.92	46.44	"
20.38	3.09	"	13.82	49.76	"
19.29	6.50	"	13.47	52.07	$2C_3H_7CO_2NaC_3H_7CO_2H$
18.86	11.66	$C_3H_7CO_2Na.H_2O$	12.40	60.72	"
17.24	17.93	"	11.03	74.63	"
16.89	20.70	"	10.59	79.92	"
16.53	24.01	"	10.35	82.28	"

EQUILIBRIUM IN THE SYSTEM SODIUM BUTYRATE AND BUTYRIC ACID, DETERMINED BY THE FREEZING-POINT METHOD.

(Bakunin and Vitale, 1935.)

t°	Mol. % $C_3H_7CO_2Na$ in sat. solution	Solid Phase	t°	Mol. % $C_3H_7CO_2Na$ in sat. solution	Solid Phase
- 6	7.11	C_3H_7COOH	155	53.14	X.1
- 13	14.56	"	196	67.80	"
- 22	22.12	"	206	72.63	"
- 27 Eutec.	—	" + 1.1	225	84.12	"
+ 20	29.76	1.1	238	92.90	$C_3H_7CO_2Na$
83.1	39.51	X.1	286 m.pt.	100.00	
127.0	47.22	"			

1.1 = $C_3H_7COONa.C_3H_7COOH$; X.1 = $XC_3H_7COONa.C_3H_7COOH$.

100 gms. Methyl Alcohol (CH_3OH) dissolve 15.31 gms. n C_3H_7COONa at 15° and 20.70 gms. at 68.2° (b.pt.).

100 gms. Acetone ($(CH_3)_2CO$) dissolve 0.14 gm. n C_3H_7COONa at 15°.
(Henstock, 1934.)

SODIUM TARTRATES

SOLUBILITY IN WATER.

Salt.	Formula.	t°.	Gms. Salt per 100 Gms. H_2O.	Authority.
Sodium Neutral Inactive Pyrotartrate	$C_5H_6O_4.Na_2.6H_2O$	20	39.73	(Schlossberg, 1900.)
" Dextro "	"	20	41.10	"
Sodium Dihydroxy Tartrate	$C_4H_4O_8Na_2.3H_2O$	0	0.039	(Fenton, 1898.)

The composition of the homogeneous mixture (plait point) of the system, Sodium Tartrate, Tertiary Butyl Alcohol and Water at 25° was found by Ginnings, Herring and Webb, 1933, to be

3.8 percent $Na_2C_4H_4O_6$ + 31.4 percent $\underline{t}(CH_3)_3COH$ + 66.8 percent H_2O.

Similar results for the system Sodium Potassium Tartrate, Tertiary Butyl Alcohol and water at 25° are

4.0 percent $NaKC_4H_4O_6$ + 31.1 percent $\underline{t}(CH_3)_3COH$ + 64.9 percent H_2O.

The original results for other points on these binodal curves are not given but only the values corresponding to derived empirical equations for the curves.

100 gms. Acetone $((CH_3)_2CO)$ dissolve 6.7 gms. $NaKC_4H_4O_6$ at 15°. (Henstock, 1934.)

CH

SODIUM FUMARATES; Neutral, $Na_2C_4H_2O_4$; Acid, $NaC_4H_3O_4$.

100 gms. H_2O dissolve 22.83 gms. neutral sodium fumarate at 25°.

100 gms. H_2O dissolve 6.87 gms. acid sodium fumarate at 25°, 10.74 gms. at 40° 18.15 gms. at 60° and 30.2 gms. at 100°. (Weiss and Downs, 1923.

SODIUM MALEATE $Na_2C_4H_2O_4.{}^1/_2H_2O$.

100 gms. H_2O dissolve 96.06 gms. $Na_2C_4H_2O_4$ at 25°. (Weiss and Downs, 1923.)

SODIUM Acid **MALEATE** $NaC_4H_3O_4.3H_2O$.

100 gms. H_2O dissolve 6.73 gms. $NaC_4H_3O_4$ at 25°, 12.81 gms. at 40°, 31.3 gms. at 60° and 288.0 gms. at 100°. (Weiss and Downs, 1923.)

SODIUM CACODYLATE $(CH_3)_2AsO.ONa$.

100 gms. H_2O dissolve about 200 gms. of the salt at 15°-20°. (Squire and Caines, 1905.)
100 cc. 90% alcohol dissolve about 100 gms. of the salt at 15°-20°. " "

SODIUM SUCCINATE $(CH_2)_2(COONa)_2.6H_2O$.

SOLUBILITY IN WATER. (Marshall and Bain, 1910.)

t°	Gms. $(CH_2)_2(COONa)_2$ per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. $(CH_2)_2(COONa)_2$ per 100 Gms. H_2O.	Solid Phase.
0	21.45	$(CH_2)_2(COONa)_2.6H_2O$	50	56.3	$(CH_2)_2(COONa)_2.6H_2O$
12.5	27.38	"	62.5	78.49	"
25	34.90	"	64.9	83.38	" $+(CH_2)_2(COONa)_2$
37.5	43.64	"	75	86.63	$(CH_2)_2(COONa)_2$

SOLUBILITY OF SODIUM HYDROGEN SUCCINATE IN WATER.

(Marshall and Bain, 1910.)

t°.	Gms. $(CH_2)_2$-(COOH)(COONa) per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. $(CH_2)_2$-(COOH)(COONa) per 100 Gms. H_2O.	Solid Phase.
0	17.55	NaHSu*$.3H_2O$	38.7	63.99	$NaHSu.3H_2O+NaHSu$
2.5	27.93	"	50	67.37	NaHSu
25	39.82	"	62.5	76.15	"
37.5	60.01	"	75	86	"

EQUILIBRIUM IN THE SYSTEM SODIUM SUCCINATE, SUCCINIC ACID AND WATER.

(Marshall and Bain, 1910.)

Results at 0°.

Gms. per 100 Gms. Sat Sol.		Solid Phase.
Na_2Su.	H_2Su.	
0	2.68	H_2Su*
3.23	4.76	"
5.38	5.83	"
8.27	7.12	" $+NaHSu.3H_2O$
8.67	6.27	$NaHSu.3H_2O$
9.68	4.74	"
11.74	3.49	"
15.62	2.34	"
18.36	1.90	" $+Na_2Su.6H_2O$
18.07	1.67	$Na_2Su.6H_2O$
17.87	0.94	"
17.64	...	

Results at 25°.

Gms. per 100 Gms. Sat. Sol.		Solid Phase.
Na_2Su.	H_2Su	
0	7.71	H_2Su
3.68	10.26	"
8.99	13.35	"
12.64	15.53	"
15.26	16.90	" $+NaHSu.3H_2O$
15.97	13.83	$NaHSu.3H_2O$
18.89	8.41	"
22.71	5.65	"
26.88	4.08	" $+Na_2Su.6H_2O$
26.50	2.38	$Na_2Su.6H_2O$
26.11	0.85	"
25.87	0	"

Results at 50°.

Na_2Su.	H_2Su.	Solid Phase.
0	19.27	H_2Su*
5.95	22.90	"
10.25	25.33	"
15.49	28.73	"
19.65	31.73	" +NaHSu
20.72	26.51	NaHSu
22.53	18.44	"
25.53	13.09	"
28.28	9.46	"
30.48	7.38	"
37.33	4.20	" $+Na_2Su.6H_2O$
36.85	3.88	$Na_2Su.6H_2O$
36.67	2.66	"
36.43	0	"

Results at 75°.

Na_2Su.	H_2Su.	Solid Phase.
0	37.64	H_2Su
8.22	40.38	"
13.14	42.50	"
16.93	44.38	"
19.56	45.98	" +NaHSu
21.88	35.60	NaHSu
24.30	26.82	"
29.45	15.28	"
36.11	7.79	"
41.26	4.93	"
45.27	4	" $+Na_2Su.H_2O$
45.36	3.17	$Na_2Su.H_2O$
45.93	1.23	"
46.42	0	

The following double and triple points were located:

t°.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
	Na_2Su.	H_2Su.	
34.9	30.8	5.6	$NaHSu.3H_2O+NaHSu+Na_2Su.6H_2O$
37.8	19.6	25.46	$NaHSu.3H_2O+NaHSu+H_2Su$
38.7	22.47	16.44	$NaHSu.3H_2O+NaHSu$
63.4	42.92	3.64	$Na_2Su.6H_2O+Na_2Su.H_2O+NaHSu$
64.9	45.43	...	$Na_2Su.6H_2O+Na_2Su.H_2O$

* In the above tables the abbreviation Su is used for $(CH_2)_2(COO)_2$.

SODIUM SUCCINATE

100 gms. Methyl Alcohol (CH_3OH) dissolve 0.72 gms. anhydrous $(CH_2)_2(COONa)_2$ at 15° and 1.80 gms. at 66.6° (b.pt.). (Henstock, 1934.)

SODIUM β Methyl **ADIPATE** (Racemic).

100 gms. sat. solution in water contain 36.8 gms. of the salt at 20°. (Meurisse.)

SODIUM URATE $C_5H_3N_4O_3.Na$.

SOLUBILITY IN AQUEOUS SODIUM CHLORIDE AT 37°.

(d'Agostino, 1910.)

Gms. Mols. per Liter.		Gms. Mols. per Liter.		Gms. Mols. per Liter.	
NaCl.	$C_5H_3N_4O_3.Na$.	NaCl.	$C_5H_3N_4O_3Na$.	NaCl.	$C_5H_3N_4O_3.Na$.
0	0.00536	0.01084	0.00211	0.05116	0.00050
0.00486	0.00340	0.01398	0.00172	0.06667	0.00034
0.00532	0.00321	0.02564	0.00102	0.07363	0.00032
0.00865	0.00256	0.04012	0.00054	0.08595	0.00026

One liter of H_2O dissolves 1.5 gms. sodium urate at 37°. (Bechhold and Ziegler, 1910.)
One liter of serum dissolves 0.025 gm. sodium urate at 37°. " "

SOLUBILITY OF SODIUM URATE IN AQUEOUS SOLUTIONS OF $KH_2PO_4 + K_2HPO_4$ AT 37°.

(Jung, 1923.)

p_H of aq. phosphate solution.	5.0.	5.6.	6.4.	6.6.	7.0.
Gms. $C_5H_3N_4O_3Na$ per liter of solvent...	0.25	0.675	0.93	1.15	1.13

SODIUM CITRATE $(CH_2)_2COH(COONa)_3.5\frac{1}{2}H_2O$.

SOLUBILITY IN AQUEOUS ETHYL ALCOHOL AT 25°.

(Seidell, 1910.)

CH

Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $C_6H_5O_7Na_3.5\frac{1}{2}H_2O$ per 100 Gms. Sat. Sol.	Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $C_6H_5O_7Na_3.5\frac{1}{2}H_2O$ per 100 Gms. Sat. Sol.
0	1.276	48.1	40	0.953	4.5
10	1.190	37.4	50	0.918	1.4
20	1.100	25	60	0.892	0.3
30	1.006	11.8	100	0.789	0

Data for equilibrium in the system sodium hydroxide, citric acid, phosphoric acid and water at 20° are given by Pratolongo (1913).

The author fails to describe clearly the terms in which the results are expressed, consequently their exact meaning is not clear.

SODIUM CAPROATE $CH_3(CH_2)_4COONa$

The triangular diagram but no numerical results for the system Sodium Caproate, Phenol and Water at 25° are given by Jencic, 1934.

SODIUM PHENOLATES. $C_6H_5ONa.3H_2O$ and $C_6H_5ONa.2C_6H_5OH$.

EQUILIBRIUM IN THE SYSTEM SODIUM HYDROXIDE, PHENOL AND WATER AT 25°.

(von Meurs, 1916.)

Mols. per 100 mols. sat. sol.			Mols. per 100 mols. sat. sol.		
NaOH.	C_6H_5OH.	Solid Phase.	NaOH.	C_6H_5OH.	Solid Phase.
33.92	0.0	$NaOH.H_2O$	16.56	28.99	$C_6H_5ONa.3H_2O$
26.56	0.08	$C_6H_5ONa.3H_2O$	16.62	31.75	»
23.69	0.61	»	16.47	36.54	$C_6H_5ONa.2C_6H_5OH$
19.47	2.06	»	14.25	44.81	»
18.19	5.18	»	13.17	48.31	»
17.61	6.91	»	10.74	57.47	»
16.52	10.08	»	7.88	67.03	»
15.27	13.44	»	5.68	73.37	C_6H_5OH
15.21	14.61	»	3.32	73.98	»
15.89	19.67	»	0.0	74.27	»
15.98	23.24	»			

SODIUM GLUCONATE $NaC_6H_{11}O_7$.

100 gms. sat. solution of Sodium Gluconate in Water contain 46.1 gms. $NaC_6H_{11}O_7$ at 25°. (May, Weisberg and Herrick, 1929.)

SODIUM Nitro **PHENOLATE** (*p*) $C_6H_4NO_2.ONa.2H_2O$.

SOLUBILITY OF SODIUM PARA NITRO PHENOLATE IN AQUEOUS ALCOHOL AT 25°.

(Fischer, 1914, 1918.)

Saturation was secured by means of constant agitation in a thermostat. The compound also crystallized with 4 H_2O but in all concentrations of alcohol above 15 per cent the solid phase was $C_6H_4NO_2.ONa.2H_2O$.

Vol. % C_2H_5OH.	Gms. *p* $C_6H_4NO_2.ONa$ per 100 cc. sat. sol.	Vol. % C_2H_5OH.	Gms. *p* $C_6H_4NO_2.ONa$ per 100 cc. sat. sol.	Vol. % C_2H_5OH.	Gms. *p* $C_6H_4NO_2.ONa$ per 100 cc. sat. sol.
0	5.640	40	5.344	75	3.284
10	5.168	45	5.313	80	2.753
15	5.019	50	5.200	85	2.045
20	5.007	55	5.039	90	1.495
25	5.088	60	4.749	95	1.256
30	5.156	65	4.378	100	4.412
35	5.281	70	3.895		

SODIUM Chloro Nitro **PHENOLATE** $C_6H_3(4)Cl(2)NO_2(1)ONa.H_2O$.

SOLUBILITY OF CHLORO NITRO PHENOLATE IN AQUEOUS ALCOHOL AT 25°.

(Fischer, 1914, 1918.)

CH

Vol. % C_2H_5OH.	Gms. $C_6H_3Cl(NO_2)ONa$ per 100 cc. sat. sol.	Solid Phase.	Vol. % C_2H_5OH.	Gms. $C_6H_3ClNO_2.ONa$ per 100 cc. sat. sol.	Solid Phase.
0	2.702	$C_6H_3ClNO_2.ONa.H_2O$	55	2.908–2.564*	
10	2.374	»	60	3.146	
15	2.346	»	65	3.110	$C_6H_3ClNO_2.ONa$
20	2.314	»	70	2.604	»
25	2.404	»	75	2.307	»
30	2.576	»	80	1.860	»
35	2.708	»	85	1.293	»
40	2.990	»	90	0.870	»
45	3.190	»	95	0.616	»
50	3.068	» + $C_6H_3ClNO_2.ONa$	100	0.680	»

* Gradual dehydration by the alcohol occurs here.

SODIUM Dinitro **PHENOLATE** $C_6H_3(2,4)(NO_2)_2(1)ONa.H_2O$.

SOLUBILITY OF SODIUM DINITRO PHENOLATE AT 25° IN :

(Fischer, 1914, 1918.)

Aqueous Ethyl Alcohol.				Aqueous Methyl Alcohol.		Aqueous Acetone.	
Vol. % C_2H_5OH.	Gms. $C_6H_3(NO_2)_2.ONa.H_2O$ per 100 cc. sat. sol.	Vol. % C_2H_5OH.	Gms. $C_6H_3(NO_2)_2.ONa.H_2O$ per 100 cc. sat. sol.	Vol. % CH_3OH.	Gms. $C_6H_3(NO_2)_2.ONa.H_2O$ per 100 cc. sat. sol.	Vol. % $CH_3CO.CH_3$.	Gms. $C_6H_3(NO_2)_2.ONa.H_2O$ per 100 cc. sat. sol.
0	4.461	55	3.392	0	4.461	0	4.461
10	3.516	60	3.214	10	3.686	10	4.859
15	3.246	65	2.976	20	3.196	20	5.470
20	3.188	70	2.630	30	2.950	30	6.086
25	3.090	75	2.174	40	2.854	40	6.850
30	3.148	80	1.798	50	2.824	50	7.442
35	3.260	85	1.258	60	2.792	60	7.784
40	3.386	90	0.818	70	2.672	70	7.568
45	3.440	95	0.566	80	2.518	80	6.536
50	3.470	100	2.671	90	2.475	90	4.356
				100	4.651	100	1.085

SODIUM *p* NITROPHENOL $C_6H_4.ONa(1).NO_2(4)$.

SOLUBILITY IN WATER AND IN AQUEOUS NORMAL SOLUTIONS OF NON-ELECTROLYTES.

(Goldschmidt, 1895.)

t°.	Gms. $C_6H_4.ONa(1).NO_2(4)$ per 100 Gms. Solution in: Water.	Alcohol.	Urea.	Glycerine.	Acetone.	Propionitril.	Acetonitril.	Urethane.
23.7	5.597	5.615	6.244	6.188	6.225	6.257	6.065	6.520
28.6	6.721	6.874	7.489	7.440	7.498	7.571	7.328	7.889
30.6	7.256	...	...	...	...	...	...	...
33.6	8.125	8.318	9.000	9.025	9.025	9.066	8.886	9.507
35.9	8.851	...	...	...	...	...	...	...
36.1	8.883	...	9.683	9.688	9.665	9.911	9.667	10.248
40.2	9.881	10.147	10.666	10.777	10.695	10.905	10.667	11.379
45.2	11.235	11.513	12.068	12.229	...	...	...	12.869
50.1	12.730	13.133	13.555	13.785	...	...	...	...

The solid phase is $C_6H_4ONa.NO_2.4H_2O$ below 36°, and $C_6H_4ONa.NO_2.2H_2O$ above 36° in each case.

SODIUM PICRATE $C_6H_2(NO_2)_3.ONa.H_2O$.

SOLUBILITY IN WATER AND IN AQUEOUS SOLUTIONS AT 25°.

(Fisher and Miloszewski, 1910.)

100 cc. H_2O dissolve 4.247 gms. $C_6H_2(NO_2)_3.ONa.H_2O$ at 25°.

Solubility in Aq. Solution of:	Gms. $C_6H_2(NO_2)_3.ONa.H_2O$ per 100 cc. Aq. Solution of Normality: 0.01.	0.02.	0.04.	0.066.	0.10.	0.25.	0.5.	1.
Na_2CO_3	4.159	4.044	3.807	3.434	3.187	2.017	1.120	0.611
NaCl	4.189	3.956	3.677	3.335	3.021	1.678	0.846	0.410
Na_2SO_4	4.246	4.102	3.879	3.651	3.195	2.053	1.156	0.552
Na_3PO_4	4.235	4.051	3.814	3.562	3.225	2.219	1.329	0.705
NaOH	4.192	4.048	3.715	3.339	2.941	1.781	0.921	0.371
$NaNO_3$	4.154	4.029	3.710	3.363	3.041	1.932	0.943	0.684
NaBr	4.190	4.117	3.770	3.384	3.024	1.777	0.912	0.499

Data for the solubility of sodium picrate and the sodium salts of other nitrophenols in aqueous alcohol and acetone solutions at 25° are given by Fisher (1914).

SOLUBILITY OF SODIUM PICRATE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL.

(Fischer, 1914, 1918.)

At 0° the mixtures were stirred in a vessel which was cooled by melting ice. At 25° the mixtures were constantly agitated in a thermostat. The dissolved picrate was determined either by evaporating and weighing the residue or by a method of titration. The concentration of the aqueous alcohol mixtures was controlled by density determinations.

The solid phase in contact with the saturated solutions was $C_6H_2(NO_2)_3ONa.H_2O$ in all cases.

Results at 0°.

Vol. % C_2H_5OH.	Gms. $C_6H_2(NO_2)_3.ONa$ per 100 cc. sat. sol.	Vol. % C_2H_5OH.	Gms. $C_6H_2(NO_2)_3.ONa$ per 100 cc. sat. sol.
0	1.824	45	1.042
5	1.426	50	1.125
10	1.169	55	1.293
15	0.964	60	1.277
20	0.816	80	0.884
25	0.721	90	0.547
30	0.718	95	0.449
35	0.755	100	2.683
40	0.843		

Results at 25°.

Vol. % C_2H_5OH.	Gms. $C_6H_2(NO_2)_3.ONa$ per 100 cc. sat. sol.	Vol. % C_2H_5OH.	Gms. $C_6H_2(NO_2)_3.ONa$ per 100 cc. sat. sol.
0	4.280	50	3.409
5	3.741	55	3.313
10	3.326	60	3.245
15	3.017	65	3.047
20	2.816	70	2.777
25	2.744	75	2.465
30	2.789	80	1.948
35	2.994	85	1.537
40	3.145	90	1.247
45	3.313	95	0.873
		100	4.438

SODIUM BENZOATE C_6H_5COONa.

Solubility of Sodium Benzoate in Water. (Sidgwick and Ewbank, 1922.)

t°.	Gms. C_6H_5COONa per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. C_6H_5COONa per 100 gms. sat. sol.	Solid Phase.
— 2.02....	8.36	Ice	59.7....	39.2	C_6H_5COONa
— 4.85....	16.52	»	87.6....	41.26	»
— 8.50...	26.01	»	97.0....	42.28	»
± 0.0....	38.52	C_6H_5COONa	133.0....	47.30	»
15.0....	38.59	»	151.3....	50.75	»
30.0....	38.60	»	186.0....	57.05	»
49.7....	38.70	»	204.5....	60.43	»

100 gms. 86.5 % glycerol ($d = 1.2326$) dissolve 31.5 gms. C_6H_5COONa at 20°.
» 98.5 % » ($d = 1.2645$) » 28.5 »

(Holm, 1921, 1922.)

SODIUM HydroxyBENZOATE (*o*) (Sodium Salicylate) $C_6H_4OH.COONa.6H_2O$.

Solubility of Sodium Ortho Hydroxy Benzoate in Water.

(Sidgwick and Ewbank, 1922.)

t°.	Gms. $C_6H_4OH.COONa$ (*o*) per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. $C_6H_4.OH.COONa$ (*o*) per 100 gms. sat. sol.	Solid Phase.
—0.77....	4.94	Ice	17.5....	44.40	$C_6H_4.OH.COONa.6H_2O$
—2.65....	13.15	»	20.0....	50.0	»
—5.04....	21.18 (unstable)	»	47.5....	55.1	$C_6H_4.OH.COONa$
—1.5....	20.06	$C_6H_4.OH.COONa.6H_2O$	78.5....	59.32	»
+9.0....	29.61	»	114.0....	64.16	»
12.5....	35.03	»	137.0....	67.95	»
15.2....	40.48	»			

CH

SODIUM Hydroxy BENZOATE (*m*) $C_6H_4.OH.COONa$.

Solubility of Sodium Meta Hydroxy Benzoate in Water.

(Sidgwick and Ewbank, 1922.)

t°.	Gms. $C_6H_4.OH.COONa$ (*m*) per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. $C_6H_4.OH.COONa$ (*m*) per 100 gms. sat. sol.	Solid Phase.
— 3.21....	14.68	Ice	+ 10.0....	58.78	$C_6H_4.OH.COONa$
— 8.85....	30.53	»	110.0....	64.61	»
—17.52....	45.16	»	147.5....	69.75	»

SODIUM Hydroxy BENZOATE (*p*) $C_6H_4.OH.COONa$.

Solubility of Sodium Para Hydroxy Benzoate in Water.

(Sidgwick and Ewbank, 1922.)

t°.	Gms. $C_6H_4.OH.COONa$. (*p*) per 100 gms. sat. sol.	Solid Phase.	t°	Gms. $C_6H_4.OH\ COONa$ (*p*) per 100 gms. sat. sol.	Solid Phase.
—0.77...	5.075	Ice	36.5....	41.32	$C_6H_4.OH.COONa.5H_2O$
—2.07...	10.43	»	39.0....	45.61	» (unstable)
+7.0....	19.65	$C_6H_4.OH.COONa.5H_2O$	43.0....	45.61	$C_6H_4.OH.COONa$
24.0....	31.47		107.5...	50.51	»
			163.0...	54.93	»

SODIUM BENZOATE C_6H_5COONa.

Solubility in Aqueous Ethyl Alcohol at 25°.

(Seidell, 1910.)

Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. C_6H_5COONa per 100 Gms. Sat. Sol.	Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. C_6H_5COONa per 100 Gms. Sat. Sol.
0	1.155	36	60	0.975	21.3
10	1.132	35.3	70	0.927	15.4
20	1.110	33.7	80	0.877	8.8
30	1.086	31.5	90	0.831	2.8
40	1.055	28.9	95	0.812	1.3
50	1.020	25.6	100	0.795	0.6

SODIUM BENZOATE

100 gms. Methyl Alcohol (CH_3OH) dissolve 8.22 gms. C_6H_5COONa at 15° and 7.55 gms. at 66.2° (b.pt.) (Henstock, 1934.)

The System Benzoic Acid, Sodium Benzoate and Water at 14°.

(Landrieu, 1920.)

The curve representing this system consists of three branches. The first branch corresponds to solutions saturated with benzoic acid. The second represents solutions saturated with the double salt, $C_6H_5COONa.2C_6H_5COOH$ and the third, solutions saturated with sodium benzoate. At the triple points the solutions have the following composition :

Gms per 100 gms. sat sol.		
C_6H_5COOH.	C_6H_5COONa.	Solid Phase.
1.25	35.3	$C_6H_5COOH + C_6H_5COONa.2C_6H_5COOH$
1.46	40.4	$C_6H_5COONa +$ "

Solubility of Caffeine in Aqueous Solutions of Sodium Benzoate and Vice Versa. (Pellini, 1910.)

Results at 25°.			Results at 40°.		
Gms. per 100 Gms. H_2O.		Solid Phase.	Gms. per 100 Gms. H_2O.		Solid Phase.
$C_8H_{10}N_4O_2$.	$C_7H_5O_2Na$.		$C_8H_{10}N_4O_2$.	$C_7H_5O_2Na$.	
2.13	0	$C_8H_{10}N_4O_2.H_2O$	4.64	0	$C_8H_{10}N_4O_2.H_2O$
8.32	6.67	"	31.43	25.31	"
38.10	45	"	56.82	69.68	"
51.74	76.75	" $+C_7H_5O_2Na.H_2O$	57.99	74.64	" $+C_7H_5O_2Na.H_2O$
46.27	76.68	$C_7H_5O_2Na.H_2O$	55.98	74.02	$C_7H_5O_2Na.H_2O$
24.79	69.56	"	18.31	67.97	"
9.47	62.97	"	0	59.82	"
0	61.17	"			

CH

Solubility of Caffeine in Aqueous Solutions of Sodium Salicylate and Vice Versa. (Pellini and Amadori, 1912.)

Results at 25°			Results at 40°.		
Gms. per 100 Gms. H_2O.		Solid Phase.	Gms per 100 Gms. H_2O		Solid Phase.
$C_8H_{10}N_4O_2$.	$C_7H_5O_3Na$.		$C_8H_{10}N_4O_2$.	$C_7H_5O_3Na$.	
2.13	0	$C_8H_{10}N_4O_2.H_2O$	4.64	0	$C_8H_{10}N_4O_2.H_2O$
38.36	30.76	"	59.49	37.47	"
55.23	47.31	"	86.49	62.47	"
74.32	68.81	"	95.94	69.15	"
16.78	124.96	$C_7H_5O_3Na$	26.93	131.52	$C_7H_5O_3Na$
13.22	121.27	"	10.75	124.35	"
9.03	120.54	"	0	119.66	"
0	115.43	"			

Data for the depression of the freezing-point of sodium salicylate solutions by caffeine and theobromine are also given.

Solubility of Sodium Benzoate in Aqueous Solutions of Caffeine and Vice Versa.

(Chambon, Bouvier and Devron, 1937.)

Results at 37°			Results at 90°		
Gms. per 100 gms. H_2O		Solid Phase	Gms. per 100 gms. H_2O		Solid Phase
$C_8H_{10}N_4O_2$	$C_7H_5O_2Na$		$C_8H_{10}N_4O_2$	$C_7H_5O_2Na$	
0.0	59.9	$C_7H_5O_2Na$	0.0	76.5	$C_7H_5O_2Na$
58.1	78.92	" $+ C_8H_{10}N_4O_2$	93.2	99.4	" $+ C_8H_{10}N_4O_2$
11.85	7.25	$C_8H_{10}N_4O_2$	64.0	7.4	$C_8H_{10}N_4O_2$
3.85	0.0	"	83.5	0.0	"

SODIUM SALICYLATE $C_6H_4.OH.COONa$.

See also Sodium o Hydroxy Benzoate.

SOLUBILITY IN AQUEOUS ETHYL ALCOHOL AT 25°. (Seidell, 1909, 1910.)

Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. C_6H_4OH-COONa per 100 Gms. Sat. Sol.	Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. C_6H_4OH-COONa per 100 Gms. Sat. Sol.
0	1.256	53.56	60	1.066	38.40
10	1.235	52.10	70	1.016	33
20	1.205	50.20	80	0.957	25
30	1.176	48	90	0.885	15
40	1.142	45.50	92.3	0.864	12
50	1.106	42.20	100	0.805	3.82

100 gms. sat. solution in water contain 51.8 gms. $C_6H_4OHCOONa$ at 15° and d_{15} of the sat. sol. is 1.249. (Greenish and Smith, 1901.)

100 gms. propyl alcohol dissolve 1.16 gms. $C_6H_4OHCOONa$ at ord. temp. (Schlamp, 1894.)

Sodium salicylate distributes itself between olive oil and water at 15° in the ratio of 0.156 gm. $C_6H_4OHCOONa$ per 100 cc. oil layer and 1.444 gms. per 100 cc. aqueous layer. (Harrass, 1903.)

100 gms. sat. solution of Sodium Salicylate in U.S.P. Alcohol (d_{15} = 0.8176 = 92 Wt. % C_2H_5OH) contain 11.74 gms. $C_6H_4OHCOONa$ at 25°. (Schnellbach, 1939.)

100 gms. Methyl Alcohol (CH_3OH) dissolve 26.28 gms. $C_6H_4OHCOONa$ at 15° and 34.73 gms. at 67.2°. (b.pt.) (Henstock, 1934.)

CH SODIUM Diethyl BARBITURATE $Na(C_8H_{11}O_3N_2)$.

SOLUBILITY IN WATER.

(Puckner and Hilpert, 1909.)

t°.	5°	15°	25°	91°
Gms. Salt per 100 Gms. Sat. Sol.	6.08	16.87	17.18	32.50

100 gms. U.S.P. Alcohol (d_{25}^{25} = 0.8063 = 93.6 Wt. % C_2H_5OH) dissolve 0.313 gm. $Na(C_8H_{11}O_3N_2)$ ("Sodium Barbital") at 25°. (Schnellbach and Rosin, 1931.)

SODIUM MANDELATE $NaC_8H_7O_3$ (Racemic).

EQUILIBRIUM IN THE SYSTEM RACEMIC SODIUM MANDELATE, RACEMIC MANDELIC ACID AND WATER AT 25°.

(Ross and Morrison, 1933.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$C_8H_8O_3$	$C_8H_7O_3Na$		$C_8H_8O_3$	$C_8H_7O_3Na$	
16.9	0.0	$C_8H_8O_3$	7.8	6.4	1.1
17.7	1.6	"	6.3	6.9	"
18.9	2.9	"	4.0	8.3	"
19.7	3.7	" + 3.1	3.1	9.2	"
17.6	3.7	3.1	2.0	10.9	"
15.9	3.9	"	1.5	12.5	"
13.7	4.5	"	0.9	15.8	"
13.0	4.8	"	0.8	16.6	"
12.4	4.9	"	0.7	17.1	"
10.9	5.5	"	0.5	22.3	"
10.4	5.7	1.1	0.4	23.7	"
9.2	6.0	"	0.4	25.5	"
			0.3	30.6	"

3.1. = $3C_8H_8O_3.C_8H_7O_3Na$; 1.1. = $C_8H_7O_3Na.C_8H_8O_3$.

SODIUM MANDELATE $NaC_8H_7O_3$ (Laevo)

EQUILIBRIUM IN THE SYSTEM LAEVO SODIUM MANDELATE, LAEVO MANDELIC ACID AND WATER AT 25°.

(Ross, Morrison and Johnstone, 1937.)

Gms. per 100 gms. sat. sol.		Solid Phase
$C_8H_8O_3$	$C_8H_7O_3Na$	
10.1	0.0	$C_8H_8O_3$
10.0	0.9	"
10.1	1.7	"
11.0	4.3	"
12.2	8.5	"
12.3	11.3	$C_8H_8O_3$ + 1.1
8.9	11.6	1.1
7.4	11.9	"
5.1	13.0	"
0.8	32.6	"

1.1 = $C_8H_7O_3.Na.C_8H_8O_3$.

SODIUM PHTHALATE $2Na_2C_8H_4O_4.7H_2O$.

EQUILIBRIUM IN THE SYSTEM SODIUM PHTHALATE, PHTHALIC ACID AND WATER.

(Smith and Sturm, 1938.)

Results at 0°

Gms. per 100 gms. sat. sol.		Solid Phase
$C_8H_6O_4$	$C_8H_4O_4Na_2$	
0.0	40.73	$2Na_2C_8H_4O_4.7H_2O$
0.16	40.74	" + $2NaHC_8H_4O_4.H_2O$
0.16	36.20	$2NaHC_8H_4O_4.H_2O$
0.28	27.20	"
0.50	19.26	"
1.63	6.60	"
2.70	3.88	" + $C_8H_6O_4$
1.68	1.93	$C_8H_6O_4$
0.30	0.0	"

Results at 25°

Gms. per 100 gms. sat. sol.		Solid Phase
$C_8H_6O_4$	$C_8H_4O_4Na_2$	
0.0	43.81	$2Na_2C_8H_4O_4.7H_2O$
0.28	44.04	" + $2NaHC_8H_4O_4.H_2O$
0.28	42.46	$2NaHC_8H_4O_4.H_2O$
0.31	41.30	"
0.31	37.20	"
0.33	35.78	"
0.48	29.22	"
0.56	26.04	"
0.82	20.17	"
1.41	13.87	"
1.85	10.85	"
2.82	7.58	"
4.48	5.52	" + $C_8H_6O_4$
3.51	3.94	$C_8H_6O_4$
1.98	1.67	"
0.68	0.0	"

Results at 35°

CH

Gms. per 100 gms. sat. sol.		Solid Phase
$C_8H_6O_4$	$C_8H_4O_4Na_2$	
0.0	45.66	$2Na_2C_8H_4O_4.7H_2O$
0.34	45.90	" + $2NaHC_8H_4O_4.H_2O$
0.39	42.03	$2NaHC_8H_4O_4.H_2O$
0.51	31.81	"
1.08	20.84	"
1.23	19.26	"
3.27	9.56	"
4.72	6.78	"
5.32	6.60	"
5.83	6.38	" + $C_8H_6O_4$
5.51	5.88	$C_8H_6O_4$
4.31	4.15	"
1.93	1.07	"
0.98	0.0	"

Results at 50°

Gms. per 100 gms. sat. sol.		Solid Phase
$C_8H_6O_4$	$C_8H_4O_4Na_2$	
0.0	50.60	$2Na_2C_8H_4O_4.7H_2O$
0.55	50.93	" + $2NaHC_8H_4O_4.H_2O$
0.60	44.58	$2NaHC_8H_4O_4.H_2O$
0.86	33.75	"
1.68	22.20	"
4.13	12.17	"
5.91	9.19	"
6.82	8.47	"
8.69	8.35	" + $C_8H_6O_4$
5.27	4.30	$C_8H_6O_4$
1.75	0.0	"

SODIUM PHTHALATE $2Na_2C_8H_4O_4.7H_2O$.

EQUILIBRIUM IN THE SYSTEM SODIUM PHTHALATE, SODIUM SULFATE AND WATER

(Foote and Smith, 1924.)

Gms. per 100 gms. sat. sol. $Na_2C_8H_4O_4$.	Gms. per 100 gms. sat. sol. Na_2SO_4.	Solid Phase.
Results at 0°.		
40.56	0.0	$2Na_2C_8H_4O_4.7H_2O$
40.20	0.56	» + $Na_2SO_4.10H_2O$
25.83	0.63	$Na_2SO_4.10H_2O$
0.0	4.48	»
Results at 25°.		
43.79	0.0	$2Na_2C_8H_4O_4.7H_2O$
40.63	3.52	»
39.92	4.57	» + Na_2SO_4
37.94	5.48	Na_2SO_4
30.88	8.69	»
24.62	12.62*	»
13.67	20.91*	»
35.40	6.29	» + $Na_2SO_4.10H_2O$
34.06	6.39	$Na_2SO_4.10H_2O$
Results at 25° (con.).		
27.52	7.59	$Na_2SO_4.10H_2O$
21.09	9.67	»
17.47	11.12	»
12.35	13.61	»
10.14	14.78	»
7.39	16.53	»
6.18	17.35	»
0.0	21.75	»
Results at 35°.		
46.06	0.0	$Na_2C_8H_4O_4.7H_2O$
43.25	3.25	» + Na_2SO_4
28.64	9.67	Na_2SO_4
11.25	22.38	»
0.0	33.10	»

* Supersaturated with respect to $Na_2SO_4.10H_2O$.

CH

SODIUM CINNAMATE $C_6H_5CH:CHCOONa$.

100 gms. H_2O dissolve 9.1 gms. sodium cinnamate at 15.20°.
100 cc. 90% alcohol dissolve 0.625 gm. at 15-20°. (Squire and Caines, 1905.)

SODIUM GUANYLATE $C_{10}H_{13}N_5O_7P$

SOLUBILITY OF SODIUM GUANYLATE IN AQUEOUS SOLUTIONS OF SODIUM ACETA

AND OF SODIUM CHLORIDE AT 20°.

(Feulgen and Rossenbeck, 1923.)

Warm solutions of sodium guanylate were prepared and these cooled unt a slight excess of the salt separated. They were then allowed to stand many hou in a thermostat at 20°. The nitrogen in a given volume of the saturated sol tion was determined and from this the amount of guanylate present was calculate

Normality of aq. salt solution.	Results for aq. CH_3COONa solutions. Gms. per 100 cc. solution. CH_3COONa.	N.	Na guanylate.	Results for aq. NaCl solutions. Gms. per 100 cc. solution. NaCl.	N.	Na guanylate
0.0 (= H_2O)....	0.0	–	2.89	0.0	–	2.88
0.0625............	0.86	0.42	2.45	0.37	0.49	2.85
0.25..............	3.45	0.315	1.81	1.46	0.29	1.68
1.00..............	13.81	0.08	0.48	5.85	0.12	0.67
2.00..............	27.22	0.04	0.20	–	–	–
4.00..............	54.44	0.020	0.11	23.4	0.035	0.20
		0.025	0.15		0.048	0.28

The results are considered of interest in showing the quantitative limits of t sodium acetate method for the determination of guanylic acid.

SODIUM CAMPHORATES

SOLUBILITY IN AQUEOUS *d* CAMPHORIC ACID SOLUTIONS AT 13.5°–16°.

(Jungfleisch and Landrieu, 1914.)

Gms. per 100 Gms. Sat. Sol. $C_{10}H_{16}O_4$.	Gms. per 100 Gms. Sat. Sol. $C_{10}H_{14}O_4Na_2$.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. $C_{10}H_{16}O_4$.	Gms. per 100 Gms. Sat. Sol. $C_{10}H_{14}O_4Na_2$.	Solid Phase.
0.621	0	$C_{10}H_{16}O_4$	2.87	25.62	$C_{10}H_{15}O_4Na.2C_{10}H_{16}O_4.2H_2O$
2.03	4.19	"	2.89	27.41	"
2.87	8.32	"	2.74	30.69	"
3.03	10.05	"	2.63	32.75	"
2.97	7.80	" $+C_{10}H_{15}O_4Na.2C_{10}H_{16}O_4.2H_2O$	2.29	40.10	$C_{10}H_{15}O_4Na.H_2O$ (or $\frac{1}{2}H_2O$)
2.87	9.06	$C_{10}H_{15}O_4Na.2C_{10}H_{16}O_4.2H_2O$	2.17	40.54	"
2.94	10.46	"	1.06	47.04	"
2.68	14.99	"	0.88	49.60	$C_{10}H_{14}O_4Na_2.3H_2O$
2.64	17.53	"	0	50.2	"

$C_{10}H_{16}O_4$ = Camphoric acid. $C_{10}H_{15}O_4Na.2C_{10}H_{16}O_4.2H_2O$ = Monosodium *d* tricamphorate. $C_{10}H_{15}O_4Na.H_2O$ = Monosodium *d* camphorate. $C_{10}H_{14}O_4Na_2.3H_2O$ = Disodium *d* camphorate (neutral).

(The mixtures were kept in a cellar at a nearly constant temperature and shaken from time to time. Additional determinations at 17°–23° are also given.)

SODIUM Benzene and Other SULFONATES

CH

SOLUBILITY OF SODIUM BENZENE SULFONATE IN WATER AND IN AQUEOUS SOLUTIONS OF SODIUM SULFATE.

(Rhodes, and Lewis, 1928.)

	Gms. Na $C_6H_5SO_3$ per 100 gms. sat. solution in: Water	Aq. 5% Na_2SO_4	Aq. 10% Na_2SO_4	Aq. 20% Na_2SO_4	Solid Phase
0	26.8	—	—	—	$NaC_6H_5SO_3.2H_2O$
30	35.8	32.2	27.7	—	"
40	38.6	—	—	—	"
50	41.9	38.6	34.4	25.8	"
60	45.1	—	—	—	"
70	48.0	45.2	42.1	31.9	$NaC_6H_5SO_3.?H_2O$
80	51.1	—	—	—	"
105	58.5	—	—	—	"

The hydrated salt is transformed to the anhydrous salt at 66.8°.

SOLUBILITY OF SODIUM BENZENE SULPONATE IN WATER.

(Hauslick, 1938.)

t°	Gm. Mols. $NaC_6H_5SO_3$ per 100 gms. H_2O	Solid Phase	t°	Gm. Mols. $NaC_6H_5SO_3$ per 100 gms. H_2O	Solid Phase
3	0.125	$NaC_6H_5SO_3.2H_2O$	70	0.440	$NaC_6H_5SO_3.?H_2O$
17	0.190	"	81	0.513	"
26	0.232	"	93	0.555	"
47	0.326	"	120	0.680	"
57	0.385	"			

SOLUBILITY OF SODIUM XYLENE SULFONATE, SODIUM CYMENE SULFONATE AND SODIUM α NAPHTHALENE SULFONATE, EACH SEPARATELY, IN WATER.

(Neuslick, 1935.)

Results for:

Na Xylene Sulfonate		Na Cymene Sulfonate		Na α Naphthalene Sulfonate	
t°	Gms. Mols. $NaC_6H_3(CH_3)_2.SO_3$ per 100 gms. H_2O	t°	Gms. Mols. $NaC_6H_3CH.(CH_3)_2.SO_3$ per 100 gms. H_2O	t°	Gms. Mols. $NaC_{10}H_7SO_3$ per 100 gms. H_2O
3	0.090	3	0.169	2	0.044
26	0.337	30	0.562	25	0.074
41	0.513	47	0.792	37	0.089
56	0.673	66	1.048	59	0.145
60	0.720	88	1.362	78	0.241
80	0.925	119	1.779	90	0.357
115	1.300				

SODIUM SULFONATES

SOLUBILITY IN WATER.

CH

Salt.	Formula.	t°.	Gms. Anhydrous Salt per 100 Gms. H_2O.	Authority.
Sodium:				
2.5 Diiodobenzene Sulfonate	$C_6H_3I_2SO_3.Na$	22.5	6.82	(Boyle, 1909.)
3.4 " "	$C_6H_3I_2SO_3Na.H_2O$	22.5	3.47	"
β Naphthalene Sulfonate	$C_{10}H_7.SO_3Na$	23.9	6.04	(Fischer, 1906.)
" "	"	25	5.87*	(Witt, 1915.)
2 Phenathrene Sulfonate	$C_{14}H_9SO_3Na.\frac{1}{2}H_2O$	20	0.42	(Sandquist, 1912.)
3 " "	$C_{14}H_9SO_3Na.H_2O$	20	1.1	"
10 " "	$C_{14}H_9.SO_3Na.2H_2O$	20	1.63	"
Phenol Sulfonate	$C_6H_4(OH)SO_3Na.2H_2O$	15	14.7†	(Greenish & Smith, '01.)
"	"	25	19.2‡	(Seidell, 1910.)

* $d_{25} = 1.019$. † $d_{15} = 1.067$. ‡ $d_{25} = 1.079$

SOLUBILITY OF SODIUM β NAPHTHALENE SULFONATE IN AQUEOUS HYDROCHLORIC ACID AT 23.9°. (Fischer 1906.)

Normality of Aq. HCl.	1.0 n.	2 n.	3 n.	5 n.
Gms. $C_{10}H_7.SO_3Na$ per 100 gms. Aq. HCl	6.47	5.35	4.13	2.42

SOLUBILITY OF SEVERAL SODIUM SULFONATES IN WATER.

Compound.	Formula.	t°.	Gms. anhydrous cmpd. per 100 gms. sat. sol.	
Sodium 10-Chloro 3 or 6 sulfonate..........	$C_{14}H_8ClSO_3Na.H_2O$	20	0.263	(1)
Sodium 2.6.8 Naphthylamine disulfonate....	$C_{10}H_5(NH_2)(SO_3Na)_2$	15	59.04	(2)
» 2.5.7 » »	»	15	72.2	(2)
» 2.6.8 » » (acid salt).	$C_{10}H_5(NH_2)(SO_3)_2HNa$	15	7.46	(2)
» 2.5.7 » » » .	»	15	7.91	(2)

(1) Sandquist, 1917. (2) Braunschweig, 1922.

SODIUM β Naphthalene SULFONATE $C_{10}H_7SO_3Na$.

Data (in the form of triangular diagrams) for the solubility of sodium β naphthalene sulfonate in aqueous solutions of sodium chloride and sodium sulfate at various temperatures between 25° and 65° are given by Cooke, 1921. In one case it is mentioned that 100 gms. of a sat. solution contain 8.47 gms. of the β salt and 2.93 gms. Na Cl at 65°.

SOLUBILITY OF SODIUM PHENOL SULFONATE IN AQUEOUS ALCOHOL AT 25°.

(Seidell, 1910.)

Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $C_6H_4(OH)$-$SO_3Na.2H_2O$ per 100 Gms. Sat. Sol.	Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $C_6H_4(OH)SO_3Na.2H_2O$ per 100 Gms. Sat. Sol.
0 (= H_2O)	1.079	19.38	60	0.919	7.5
10	1.054	17.4	70	0.886	5.1
20	1.030	15.5	80	0.852	2.9
30	1.004	13.6	90	0.820	1.1
40	0.977	11.7	95	0.810	0.8
50	0.950	9.7	100	0.800	1.5

In the 100 per cent C_2H_5OH solution, the solid phase, $C_6H_4(OH)SO_3Na.2H_2O$, became opaque.

100 gms. H_2O dissolve 18.25 gms. $C_6H_4(OH)SO_3Na.2H_2O$ at 14.8°, $d_{14.8}$ of sat. sol. = 1.0675. (Greenish and Smith, 1901.)

SOLUBILITY OF SODIUM BENZENE SULFONATE AND OF SODIUM NAPHTHALENE SULFONATE, EACH SEPARATELY IN METHYL ALCOHOL.

(Henstock, 1934.)

Compound	Formula	t°	Gms. Anhydrous Compound per 100 gms. CH_3OH
Na Benzene Sulfonate	$NaC_6H_5SO_3.2H_2O$	15	6.51
" " "	"	b.pt. (66.6°)	8.00
" Naphthalene "	$NaC_{10}H_7SO_3$	15	1.37
" " "	"	b.pt. (65.8°)	2.10

CH

SOLUBILITY OF CHLORO BENZENE SULFONATES IN WATER.

(Ferrero and Bollinger, 1928.)

Compound	Formula	Gms. Compound per 100 cc. sat. sol. at: 18°	98°
Na Benzene 1.3 Chloro Sulfonate	$NaC_6H_4ClSO_3$	4.37	45.0
" " 1.4 " "	"	1.79	40.0

SOLUBILITY OF SODIUM ANTHRAQUINONE SULFONATES IN WATER.

(Fierz-David, Krebser and Anderau, 1927.)

Compound	Formula	t°	Gms. Anhydrous (?) compound per 100 cc. H_2O
Na Anthraquinone 1.5 Disulfonate	$Na_2C_{14}H_6O_2(SO_3)_2.4H_2O$	18	66
" " 1.8 "	" $.5H_2O$	18	66
" " 1.6 "	" $.3H_2O$	18	100
" " 1.5.Chloro Sulfonate	$NaC_{14}H_6O_2ClSO_3.\frac{1}{2}H_2O$	18	1.05
" " 1.8 " "	" $.H_2O$	18	1.37
" " " " "	" "	100	1.43
" " -2- Sulfonate	$NaC_{14}H_7O_2SO_3.H_2O$	18	0.83*
" " " "	"	100	21.0 *
" " 2.6 Disulfonate	$Na_2C_{14}H_6O_2(SO_3)_2.2H_2O$	18	2.90*
" " " "	" "	100	18.33*
" " 2.7 "	" $.H_2O$	18	30.50*

* Gms. per 100 gms. sat. solution.

SODIUM SULFONATES

SOLUBILITY OF SODIUM ALKYL SULFONATES IN WATER.

(Reed and Tartar, 1936.)

Compound	Formula	Gms. Compound per 100 gms. H_2O at: 25°	60°
Na n Octyl Sulfonate	$NaCH_3(CH_2)_6CH_2SO_3$	74.40	—
Na n Decyl "	$NaCH_3(CH_2)_8CH_2SO_3$	4.55	—
Na Lauryl "	$NaCH_3(CH_2)_{10}CH_2SO_3$	0.253	>48.0
Na Myristyl "	$NaCH_3(CH_2)_{12}CH_2SO_3$	0.041	38.8
Na Cetyl "	$NaCH_3(CH_2)_{14}CH_2SO_3$	0.0073	6.49
Na n Octa decyl "	$NaCH_3(CH_2)_{16}CH_2SO_3$	0.0010	0.131

SOLUBILITY OF SODIUM ALKYL SULFONATES IN WATER.

(Tartar and Wright, 1939.)

The following very careful determinations show that these salts increase in solubility very slowly up to a certain temperature and very sharply beyond this definite critical concentration. This phenomenon is explained in terms of the ionic micelle concept. It was also found by hydration experiments that each salt forms a hydrate containing 3.5 mols. of H_2O.

CH The following results are in terms of the grams of salt (designated C_{10}, C_{12}, etc.) dissolved per 100 gms. H_2O.

C_{10} = Sodium Decyl Sulfonate, $NaCH_3(CH_2)_8CH_2SO_3$.
C_{12} = " Dodecyl " " $(CH_2)_{10}$ "
C_{14} = " Tetradecyl " " $(CH_2)_{12}$ "
C_{16} = " Hexadecyl " " $(CH_2)_{14}$ "
C_{18} = " Octadecyl " " $(CH_2)_{16}$

t°	C_{10}	t°	C_{12}	t°	C_{14}	t°	C_{16}	t°	C_{18}
15	0.733	20	0.134	25	0.040	37	0.013	47.5	0.0117
17	0.800	25	0.191	29	0.052	41	0.0205	54	0.0217
20	0.897	30	0.248	40	0.087	47.5	0.035	57	0.0270
23	1.04	32	0.277	41.7	0.129	48.25	0.0462	58	0.0362
24	1.22	34	0.360	43	0.270	49	0.056	59	0.0620
25	1.93	35	0.441	45	0.700	50	0.100	60	0.0820
27.38	6.43	36	0.950	46	1.38	53	0.351	61.5	0.177
29	11.02	37	1.78	47	2.20	55	0.88	65	0.90
31	18.70	38	2.97	48	3.28	56.5	1.60	67.01	2.00
32	23.68	40	6.54	49	5.08	58.0	2.60	69.05	5.60
34	36.70	41	9.60	50	8.20	60	6.00	70.23	11.5
36	53.5	43	18.20	51	12.3	61.96	11.55		
36.86	62.3	45	31.46	53	22.4	63.36	20.86		
		46.34	52.8	54	32.9				

SODIUM LAURATE $NaCH_3(CH_2)_{10}COO$.

EQUILIBRIUM IN THE SYSTEM SODIUM LAURATE AND WATER

(McBain, Brock, Vold and Vold, 1938.)

The determinations were made by the synthetic method which consists in observing the temperatures at which phase changes occur in systems of known composition. In the following table, t^o_1, shows the upper temperature limits of the existence of liquid crystalline soap phases and t^o_2, shows the upper temperature limits of the existence of crystalline soap.

t^o_1	t^o_2	Wt. percent $Na(CH_3)(CH_2)_{10}COOH$ in sat. sol.	t^o_1	t^o_2	Wt. percent $Na(CH_3)(CH_2)_{10}COOH$ in sat. sol.
—	24	2.17	145	51	43.44
—	28	3.53	149	55	46.75
—	32	5.20	139	57	49.39
—	38	10.89	141	59	51.12
—	42	28.77	153	60	51.29
—	42	32.69	182	61	53.21
85	44	35.09	237	62.5	58.40
100	44	36.80	247	66	60.89
142	50	42.50	290	76	71.16
144	51	43.63	310	226	100.00

CH

The authors also give results for the system Sodium Laurate, Sodium Chloride and Water at temperatures between 60° and 250°.

Results for the four component system Sodium Laurate, Sodium Palmitate, Sodium Chloride and Water at 90°, for two constant ratios of sodium palmitate to sodium laurate, are given by McBain, Vold and Jameson, 1939.

Results for the system Lauric Acid, Sodium Hydroxide and Water at 25° are given by Bury and Owens, 1936.

Results in the form of a triangular diagram for the system Lauric Acid Phenol and Water at 25° are given by Jencic, 1934.

SOLUBILITY OF SODIUM LAURATE IN 80 TO 100 VOL. PERCENT ETHYL ALCOHOL.

(Ekwald and Mylius, 1932.)

t^o	Gms. $Na(CH_3)(CH_2)_{10}COO$ per 100 cc of:		
	80 Vol. % C_2H_5OH	96 Vol. % C_2H_5OH	99.9 Vol. % C_2H_5OH
0	1.98	0.61	0.42
8	2.63	0.86	0.54
12.5	3.65(13°)	1.01	0.67(16°)
20	6.62	1.31(19°)	0.74(20.5°)

The authors also give the following results for the Solubility of Lauric Acid in Ethyl Alcohol.

t^o	Gms. $CH_3(CH_2)_{10}COOH$ per 100 cc of:		
	80 Vol. % C_2H_5OH	96 Vol. % C_2H_5OH	99.9 Vol% C_2H_5OH
0	5.26	14.17(-1°)	20.84
8	9.15(8°)	28.48	36.00
12	22.50(14°)	38.65	48.36
16.5	48.30(21°)	56.32	72.81

SODIUM PALMITATE $NaCH_3(CH_2)_{14}COO$.

EQUILIBRIUM IN THE SYSTEM SODIUM PALMITATE AND WATER.

(McBain, Lazarus and Pitten, 1930.)

The determinations were made by the synthetic method. The column t°_1 shows the temperature above which the system consists of a single isotropic phase; t°_c shows the temperature above which the soap is completely in solution and crystals have completely disappeared.

t°_1	t°_c	Gm. Equivalent $NaCH_3(CH_2)_{14}COO$ per 1000 gms. H_2O	t°_1	t°_c	Gm. Equivalent $NaCH_3(CH_2)_{14}COO$ per 1000 gms. H_2O
—	58	0.105	164	79.5	3.18
—	64	0.256	159	80	3.427
—	66.1	0.500	173	—	3.511
—	71.1	1.411	225	79.3	4.087
—	72.2	1.744	258.5	81.2	5.01
120	73.5	1.50	264.5	82	6.016
152	74.8	1.856	277.5	93	9.003
157.5	76.5	2.047	285	102	11.90
167	78	2.343	—	114	17.54
170	78.3	2.633	—	125	26.40
171	78	2.67	—	130	47.00
168.5	79	2.996	—	132	84.80
			290	134	100.00

CH The authors also give similar results for the system Sodium Palmitate + Sodium Chloride + Water, from which the isotherms between 80° and 290° are constructed.

The complete equilibrium diagram of the system Sodium Palmitate + Sodium Chloride + Water at 90°, has been determined by Vold and Ferguson, 1938, with greater precision than attempted for any other system composed of soap, inorganic electrolyte and water.

EQUILIBRIUM IN THE SYSTEM SODIUM PALMITATE AND PALMITIC ACID.

(McBain and Field, 1933.)

The previous determinations upon this system by Donnan and White, 1911, are incomplete and erroneous, resulting from imperfect separation of solid from liquid. The present results establish the existence of definite acid soaps of constant composition. The observed temperature t°_c is that at which the last trace of solid crystal disappears on heating and t_1 is the first temperature at which the homogeneous isotropic liquid becomes turbid or non-homogeneous on cooling.

t°_c	Mol. fraction $NaCH_3(CH_2)_{14}COO$ in sat. sol.	t°_c	Mol. fraction $NaCH_3(CH_2)_{14}COO$ in sat. sol.	t°_c	Mol. fraction $NaCH_3(CH_2)_{14}COO$ in sat. sol.
62.8	0.0000	74.2 tr.pt.	0.2747	113.2	0.4673
59.2 Eutec.	—	77.5	0.3034	120.5	0.5010
60.7	0.0175	82.5	0.3335	127.8	0.5310
61.1	0.0364	85.1	0.3599	138.0	0.5709
65.2	0.0665	88.4	0.3850	147.8	0.6155
67.9	0.1119	90.0	0.3995	154 tr.pt.	—
70.0	0.1555	91.1 tr.pt.	—	— (t°_1 = 168.5)	0.6682
72.3	0.2074	97.8	0.4161	— (t°_1 = 203.5)	0.7188
73.6	0.2404	106.2	0.4395	216 (t°_1 = 316.0)	1.000

The acid soaps which are formed have the composition $NaCH_3(CH_2)_{14}COO.CH_3(CH_2)_{14}COOH$ and $2NaCH_3(CH_2)_{14}COO.CH_3(CH_2)_{14}COOH$. Further results upon the above system by Ekwall, 1933, confirm the existence of definite acid soaps but their compositions are given as $NaCH_3(CH_2)_{14}COO.2CH_3(CH_2)_{14}COOH$ and $2NaCH_3(CH_2)_{14}COO.CH_3(CH_2)_{14}COOH$.

SODIUM PALMITATE $CH_3(CH_2)_{14}COONa$.

100 gms. sat. solution in H_2O contain 0.2 gm. sodium palmitate.

100 gms. sat. solution in 5% aq. bile salts contain 1 gm. sodium palmitate.

100 gms. sat. solution in 5% aq. bile salts + 1% lecithin contain 2.4 gms. sodium palmitate. (Moore, Wilson and Hutchinson, 1909.)

SOLUBILITY OF SODIUM PALMITATE IN 70 TO 100 VOL. PERCENT ETHYL ALCOHOL.

(Ekwall and Mylius, 1937.)

t°	Gms. $CH_3(CH_2)_{14}COONa$ per 100 cc: 70 Vol. % C_2H_5OH	80 Vol. % C_2H_5OH	90 Vol. % C_2H_5OH	96 Vol. % C_2H_5OH	99.9 Vol. % C_2H_5OH
-10	—	—	—	—	0.12
0	—	—	—	—	0.19
+ 5.5	1.16	—	—	—	—
8.0	—	1.16	0.67	0.40(7.5°)	—
12.0	1.47	—	0.84(14.°)	0.48(12.5°)	—
18.0	2.16	1.85(18.5°)	1.08(19.5°)	0.63 20°)	0.26(17°)
23.0	3.21	3.20(25°)	1.31(23.5°)	0.70(25°)	—

CH

The authors also give the following results for the solubility of Palmitic Acid in Ethyl Alcohol.

t°	Gms. $CH_3(CH_2)_{14}COOH$ per 100 cc: 70 Vol. % C_2H_5OH	80 Vol. % C_2H_5OH	90 Vol. % C_2H_5OH	96 Vol. % C_2H_5OH	98 Vol. % C_2H_5OH	99.9 Vol. % C_2H_5OH
-10	—	—	—	—	—	0.61
0	—	—	—	—	—	1.56
+ 7	0.09	0.24(6.5°)	0.82(6°)	1.38	1.80(8°)	—
12	0.14(12.5°)	0.47(13°)	1.12	1.95	2.21	—
19	0.32(19.5°)	0.76	—	3.09(16°)	4.60	5.53(17°)
20	—	—	2.48	3.97	4.74	—
25	0.48(24.5°)	1.45	—	—	—	—

SODIUM OLEATE $C_8H_{17}CH:CH(CH_2)_7COONa$.

SOLUBILITY IN WATER AND AQUEOUS BILE SALTS.

(Moore, Wilson and Hutchinson, 1909.)

Solvent.	Gms. Oleate per 100 Gms. Sat. Sol.
Water	5
Aq. 5% Bile Salts	7.6
Aq. 5% Bile Salts + 1% Lecithin	11.6

EQUILIBRIUM IN THE SYSTEM SODIUM OLEATE, PHENOL AND WATER AT 25°.

(Woodman, 1933.)

The determinations were made by titrating one component into a mixture of the other two until homogeneity or heterogeneity resulted.

Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.	
$NaC_{18}H_{33}O_2$	C_6H_5OH	$NaC_{19}H_{33}O_2$	C_6H_5OH	$NaC_{18}H_{33}O_2$	C_6H_5OH
0.0	8.27	10.45	0.0	36.91	48.41
0.09	8.67	12.62	2.14	29.29	59.22
0.23	9.94	13.71	4.60	20.37	69.16
0.48	12.19	14.61	7.39	15.68	76.70
1.72	16.96	17.22	11.48	13.24	78.37
1.80	38.16	21.39	14.36	6.27	87.26
2.04	45.11	25.87	16.24	0.0	94.74
2.25	57.54	34.85	21.58	2.09	92.15
1.50	64.62	36.57	27.99	3.08	91.62
1.11	65.88	39.60	29.34	9.44	86.03
0.80	67.36	43.75	33.88	11.29	83.42
0.72	68.04	43.57	34.94	12.57	81.58
0.52	68.36	44.25	35.16	13.52	81.92
0.0	70.34				

Similar results are given for the remaining ternary mixtures in the quarternary system, Sodium Oleate, Phenol, Toluene and Water and are of Practical value in the preparation of mixtures used for spraying.

CH

EQUILIBRIUM IN THE SYSTEMS CRESOLS, SODIUM OLEATE AND WATER.

(Bailey, 1923.)

Especial attention was given to the purification of the sodium oleate. The determinations were made by the synthetic method.

Ortho Cresol + Sodium Oleate + Water at 20°.		Meta Cresol + Sodium Oleate + Water at 20°.		Meta Cresol + Sodium Oleate + Water at 60°.		Para Cresol + Sodium Oleate + Water at 20°.	
Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.	
Cresol.	Oleate.	Cresol.	Oleate.	Cresol.	Oleate.	Cresol.	Oleate.
2.8	–	2.4	–	3.0	–	2.0	–
7.5	2.3	5.2	1.2	6.6	1.3	7.5	1.7
10.5	3.7	11.0	3.5	10.5	2.6	12.1	2.9
31.3	8.5	16.0	5.2	22.5	5.1	17.2	4.1
49.5	8.5	23.6	7.2	30.7	6.2	35.6	7.2
67.3	7.4	36.4	9.1	48.6	8.6	38.9	7.6
75.5	5.6	42.6	11.0	54.3	10.2	48.8	9.1
80.6	3.5	45.1	13.3	63.3	9.2	62.4	9.0
84.0	1.3	52.8	14.1	71.0	6.6	71.0	6.2
85.1	0.7	61.6	12.2	79.6	2.2	76.4	4.1
85.7	0.4	71.4	8.3	82.0	0.9	80.3	2.5
86.0	0.3	81.2	3.7	82.7	0.5	81.8	1.8
86.4	–	84.9	1.9	83.4	–	85.2	–
		87.2	–				

Results for equilibrium in the ternary systems and quarternary systems possible with the four components, sodium oleate, sodium chloride, ethyl acetate and water at 25° are given by Smith, 1932.)

SODIUM Salts of PHENOLPHTALEIN

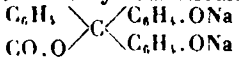
EQUILIBRIUM IN THE SYSTEM SODIUM OXIDE, PHENOLPHTHALEIN ANHYDRIDE AND WATER AT 25°. (Bassett and Halton, 1923.)

Saturation was secured by constant rotation in a thermostat for 3 days. Both the solutions and the solid phases were analyzed. The compositions of the latter were established by the " rest method ".

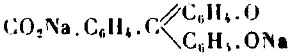
CH

Gms. per 100 gms. sat. sol Na_2O.	Gms. per 100 gms. sat. sol Phenolphthalein anhydride.	Solid Phase.
0.58	2.90	Phenolphthalein
2.71	13.74	»
4.25	22.43	»
6 11	31.96	»
6.95	36.06	Mono sodium salt+$8H_2O$
7.48	37.73	»
8.32	41.16	»
6.78	33.34	Mono sodium salt+$4H_2O$
9.31	37.36	»
9.88	41.45	»
10.06	44.06	»
11.00	45.55	Disodium salt, anhydrous
12.31	40.16	»
11.67	37.79	Di sodium salt $4H_2O$
11.98	34.78	»
9.97	38.42	Di sodium salt $8H_2O$
10.17	33.72	»
10.24	31.00	Tri sodium salt $14H_2O$
10.37	27.89	»
11.34	25.03	»
12.69	23.25	»
13.73	20.51	Tri sodium salt $13H_2O$
14.29	16.91	»
17.48	10.35	»
19.8	9.12	Tri sodium salt $12H_2O$
20.32	4.28	»
23.46	1.37	»
25.42	0.86	»
27.01	0.11	Tri sodium salt $6H_2O$
28.03	0.0	»
30.74	0.0	»
37.44	0.23	»
39.88	0.0	» +$NaOH.H_2O$

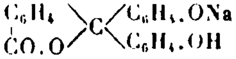
The crystalline anhydrous disodium salt could be either



or



Since it is colorless it must be regarded as the diphenolic salt. The two hydrated forms of the disodium salt also have the phenolic structure. For the trisodium salt there is only one possible structure, namely, $CO_2 Na.C_6 H_4.C (C_6 H_4O Na)_2.OH$, but two mono sodium salts are possible. They are $CO_2 Na.C_6 H_4.C (C_6 H_4OH)_2.OH$ and



. It is probable that the solid hydrated mono sodium salts, which have been obtained in the present investigation, have the phenolic structure shown by the latter formula.

SODIUM CYANIDE $NaCN.2H_2O$.

SOLUBILITY OF SODIUM CYANIDE IN WATER. (Frost, 1936.)

CN

t°	Gms. NaCN per 100 gms. sat. solution	Solid Phase
- 4.0	5.50	Ice
- 9.2	11.03	"
-12.5	13.90	"
-15.2	16.01	"
-19.5	19.11	"
-23.4	21.23	"
-26.4	23.46	" + $NaCN.2H_2O$
-21.4	24.84	$NaCN.2H_2O$
-18.1	25.90	"
-14.8	26.5	$NaCN.2H_2O$.
- 7.6	27.9	"
- 4.0	28.9	"
+10.0	32.5	"
15.0	34.2	"
20.4	37.02	"
25.4	39.1	"
29.5	41.56	"
34.0	44.82	"
35.0	45.0	NaCN

SOLUBILITY OF SODIUM CYANIDE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE.

(Kirejew and Nagrenskaja, 1935.)

Results at 0°		Results at 25°			Results at 40°		
Gms. per liter sat. sol.		d. of sat. sol.	Gms. per liter sat. sol.		d. of sat. sol.	Gms. per liter sat. sol.	
NaOH	NaCN		NaOH	NaCN		NaOH	NaCN
10	370	1.186	45	490	—	10	530
40	349	1.293	125	430	1.265	35	505
140	300	—	140	417	—	90	460
160	280	—	178	388	—	110	445
		1.332	210	365	—	160	400
		1.348	290	305	1.319	235	330
		—	420	220	—	290	305
		—	520	160	—	370	255

100 gms. Methyl Alcohol (CH_3OH) dissolve 6.44 gms. anhydrous NaCN at 15° and 4.10 gms. at 67.4° (b.pt.). (Henstock, 1934.)

Data for equilibrium in the system Sodium Cyanide, Sodium Chloride and Liquid Ammonia at different temperatures are given by Wassiliew, Ettinger and Galowkow, 1934.

100 gms. Liquid Sulfur Dioxide (SO_2) dissolve 0.018 gm. NaCN at 0°. (Jander and Ruppolt, 1937.)

Fusion-point data for mixtures of NaCN + NaCl are given by Truthe, 1912.

SODIUM CYANATE NaCNO.

CNO

100 gms. alcohol of $d_{17} = 0.799$ dissolve 0.22 gm. Na C NO at 0° and 0.52 gm at the b. pt.

100 gms. benzene dissolve 0.13 gm. Na C NO at the b. pt.

(Cranston and Livingstone, 1926.

SODIUM Ferro CYANIDE $Na_4Fe(CN)_6 \cdot 10H_2O$.

SOLUBILITY OF SODIUM FERRO CYANIDE IN WATER.

(Friend, Townley and Vallance, 1929.)

t°	d. of sat. sol.	Gms. $Na_4Fe(CN)_6$ per 100 gms. sat. sol.	t°	d. of sat. sol.	Gms. $Na_4Fe(CN)_6$ per 100 gms. sat. sol.
0.65	1.0680	10.23	71.0	—	34.34
16.7	1.1079	14.69	75.25	—	35.82
25.35	1.1303	17.63	79.5	1.2809	38.26
35.75	1.1572	21.54	81.7 tr.pt.	—	—
49.65	1.1921	26.20	85.0	1.285	38.5—39.5
59.75	1.2180	30.35	104.0	1.285	38.5—39.5

The solid phase below 81.7 is $Na_4Fe(CN)_6 \cdot 10H_2O$.

The previous results of Conroy, 1898 and Farrow, 1926, differ only slightly from the above at temperatures up to 65°.

SOLUBILITY OF SODIUM FERROCYANIDE IN AQUEOUS SOLUTIONS OF AMMONIA AT 18°.

(Tettamanzi, 1935.)

Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.	
NH_3	$Na_4Fe(CN)_6$	NH_3	$Na_4Fe(CN)_6$	NH_3	$Na_4Fe(CN)_6$
0.0	14.28	14.89	4.40	24.64	2.61
2.58	11.52	15.60	4.17	27.88	2.29
6.58	8.26	17.53	3.64	30.88	2.44
7.53	7.92	21.10	3.04	31.09	2.49
9.17	6.69	23.81	2.68		

The solid phase was $Na_4Fe(CN)_6.10H_2O$ in all cases.

SIMULTANEOUS SOLUBILITY OF SODIUM FERROCYANIDE AND SODIUM SULFATE IN WATER AT VARIOUS TEMPERATURES.

(Dominik, 1922.)

t°.	d of sat. sol.	Gms. per 100 cc. sat. sol.		t°.	d of sat. sol.	Gms. per 100 cc. sat. sol.	
		$Na_4Fe(CN)_6$.	Na_2SO_4.			$Na_4Fe(CN)_6$.	Na_2SO_4.
10....	1.136	8.94	7.33	34....	1.357	4.95	42.20
14....	1.147	9.46	8.58	42....	1.353	8.64	38.69
23.5..	1.228	8.64	19.53	55....	1.299	16.42	31.47
32....	1.357	4.90	42.25	63....	1.300	27.85	28.08

SOLUBILITY OF SODIUM FERROCYANIDE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 20°.

(Dias de Mesa and Bermejo, 1929.)

Vol. % C_2H_5OH in solvent	Gms. $Na_4Fe(CN)_6$ per 100 gms. sat. sol.	Vol. % C_2H_5OH in solvent	Gms. $Na_4Fe(CN)_6$ per 100 gms. sat. sol.
0 (= H_2O)	16.77	45	0.259
10	6.745	50	0.186
15	4.535	55	0.133
20	2.909	60	0.073
25	1.618	65	0.041
30	1.126	70	0.025
35	0.614	80	0.007
40	0.481	85	0.000

SODIUM THIOCYANATE NaCNS

CNS

SOLUBILITY OF SODIUM THIOCYANATE IN WATER.

(Hughes and Mead, 1929.)

t°	Gms. NaCNS per 100 gms.		Solid Phase	t°	Gms. NaCNS per 100 gms.		Solid Phase
	H_2O	sat. sol.			H_2O	sat. sol.	
10.7	112.7	52.98	$NaCNS.H_2O$	25.	167.8*	62.66	NaCNS
17.3	127.5	56.01	"	25	165.9	62.39*(1)	"
21.3	139.3	58.21	"	33.8	172.4	63.29	"
25.0	142.6	58.78(1)	"	46.1	178.0	64.03	"
29.2	167.5	62.62	"	65.8	189.5	65.46	"
30.4 t.pt.	—	—	" + NaCNS	73.8	196.2	66.24	"
15	164.5*	62.19	NaCNS	81.8	202.0	66.89	"
20	165.6*	62.36	"	101.4	225.6	69.29	"

* These three metastable points are by Bump, 1932.
(1) Occleshaw, 1931.

The determinations of Hughes and Mead were made by observing the temperatures at which the last crystal in a known mixture of NaCNS + H_2O began to show sharp or rounded edges with slow variations of temperature.

SOLUBILITY OF SODIUM THIOCYANATE IN METHYL ALCOHOL, ETHYL ALCOHOL AND IN ACETONE.

(Hughes and Mead, 1929.)

Results for :

Methyl Alcohol		Ethyl Alcohol		Acetone	
t°	Gms. NaCNS per 100 gms. CH_3OH	t°	Gms. NaCNS per 100 gms. C_2H_5OH	t°	Gms. NaCNS per 100 gms. $(CH_3)_2CO$
15.8	35.00	18.8	18.37	18.8	6.85
24.7	40.04	35.8	19.05	20.2	9.50
34.6	45.14	52.8	21.05	41.9	14.08
48.0	50.98	61.8	22.60	51.0	18.61
52.3	53.54	70.9	24.43	56.0	21.40

In the case of Acetone the equimolecular compound $NaCNS(CH_3)_2CO$ was formed.

The accuracy of the above results is questioned by Partington and Winterton, 1934a, who found 20.66 gms. NaCNS per 100 gms. C_2H_5OH at 25°. They consider that saturation with excess of salt is a more accurate method than observation of the point at which the last crystal in a solution shows sharp or rounded edges.

CNS

SODIUM THIOCYANATE

SOLUBILITY OF SODIUM THIOCYANATE IN ALLYL ALCOHOL SOLUTIONS OF SODIUM IODIDE AT 25°.

(Partington and Winterton, 1934.)

Gms. per 100 gms. CH_2CHCH_2OH		Solid Phase
NaI	NaSCN	
0.0	12.40	NaSCN
1.87	12.01	"
3.92	11.77	"
6.81	10.82	"
14.20	8.44	"
14.61	8.45	NaSCN
21.72	5.20	"
22.0	5.04	"
28.48	0.0	NaI

100 gms. Liquid Ammonia (NH_3) dissolve 205.5 gms. NaSCN at 25°.
(Hunt, 1932.)

SODIUM CARBONATE $Na_2CO_3.10H_2O$.

SOLUBILITY IN WATER.

(Wells and McAdam, Jr., 1907; Mulder, below 27° and above 44°.)

t°.	Gms. Na_2CO_3 per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. Na_2CO_3 per 100 Gms. H_2O.	Solid Phase.
0	7	$Na_2CO_3.10H_2O$	34.76	48.98	$Na_2CO_3.7H_2O$
5	9.5	"	35.62	50.08	"
10	12.5	"	35.50	...	" $+Na_2CO_3.H_2O$
15	16.4	"	29.86	50.53	$Na_2CO_3.H_2O$
20	21.5	"	31.80	50.31	"
27.84	34.20	"	35.17	49.63	"
29.33	37.40	"	36.45	49.36	"
30.35	40.12	"	37.91	49.11	"
31.45	43.25	"	41.94	48.51	"
32.06	45.64	"	43.94	47.98	"
32.15	...	" $+Na_2CO_3.7H_2O$	60	46.4	"
33.10	...	" $+Na_2CO_3.H_2O$	80	45.8	"
30.35	43.50	$Na_2CO_3.7H_2O$	100	45.5	"
32.86	46.28	"	105	45.2	"

The determinations of Wells and McAdam, Jr., were made with extreme care. They correct the discrepancies which have so far existed between the solubility and transition points of the hydrates. Earlier data, which differ more or less from the above, are given by Löwel, 1851; Reich, 1891; Eppel, 1899 and Ketner, 1901–02. Single determinations at 15°, 25°, and 30° are given by Greenish and Smith (1901); Osaka (1910–1911); de Paepe (1911) and Cocheret (1911).

Sp. Gr. of solution saturated at 17.5°, 1.165 (Hager); at 18°, 1.172 (Kohlrausch); at 23°, 1.22 (Schiff); at 30°, 1.342 (Lunge). See also Wegscheider and Walter, 1905, for Sp. Gr. determinations at other temperatures.

The following determinations of the solubility of Sodium Carbonate in Water are reported by Seyer and Todd, 1929. The saturated solutions below 100° were prepared in a sealed pyrex tube having two arms which permitted separation of liquid from solid after saturation. Above 100° an iron tube having two arms was used.

t°	Gms. Na_2CO_3 per 100 gms. sat. sol.	Solid Phase	t° t°	Gms. Na_2CO_3 per 100 gms. sat. sol.	Solid Phase
-2.05 (1.056)	5.71	Ice+$Na_2CO_3.10H_2O$	65.6	31.3	$Na_2CO_3.H_2O$
15.0 (1.1515)	14.23	$Na_2CO_3.10H_2O$	79.0	30.6	"
16.6	14.5	"	90.0	30.5	"
18.4	16.2	"	101.0	29.8	"
20.0 (1.1941)	18.0	"	132	28.7	"
20.2	17.8	"	131	28.4	"
25.0	22.5	"	140	27.6	"
25.0 (1.2416)	22.55	"	149 tr.pt.	—	" + Na_2CO_3
30.0	28.4	"	161	26.0	Na_2CO_3
34.8 tr.pt.	32.8	" + $Na_2CO_3.H_2O$	173	24.5	"
46.5	32.3	$Na_2CO_3.H_2O$			
52.2	32.0	"			

The results in the above table accompanied by density determinations (in parentheses) are by Flöttmann, 1928. The results for the Eutectic are by Hill and Baron, 1927.

SODIUM CARBONATE

SOLUBILITY OF SODIUM CARBONATE IN WATER AT TEMPERATURES UP TO 348°.

(Waldeck, Lynn and Hill, 1932.)

The various procedures which have been employed for solubility determinations at high temperatures are reviewed. For their own experiments the authors used a bomb made of chromium-nickel steel, provided with a tubular receptical attached to the side of the bomb which was previously evacuated and served to withdraw a portion of the solution after saturation. Temperatures were maintained by means of an electrically heated air bath. The mixtures were shaken four hours for saturation. The results differ from those of Seyer and Todd especially at the transition point of monohydrate to anhydrous carbonate.

CO

t°	Gms. Na_2CO_3 per 100 gms. sat. sol.	Solid Phase	t°	Gms. Na_2CO_3 per 100 gms. sat. sol.	Solid Phase
50	32.0	$Na_2CO_3.H_2O$	139.0	28.1	Na_2CO_3
60	31.6	"	145	27.7	"
75.5	31.0	"	159.0	26.8	"
83.6	30.8	"	170.0	26.1	"
99.5	30.6	"	180.0	25.0	"
103.0	30.8	"	200	23.3	"
106.0	30.7	"	225	20.7	"
112.5	30.8	" + Na_2CO_3	239.0	18.7	"
116.0	30.3	Na_2CO_3	275.0	13.2	"
121.5	29.8	"	300.0	8.4	"
125.0	29.5	"	326.0	4.4	"
131.5	28.8	"	348.4	0.0 (1.96)	"

The vapor pressures of the saturated solutions are also given.

The result in parenthesis at 348° is by Schroeder, Berk and Gabriel, 1936. It is believed that the value of 0.0 given by Waldeck, Lynn & Hill resulted from under allowance for expansion of the solution with temperature.

SODIUM (Bi) CARBONATE $NaHCO_3$.

SOLUBILITY IN WATER.

(Dibbits, 1874; Fedotieff, 1904.)

t°.	Gms. $NaHCO_3$ per 100 Gms.		t°.	Gms. NaHCO per 100 Gms.	
	Water.	Solution.		Water.	Solution.
0	6.9	6.5	30	11.1	10
10	8.15	7.5	40	12.7	11.3
20	9.6	8.8	50	14.45	12.6
25	10.35	9.4	60	16.4	13.8

Later results agreeing satisfactorily with the above are given by Makarow and Wachsberg, 1930.

The solubility at the Eutectic point, -2.23, was found by Hill and Bacon, 1927 to be 6.26 gms. $NaHCO_3$ per 100 gms. sat. sol. of density = 1.046.

The following results for temperatures up to 200° are given by Waldeck, Lynn and Hill, 1934.

t°	Gms. $NaHCO_3$ per 100 gms. sat. sol.	t°	Gms. $NaHCO_3$ per 100 gms. sat. sol.
100	19.1	190	37.5
150	27.2	200	43.0
170	32.0		

100 gms. H_2O dissolve 9.03 gm. $NaHCO_3$ at 15°, d_{15} = 1.061.
(Greenish and Smith, 1901.)

100 gms. alcohol of 0.941 Sp. Gr. dissolve 1.2 gms. $NaHCO_3$ at 15.5°

100 gms. glycerol dissolve 8 gms. $NaHCO_3$ at 15.5°. (Ossendowski, 1907.)

SODIUM CARBONATE $Na_2CO_3.10H_2O$.

SODIUM BiCARBONATE $NaHCO_3$.

EQUILIBRIUM IN THE SYSTEM SODIUM CARBONATE, SODIUM BICARBONATE AND WATER.

(Freeth, 1922.)

Constant stirring was employed and the solid phases were identified by the Schreinemakers « rest method ».

CO

Results at 0°. Gms. per 100 gms. sat. sol.		Results at 15°. Gms. per 100 gms. sat. sol.		Results at 20°. Gms. per 100 gms. sat. sol.		Solid Phase at Each Temperature.
Na_2CO_3.	$NaHCO_3$.	Na_2CO_3.	$NaHCO_3$.	Na_2CO_3.	$NaHCO_3$.	
6.4	0.0	14.1	0.0	18.0	0.0	$Na_2CO_3.10H_2O$
5.9	1.4	13.8	1.8	17.3	2.9	»
5.6	4.6	13.0	4.3	17.0	4.0	» + $NaHCO_3$
4.0	5.1	6.0	6.0	6.3	6.5	$NaHCO_3$
0.0	6.5	0.0	8.1	3.5	7.2	»
				0.0	8.7	»

t°.	Gms. per 100 gms. sat. sol. Na_2CO_3.	$NaHCO_3$.	Solid Phase.
25....	22.7	0.0	$Na_2CO_3.10H_2O$
25....	22.6	1.5	» + 1.1.2
25....	20.8	2.5	1.1.2
25....	17.9	4.0	» + $NaHCO_3$
25....	16.7	3.3	$NaHCO_3$
25....	10.0	3.9	»
25....	6.1	4.9	»
25....	0.0	9.3	»
30....	28.45	0.0	$Na_2CO_3.10H_2O$
30....	27.5	0.8	»
30....	27.1	1.3	» + 1.1.2
30....	26.5	1.1	1.1.2
30....	26.1	1.2	»
30....	18.3	3.8	»
30....	17.6	4.3	» + $NaHCO_3$
30....	17.5	4.6	$NaHCO_3$
30....	9.7	6.3	»
30....	0.8	9.1	»
30....	0.0	9.9	»

1.1.2 = $Na_2CO_3.NaHCO_3.2H_2O$

t°.	Gms. per 100 gms. sat. sol. Na_2CO_3.	$NaHCO_3$.	Solid Phase.
35....	32.9	0.0	$Na_2CO_3.7H_2O$
35....	32.8	0.3	»
35....	32.5	0.6	» + 1.1.2
35....	28.7	0.9	1.1.2
35....	23.7	2.0	»
35....	17.3	4.7	» + $NaHCO_3$
35....	9.7	6.7	$NaHCO_3$
35....	0.0	10.6	»
45....	32.2	0.0	$Na_2CO_3.H_2O$
45....	31.7	0.9	» + 1.1.2
45....	27.3	1.3	1.1.2
45....	21.4	3.0	»
45....	16.9	5.9	» + $NaHCO_3$
45....	8.7	8.0	$NaHCO_3$
45....	0.8	11.3	»
45....	0.0	12.0	»
60....	31.8	0.0	$Na_2CO_3.H_2O$
60....	30.7	1.3	» + 1.1.2
60....	25.8	2.4	1.1.2
60....	16.9	7.4	» + $NaHCO_3$
60....	8.5	10.1	$NaHCO_3$
60....	1.4	12.9	»

EQUILIBRIUM IN THE SYSTEM SODIUM CARBONATE, SODIUM BICARBONATE, AND WATER AT 25°.

(McCoy and Test, 1911.)

(Forty grams of $NaHCO_3$ and about 200 cc. of H_2O were rotated at 25° until equilibrium was reached. Small portions of the clear solution were then analyzed by the Winkler method for carbonate content, and by titration in presence of methyl orange, for sodium. About 15 gms. of $Na_2CO_3.10H_2O$ were then added, and the mixture again rotated until equilibrium was reached, and again analyzed. This was continued and the following results were obtained.)

CO

Per cent of Total Na Present as Bicarbonate.	Gms. Na per Liter.	Gms. Bicarbonate per Liter.	Gms. Carbonate per Liter.	Solid Phase.
0	119.9	0	276.4	$Na_2CO_3.10H_2O$
5.92	127.6	27.6	276.3	" $+Na_2CO_3.NaHCO_3.2H_2O$
7.5	120	...	...	$Na_2CO_3.NaHCO_3.2H_2O$
10	107	...	...	"
12.89	108	50.8	216.6	" $+NaHCO_3$
15	100	...	...	$NaHCO_3$
20	80	...	...	"
32	60	...	...	"
56	40	...	...	"
80	30	...	...	"
100	27.02	98.7	0	"

The following data for this system also at 25°, but given in terms of weight instead of volume of solution, are reported by de Paepe (1911).

Gms. per 100 Gms H_2O		Solid Phase.	Gms. per 100 Gms. H_2O.		Solid Phase.
Na_2CO_3.	$NaHCO_3$.		Na_2CO_3.	$NaHCO_3$.	
28.3	0	$Na_2CO_3.10H_2O$	12.4	7.3	$NaHCO_3$
27.3	2.1	"	6.2	9	
26.5	4.2	" $+NaHCO_3$	1	10.1	
19.2	5.7	$NaHCO_3$			

SODIUM CARBONATE

EQUILIBRIUM IN THE SYSTEM SODIUM CARBONATE SODIUM BICARBONATE AND WATER.

(Hill and Bacon, 1927.)

d. of sat. sol.	Gms. per 100 gms. sat. sol. Na_2CO_3	Gms. per 100 gms. sat. sol. $NaHCO_3$	Solid Phase
	Results at 24.87°		
—	22.45	0.0	$Na_2CO_3 . 10H_2O$
1.238	22.20	0.86	"
1.243	22.26	1.09	"
1.247	22.15	1.59	"
—	22.10	2.09	" + 1.1.2
1.240	20.90	2.49	1.1.2
1.228	19.31	3.18	"
1.225	18.60	3.57	"
1.216	17.85	4.00	" + $NaHCO_3$
1.179	13.61	4.90	$NaHCO_3$
1.152	10.88	5.50	"
1.125	8.11	6.13	"
1.076	8.21	2.10	"
1.065	9.11	0.2	"
—	9.3	0.0	"
	Results at 30°		
1.296	28.24	0.0	$Na_2CO_3 . 10H_2O$
1.307	28.09	0.76	" + 1.1.2
1.301	27.52	0.82	1.1.2
	Results at 30° con.		
1.269	24.30	1.47	1.1.2
1.256	23.39	1.79	"
1.239	21.00	2.65	"
1.226	18.54	3.91	"
1.216	17.52	4.45	" + $NaHCO_3$
1.160	11.84	5.60	$NaHCO_3$
1.112	6.06	7.30	"
1.068	0.25	9.71	"
—	0.0	9.8	"
	Results at 50°		
1.331	32.16	0.0	$Na_2CO_3 . H_2O$
1.337	31.92	0.48	" + 1.1.2
1.260	23.79	2.40	1.1.2
1.214	16.97	6.28	" + $NaHCO_3$
1.196	14.90	6.80	$NaHCO_3$
1.152	10.04	8.27	"
1.112	4.78	9.93	"
1.079	1.08	11.68	"
—	0.0	12.40	"

The authors also determined four invariant points of the system.

t°	d. of sat. sol.	Gms. per 100 gms. sat. sol. Na_2CO_3	Gms. per 100 gms. sat. sol. $NaHCO_3$	Solid Phase
- 3.32	1.078	4.41	4.64	$Na_2CO_3 . 10H_2O + NaHCO_3 +$ Ice
+21.26	1.220	18.15	3.74	$Na_2CO_3 . 10H_2O + NaHCO_3 \rightleftarrows$ 1.1.2
31.98	1.334	31.32	0.16	$Na_2CO_3 . 10H_2O +$ 1.1.2 $\rightleftarrows Na_2CO_3 . 7H_2O$
35.17	1.350	33.08	0.19	$Na_2CO_3 . 7H_2O +$ 1.1.2 $\rightleftarrows Na_2CO_3 . H_2O$

1.1.2 = $Na_2CO_3 . NaHCO_3 . 2H_2O$ (Trona)

Results at 25° differing somewhat from the above are given by Makarow and Jakimow, 1933.

This system has also been very completly studied by Wegschaeider and Mehl, 1928, who give results for eleven isotherms between 20° and 94.5°. They also give results for an unstable form of Sodium carbonate obtained by the decomposition of the double salt 1.1.2 (Trona) with water.

CO

SODIUM CARBONATE

EQUILIBRIUM IN THE SYSTEM SODIUM CARBONATE, SODIUM BICARBONATE AND WATER AT TEMPERATURES FROM 100° TO 200°.

(Waldeck, Lynn and Hill, 1934.)

The chromium nickel steel bomb which was used differed from that employed for the solubility of sodium carbonate in water up to 348° in that the sampling receptacle was set in from the top instead of on the side.

Results at 100°

Gms. per 100 gms. sat. sol.		Solid Phase
Na_2CO_3	$NaHCO_3$	
30.7	0.0	$Na_2CO_3.H_2O$
29.9	2.3	"
29.1	4.2	" + 1.1.2
26.7	5.9	1.1.2
25.3	7.1	"
23.6	8.2	"
21.1	9.7	" + 1.3
19.3	10.7	1.3
16.5	11.9	"
13.4	14.4	"
12.7	14.4	" + $NaHCO_3$
15.3	13.8*	$NaHCO_3$
8.7	16.0	"
1.2	18.5	"

Results at 150°

Gms. per 100 gms. sat. sol.		Solid Phase
Na_2CO_3	$NaHCO_3$	
27.5	0.0	Na_2CO_3
24.4	7.4	"
20.9	15.9*	"
23.1	10.2	" + 1.1.2
22.4	11.9	1.1.2
20.7	15.4	" + 1.3
13.8	20.0	1.3
8.4	25.6	" + $NaHCO$
2.5	26.8	$NaHCO_3$

Results at 170°

Gms. per 100 gms. sat. sol.		Solid Phase
Na_2CO_3	$NaHCO_3$	
26.0	0.0	Na_2CO_3
18.9	18.3	" + 1.1.2
18.4	19.7	1.1.2
13.5	24.3	" + 1.3
9.7	28.4	1.3
7.5	31.2	" + $NaHCO_3$
3.6	31.7	$NaHCO_3$

Results at 190°

Gms. per 100 gms. sat. sol.		Solid Phase
Na_2CO_3	$NaHCO_3$	
19.7	11.6	Na_2CO_3
17.2	20.7	"
16.7	25.5	" + 1.1.2
13.7	28.9	1.1.2
10.2	33.0	" + 1.3
7.0	35.0	1.3 + $NaHCO_3$
1.7	36.8	$NaHCO_3$

Results at 200°

Gms. per 100 gms. sat. sol.		Solid Phase
Na_2CO_3	$NaHCO_3$	
19.9	7.5	Na_2CO_3
16.9	20.3	"
15.4	30.5	" + 1.3
13.0	32.4	1.3
9.0	36.4	" + $NaHCO_3$
6.1	38.6	$NaHCO_3$

1.1.2 = $Na_2CO_3.NaHCO_3.2H_2O$; 1.3 = $Na_2CO_3.3NaHCO_3$.

Results are also given for five additional invariant points.

EQUILIBRIUM IN THE SYSTEM SODIUM CARBONATE, SODIUM BICARBONATE, SODIUM CHLORIDE AND WATER AT VARIOUS TEMPERATURES.

(Freeth, 1922.)

Na 10 = $Na_2CO_3.10H_2O$; Na 7 = $Na_2CO_3.7H_2O$; Na 1 = $Na_2CO_3.H_2O$; NaH = $NaHCO_3$;
1.1.2 = $Na_2CO_3.NaHCO_3.2H_2O$ (sodium sesquicarbonate).

Gms. per 100 gms. sat. sol.			
Na_2CO_3.	$NaHCO_3$.	NaCl.	Solid Phase.
Results at 0°.			
3.78	3.51	4.61	Na 10 + NaH
2.89	2.83	9.53	»
2.39	2.14	15.14	»
2.63	0.92	21.32	»
2.77	1.11	22.84	» +1.1.2
2.99	0.73	23.86	Na 10+NaCl+ »
2.72	0.96	23.88	NaH+NaCl+ »
2.77	0.92	23.86	» »
1.30	0.73	25.05	» »
Results at 15°.			
11.42	4.05	3.06	Na 10+NaH
9.62	2.33	7.71	»
9.74	1.41	11.19	» +1.1.2
9.33	2.06	11.58	» »
4.80	1.91	18.52	NaH + 1.1.2
8.48	1.38	15.24	Na 10+1.1.2
9.11	0.19	20.49	Na 10+1.1.2+NaCl
6.41	0.08	22.18	» »
4.70	0.31	23.22	» »
3.25	0.61	23.93	NaH +1.1.2+NaCl

Gms. per 100 gms. sat. sol.			
Na_2CO_3.	$NaHCO_3$.	NaCl.	Solid Phase.
Results at 20°.			
16.17	3.40	2.22	Na 10+NaH+1.1.2
13.40	2.60	7.90	Na 10 + 1.1.2
12.58	1.07	13.97	»
13.40	0.61	17.54	Na 10+1.1.2+NaCl
8.48	0.69	20.50	1.1.2 + NaCl
5.35	0.84	22.38	»
14.60	3.51	3.87	1.1.2 + NaH
12.70	3.09	6.03	»
11.52	2.86	7.64	»
6.99	2.83	13.43	»
2.60	1.53	23.74	1.1.2+NaH+NaCl
Results at 25°.			
19.84	1.34	5.01	Na 10 + 1.1.2
18.99	0.76	11.09	»
18.99	0.80	11.38	Na 10+1.1.2+Na 7
18.36	0.53	12.84	1.1.2 + Na 7
17.28	0.34	15.28	1.1.2+Na 7+NaCl
13.28	0.61	17.72	1.1.2 + NaCl
7.28	0.53	21.35	»
11.35	2.90	7.57	1.1.2 + NaH
6.65	1.95	15.04	»
2.55	1.38	23.97	» + NaCl

C

Gms. per 100 gms. sat. sol.			
Na_2CO_3.	$NaHCO_3$.	NaCl.	Solid Phase.
Results at 30°.			
26.61	0.99	3.65	1.1.2+Na 10+Na 7
22.63	0.61	9.88	» + Na 1 + »
17.79	0.53	14.88	» + » +NaCl
13.20	0.99	17.69	» +NaCl
7.33	0.96	21.30	» »
11.21	3.32	7.70	» +NaH
6.70	2.25	14.96	» »
25.3	1.68	24.01	» » +NaCl
Results at 35°.			
21.96	0.12	8.30	1.1.2+Na 1
18.46	0.11	12.08	» »
30.27	0.57	1.97	» » +Na 7
17.04	0.61	15.52	» » +NaCl
13.23	0.57	17.85	» +NaCl
7.42	0.61	21.41	» »
11.57	3.59	7.61	» +NaH
6.72	2.56	14.85	» »
5.52	2.10	16.97	» »
3.25	0.76	23.75	» » +NaCl
3.01	1.34	23.92	» » »

Gms. per 100 gms. sat. sol.			
Na_2CO_3.	$NaHCO_3$.	NaCl.	Solid Phase.
Results at 45°.			
23.35	1 03	7.84	1.1.2+Na 1
18.97	0.50	12.62	» »
14.34	0.61	17.40	» » +NaCl
9.25	0.15	20.62	» +NaCl
6.84	0.50	21.98	» »
6.29	0.76	22.35	» »
4.29	1.11	23.43	» »
12.44	5.08	5.88	» +$NaHCO_3$
10.75	3.29	8.91	» »
6.94	2.52	14.70	» »
3.04	1.99	23.91	» » +NaCl
Results at 60°.			
25.59	1.57	4.73	1.1.2+Na 1
18 87	0.80	11.94	» »
12.39	0.53	19.13	» » +NaCl
10.75	0.73	20.06	» +NaCl
14.00	6.11	3.73	» +$NaHCO_3$
8.99	4.16	11.34	» »
3.45	1.83	23.88	» » +NaCl
3.11	2.56	24.37	» » »

Additional experiments upon this system made at 30°, 49.7° and at 89.5° are reported by Wegschneider and Mebl, 1928. These authors employed solutions in which the ratio of NaCl to H_2O was kept constant throughout. They make no reference to the previous results of Freeth.

The following additional determinations of this system at 35° are given by Teeple, 1929.

Gms. per 100 gms. H_2O			Solid Phase
Na_2CO_3	$NaHCO_3$	NaCl	
24.8	—	24.0	$Na_2CO_3.H_2O$ + NaCl
—	2.0	35.2	$NaHCO_3$ + "
49.2	0.8	—	$Na_2CO_3.H_2O$ + 1.1.2 (trona)
21.8	6.2	—	$NaHCO_3$ + "
24.7	0.3	24.0	$Na_2CO_3.H_2O$ + " + NaCl
4.2	1.8	33.5	$NaHCO_3$ + " + "

EQUILIBRIUM IN THE SYSTEM SODIUM CARBONATE, SODIUM BICARBONATE, SODIUM SULFATE AND WATER AT 25°.

(Makarow and Jakimow, 1933.)

CO

Gms. per 100 gms. sat. solution			Solid Phase
Na_2CO_3	$NaHCO_3$	Na_2SO_4	
16.5	3.86	5.88	$NaHCO_3$ + 1.1.2
13.41	3.00	13.72	" "
19.48	1.84	8.50	$Na_2CO_3.10H_2O$ + 1.1.2
18.50	1.72	11.64	" "
14.79	1.58	16.50	$Na_2SO_4.10H_2O$ + "
7.09	3.28	18.26	$NaHCO_3$ + $Na_2SO_4.10H_2O$
11.08	2.54	17.05	" + " + 1.1.2
17.62	1.36	16.21	$Na_2CO_3.10H_2O$ + $Na_2SO_4.10H_2O$ + 1.1.2

The following additional determinations of this system at 20° are given by Teeple, 1929.

Gms. per 100 gms. H_2O			Solid Phase
Na_2CO_3	$NaHCO_3$	Na_2SO_4	
—	5.4	17.1	$NaHCO_3$ + $Na_2SO_4.10H_2O$
6.9	—	15.8	$Na_2SO_4.10H_2O$
20.1	—	14.9	" + $Na_2CO_3.10H_2O$
20.3	—	12.5	$Na_2CO_3.10H_2O$
20.6	3.9	14.7	" + $NaHCO_3$ + $Na_2SO_4.10H_2O$
20.8	4.8	8.1	" + "
9.7	4.5	15.5	$Na_2SO_4.10H_2O$ + $NaHCO_3$

SOLUBILITY OF SODIUM CARBONATE IN AQUEOUS SOLUTIONS OF SODIUM BROMIDE AND OF SODIUM IODIDE AT 30°.

(Cocheret, 1911.)

In Aq. NaBr Solutions.

Gms. per 100 Gms. Sat. Sol. Na_2CO_3.	Gms. per 100 Gms. Sat. Sol. NaBr.	Solid Phase.
27.98	0	$Na_2CO_3.10H_2O$
27.54	2.41	"
26.72	4.06	"
26.23	6.26	" $+Na_2CO_3.7H_2O$
23.40	11	$Na_2CO_3.7H_2O$
22.68	12.22	"
19.86	16.88	"
19.57	16.95	" $+Na_2CO_3.H_2O$
18.11	19.32	$Na_2CO_3.H_2O$
8.45	33.39	"
6.90	36.13	"
3.04	44.75	"
2.99	45.31	" $+NaBr.2H_2O$
2.60	45.68	$NaBr.2H_2O$
0	49.40	"

In Aq. NaI Solutions.

Gms. per 100 Gms. Sat. Sol. Na_2CO_3.	Gms. per 100 Gms. Sat. Sol. NaI.	Solid Phase.
26.5	2.4	$Na_2CO_3.10H_2O$
25.5	4.7	"
24.4	8.6	"
24.3	9.5	" $+Na_2CO_3.7H_2O$
23	11.2	$Na_2CO_3.7H_2O$
20.8	14	"
18.7	18.4	"
15.3	25.4	" $+Na_2CO_3.H_2O$
13.1	29.1	$Na_2CO_3.H_2O$
10.4	33.3	"
4.2	46	"
2.7	51	"
0.9	57.6	"
0.3	65.6	" $+NaI.2H_2O$
0	65.5	$NaI.2H_2O$

SOLUBILITY OF SODIUM CARBONATE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AT 15°.

(Reich, 1891.)

Gms. per 100 Gms. H_2O. NaCl.	Gms. per 100 Gms. H_2O. $Na_2CO_3.10H_2O$.	Gms. NaCl per 100 Gms. Solution.	Gms. Na_2CO_3 per 100 Gms. NaCl Solution.
0	61.42	0	16.42
4.03	53.86	2.92	14.47
8.02	48	5.80	12.87
12.02	43.78	8.61	11.62
16.05	40.96	11.31	10.70
19.82	39.46	13.71	10.11
23.70	39.06	15.96	9.76
27.93	39.73	18.26	9.62
31.65	41.44	20.06	9.73
35.46	43.77	21.75	7.95
37.23	45.27*	22.46	10.13

* Both salts in solid phase.

SOLUBILITY OF SODIUM CARBONATE IN AQUEOUS SODIUM CHLORIDE AT 30°.

(Cocheret, 1911.)

Gms. per 100 Gms. Sat. Sol. Na_2CO_3.	Gms. per 100 Gms. Sat. Sol. NaCl.	Solid Phase.
27.98	0	$Na_2CO_3.10H_2O$
27.48	0.90	"
27.12	3.33	"
26.82	4.15	" $+Na_2CO_3.7H_2O$
25.59	5.17	$Na_2CO_3.7H_2O$
24.26	5.93	"
22.75	10.24	" $+Na_2CO_3.H_2O$
20.72	11.49	$Na_2CO_3.H_2O$
18	14.12	" +NaCl
14.81	16.26	NaCl
9.71	18.76	"
5.65	21.94	"
0	26.47	"

EQUILIBRIUM IN THE SYSTEM SODIUM CARBONATE, SODIUM CHLORIDE AND WATER.

(Freeth, 1922.)

Saturation was secured by means of constant stirring in a thermostat.

Results at 0°. Gms. per 100 gms. sat. sol. Na_2CO_3.	NaCl.	Results at 15°. Gms. per 100 gms. sat. sol. Na_2CO_3.	NaCl.	Results at 20°. Gms. per 100 gms. sat. sol. Na_2CO_3.	NaCl.	Solid Phase. at Each Temperature.
6.6	0.0	14.1	0.0	17.6	0.0	$NaCO.10H_2O$
4.3	4.5	9.9	9.9	15.5	4.0	»
3.7	8.2	8.7	14.7	14.1	7.7	»
3.1	12.3	–	–	12.9	12.8	»
2.9	15.6	– (10.6)	– (7.2)	–	–	»
2.8	20.4	– (10.2)	– (13.7)	–	–	»
2.8 (3.16)	24.2 (25.5)	9.2 (9.6)	20.2 (20.4)	13.5	17.4	» + NaCl
0.0	26.3	3.5 (3.1)	24.0 (24.3)	6.9	22.0	NaCl
		0.0	26.3	9.5	20.3	»
				11.5	18.9	»
				0.0	26.4	»

The results in parentheses are by Mondain-Monval, 1922.

t°.	Gms. per 100 gms. sat. sol. Na_2CO_3.	NaCl.	Solid Phase.	t°.	Gms. per 100 gms. sat. sol. Na_2CO_3.	NaCl.	Solid Phase.
25....	22.7	0.0	$Na_2CO_3.10H_2O$	35...	32.9	0.0	$Na_2CO_3.7H_2O$
25....	19.6	5.6	»	35...	31.5	2.0	»
25....	18.8	10.8	»	35...	31.0	2.5	» + $Na_2CO_3.H_2O$
25....	19.0	11.8	» + $Na_2CO_3.7H_2O$	35...	30.2	2.9	$Na_2CO_3.H_2O$
25....	18.4	13.0	$Na_2CO_3.7H_2O$	35...	25.5	7.1	»
25....	17.3	15.5	» + NaCl	35...	16.8	16.1	» + NaCl
25....	7.9	21.3	NaCl	35...	7.4	21.7	NaCl
25....	0.0	26.4	»	35...	4.0	24.0	»
30....	28.5	0.0	$Na_2CO_3.10H_2O$	40...	32.2	0.0	$Na_2CO_3.H_2O$
30....	27.0	3.7	»	40...	28.2	3.9	»
30....	26.9	3.9	» + $Na_2CO_3.7H_2O$	40...	24.4	7.3	»
30....	26.6	4.2	$Na_2CO_3.7H_2O$	40...	20.7	11.1	»
30....	24.6	7.2	»	40...	17.6	14.6	»
30....	22.7	9.3	»	40...	15.0	17.4	» + NaCl
30....	22.5	10.2	» + $Na_2CO_3.H_2O$	40...	10.3	20.2	NaCl
30....	21.9	10.4	$Na_2CO_3.H_2O$	40...	3.6	24.2	»
30....	20.5	11.1	»	60...	31.8	0.0	$Na_2CO_3.H_2O$
30....	21.2	12.9	$Na_2CO_3.7H_2O$ + NaCl	60...	24.0	7.2	»
30....	17.7	15.0	$Na_2CO_3.H_2O$ + NaCl	60...	20.2	10.9	»
30....	5.0	22.7	NaCl	60...	16.6	14.5	»
30....	0.0	26.5	»	60...	13.9	17.8	» + NaCl

The following results for the invariant points at other temperatures are given by Makarow, 1932.

t°	Gms. per 100 gms. sat. sol. Na_2CO_3	NaCl	Solid Phase
-21.4	1.4	23.0	Ice + $Na_2CO_3.10H_2O$ + $NaCl.2H_2O$
- 1.2	2.6	24.4	$Na_2CO_3.10H_2O$ + $NaCl.2H_2O$ + NaCl
+21.0	15.1	16.7	" + $Na_2CO_3.7H_2O$ + "
22	15.8	16.7	+ " + "
"	16.3	14.7	$Na_2CO_3.10H_2O$ + "
26.2	20.2	10.0	" + "
"	18.5	14.3	$Na_2CO_3.H_2O$ + " + NaCl
27.0	21.6	8.8	$Na_2CO_3.10H_2O$ + "
"	19.2	13.6	$Na_2CO_3.H_2O$ + "
"	18.3	14.5	" + "

EQUILIBRIUM IN THE SYSTEM SODIUM BICARBONATE, SODIUM CHLORIDE AND WATER.

(Freeth, 1922.)

Results at 0°. Gms. per 100 gms. sat. sol.		Results at 15°. Gms. per 100 gms. sat. sol.		Results at 20°. Gms. per 100 gms. sat. sol.		Results at 25°. Gms. per 100 gms. sat. sol.		Solid Phase at Each Temp.
NaHCO₃.	NaCl.	NaHCO₃.	NaCl.	NaHCO₃.	NaCl.	NaHCO₃.	NaCl.	
6.5	0.0	8.1	0.0	8.7	0.0	9.3	0.0	$NaHCO_3$
2.7	8.8	3.8	8.6	4.2	8.5	3.2	12.7	»
1.1	19.8	2.0	16.4	1.7	19.5	1.8	19.7	»
0.6	25.9	0.9 (0.77)	26.1 (26.1)	1.0	26.1	1.2	26.0	»+NaCl

The results in parentheses are by Toporescu, 1922.

Results at 30°. Gms. per 100 gms. sat. sol.		Result at 35°. Gms. per 100 gms. sat. sol.		Result at 45°. Gms. per 100 gms. sat. sol.		Result at 60°. Gms. per 100 gms. sat. sol.		Solid Phase at Each Temp.
NaHCO₃.	NaCl.	NaHCO₃.	NaCl.	NaHCO₃.	NaCl.	NaHCO₃.	NaCl.	
9.9	0.0	10.6	0.0	12.0	0.0	14.1	0.0	$NaHCO_3$
4.9	8.8	4.7	10.3	5.8	10.5	7.4	10.0	»
1.9	19.5	2.1	19.6	2.7	19.2	3.7	19.1	»
1.2	26.1	1.3	26.2	1.5	26.2	2.2	26.4	»+NaCl

SOLUBILITY OF SODIUM BICARBONATE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE SATURATED WITH CO₂.

CO

(Fedotieff; see also Reich, 1891.)

t°.	Wt. of 1 cc. Solution.	Mols. per 1000 Gms. H₂O. NaCl.	Mols. per 1000 Gms. H₂O. NaHCO₃.	Grams per 1000 Gms. H₂O. NaCl.	Grams per 1000 Gms. H₂O. NaHCO₃.
0	..	0.0	0.82	0.0	69.0
"	1.208	6.0	0.09	350.1	7.7
15	1.056	0.0	1.05	0.0	88.0
"	1.063	0.52	0.82	30.2	68.6
"	1.073	1.03	0.64	60.1	53.6
"	1.096	2.11	0.41	123.1	34.8
"	1.127	3.20	0.28	187.2	23.0
"	1.158	4.39	0.19	256.9	16.1
"	1.203	6.06	0.12	354.6	10.0
30	1.066	0.0	1.31	0.0	110.2
"	1.079	1.02	0.87	59.9	72.8
"	1.100	2.08	0.56	121.9	47.3
"	1.127	3.18	0.38	186.3	32.0
"	1.156	4.38	0.27	256.0	22.3
"	1.199	6.12	0.17	358.1	13.9
45	1.077	0.0	1.65	0.0	138.6
"	1.086	1.04	1.12	60.7	94.0
"	1.115	2.65	0.62	155.2	52.0
"	1.127	3.24	0.52	189.4	43.4
"	1.155	4.38	0.37	256.1	30.7
"	1.198	6.18	0.23	361.5	19.5

SODIUM CARBONATE

EQUILIBRIUM IN THE SYSTEM SODIUM CARBONATE, SODIUM CHLORIDE AND SODIUM SULFATE.

(Teeple, 1929.)

Gms. per 100 gms. H_2O			Solid
Na_2CO_3	Na_2SO_4	NaCl	Phase
Results at 20°			
20.1	14.9	—	C.10 + S.10
20.3	12.5	—	C.10
6.9	15.8	—	S.10
19.8	—	25.4	C.10 + Cl
18.0	—	9.9	C.10
17.4	—	17.2	"
—	13.0	29.0	S.10 + S
—	12.5	11.8	S.10
—	11.7	20.4	"
—	12.1	26.2	"
—	11.0	31.8	S + Cl
13.5	—	28.9	Cl
18.8	13.8	11.5	C.10 + S.10 + B
19.7	11.2	17.3	C.10 + B
19.2	13.8	7.2	C.10 + S.10
21.1	6.2	23.2	" + Cl + B
11.0	14.1	21.4	" + S + B
8.3	10.5	28.5	Cl + " + "
Results at 35°			
—	9.2	33.6	S + Cl
24.8	—	23.9	C.1 + Cl
45.8	6.9	—	C.1 + B
18.5	34.3	—	S + B
Results at 35° (con.)			
24.2	2.7	23.2	C.1 + Cl + B
4.6	8.8	30.7	S + Cl + B
Results at 50°			
—	7.3	33.7	S + Cl
20.9	—	27.0	C.1 + Cl
44.4	6.3	—	C.1 + B
12.6	36.7	—	S + B
20.2	2.0	26.4	C.1 + Cl + B
2.9	7.7	32.9	S + Cl + B
Results at 75°			
—	6.8	35.5	S + Cl
16.4	—	30.8	C.1 + Cl
42.9	5.4	—	C.1 + B
7.9	39.0	—	S + B
16.6	1.4	30.3	C.1 + B + Cl
1.5	6.7	35.2	S + B + Cl
Results at 100°			
—	6.5	37.3	S + Cl
15.1	—	33.5	Cl + C.1
1.2	6.7	37.2	Cl + S + B
14.9	0.9	33.1	Cl + C.1 + B

CO

C.10 = $Na_2CO_3.10H_2O$; C.1 = $Na_2CO_3.H_2O$; S.10 = $Na_2SO_4.10H_2O$; S = Na_2SO_4
Cl = NaCl; B = Burkeite, $Na_2CO_3.2Na_2SO_4$.

EQUILIBRIUM IN THE SYSTEM SODIUM BICARBONATE, SODIUM CHLORIDE, SODIUM SULFATE AND WATER AT 20°.

(Teeple, 1929.)

Gms. per 100 gms. H_2O			Solid
$NaHCO_3$	Na_2SO_4	NaCl	Phase
5.4	17.1	—	$NaHCO_3$ + S.10
—	12.5	11.8	S.10
—	11.7	20.4	"
—	12.1	26.2	"
—	13.0	29.0	S.10 + S
2.1	13.2	27.8	$NaHCO_3$ + S.10 + S
2.0	12.5	25.8	" + "
1.7	10.8	31.4	" + NaCl + S

S.10 = $Na_2SO_4.10H_2O$; S = Na_2SO_4.

EQUILIBRIUM IN THE SYSTEM SODIUM BICARBONATE, SODIUM CHLORIDE AND WATER UNDER 1.2 ATMOSPHERES PRESSURE OF CARBON DIOXIDE.

(Neumann and Domke, 1928.)

Results at 20°		Results at 30°		Results at 40°	
Gms. per 1000 cc sat. sol.		Gms. per 1000 gms. sat. sol.		Gms. per 100 cc sat. sol.	
NaCl	$NaHCO_3$	NaCl	$NaHCO_3$	NaCl	$NaHCO_3$
0.0	90.8	0.0	104.2	0.0	119.6
45.5	61.7	34.1	80.0	98.5	56.9
143.0	33.3	103.2	47.3	178.6	35.6
310.9	9.92	311.3	12.6	311.9	15.6
312.3	0.0	314.4	0.0	316.0	0.0

SOLUBILITY OF SODIUM BICARBONATE IN AQUEOUS AMMONIUM BICARBONATE SOLUTIONS SATURATED WITH CO_2.

(Fedotieff, 1901.)

t°.	Wt. of 1 cc. Solution.	Mols. per 1000 Gms. H_2O.		Grams per 1000 Gms. H_2O.	
		NH_4HCO_3.	$NaHCO_3$.	NH_4HCO_3.	$NaHCO_3$.
0	1.072	1.39	0.58	109.4	48.2
"	...	0.0	0.82	0.0	69.0
15	1.056	0.0	1.05	0.0	88.0
"	1.061	0.29	0.95	23.0	80.0
"	1.065	0.56	0.89	44.0	74.6
"	1.073	1.08	0.79	85.7	66.7
"	1.090	2.16	0.71	170.6	59.2
30	...	0.0	1.65	0.0	138.6
"	...	2.91	0.83	230	70.0

CO

EQUILIBRIUM IN THE SYSTEM SODIUM CARBONATE, SODIUM HYDROXIDE, SODIUM CHLORIDE AND WATER AT VARIOUS TEMPERATURES. (Freeth, 1922.)

Gms. per 100 gms. sat. sol.				Gms. per 100 gms. sat. sol.			
Na_2CO_3.	NaOH.	NaCl.	Solid Phase.	Na_2CO_3.	NaOH.	NaCl.	Solid Phase.
Results at 0°.				Results at 20°.			
2.4	8.4	17.3	Na 10+NaCl	12.8	1.7	16.9	Na10+Na7+NaCl.
2.4	14.3	12.7	» »	11.6	9.5	6.9	» »
2.8	16.0	11.2	» » +Na7	12.0	3.6	15.9	NaCl+ »
2.9	20.5	4.2	» +Na7	9.6	8.5	13.4	» »
2.9	19.9	8.5	Na1+ » +NaCl	9.6	9.7	12.4	» » +Na1
3.4	22.1	4.2	» »	10.1	12.4	7.5	Na1+ »
2.2	25.1	6.9	» +NaCl	10.6	15.5	1.9	» »
1.9	23.0	6.5	» »	7.0	12.3	11.9	» +NaCl
1.2	25.8	5.6	» »	1.2	25.1	6.6	» »
0.6	29.2	4.3	« »	1.7	46.7	0.9	» »
Results at 15°.				Results at 25°.			
9.2	1.5	19.4	Na 10+NaCl	18.1	1.7	8.6	Na10+Na7
8.4	5.8	16.2	» »	18.3	6.3	3.3	» »
8.7	7.2	14.9	» » +Na7	15.9	1.7	15.0	NaCl+ »
7.9	10.4	10.5	» +Na7	14.9	8.6	6.4	Na1+ »
8.7	15.6	2.4	» »	15.2	11.0	3.2	» + »
7.5	10.6	12.7	NaCl+ »	13.5	4.4	14.1	» + » +NaCl
7.2	12.5	11.7	» » +Na1	9.1	8.9	13.5	» +NaCl
8.2	13.6	9.6	Na7+Na1	3.1	18.5	9.9	» »
7.9	17.7	3.1	» »	0.3	41.5	1.5	» »
1.9	23.1	7.4	NaCl+ »	0.3	44.0	1.3	» »
0.2	46.2	0.9	» »	0.5	45.7	1.1	» »+Na_2CO_3
				0.2	49.9	1.0	NaCl+Na_2CO_3

EQUILIBRIUM IN THE SYSTEM SODIUM CARBONATE, SODIUM HYDROXIDE, SODIUM CHLORIDE AND WATER AT VARIOUS TEMPERATURES (CON.).

(Freeth, 1922.)

Gms. per 100 gms. sat. sol.				Gms. per 100 gms. sat. sol.			
Na_2CO_3.	NaOH.	NaCl.	Solid Phase.	Na_2CO_3.	NaOH.	NaCl.	Solid Phase.
			Results at 30°.				Results at 45°.
26.7	2.2	1.2	Na 10 + Na 7	9.2	6.1	16.7	Na 1 + NaCl
23.1	1.5	7.6	Na 1 + »	2.9	18.1	10.8	» »
22.4	5.2	2.9	» »	0.4	33.4	3.8	» »
6.0	12.4	12.5	» + NaCl	0.3	37.2	2.7	» » + Na_2CO_3
0.2	34.6	3.0	» + »	0.3	38.8	2.4	Na_2CO_3 + NaCl
0.2	41.8	1.5	» + » + Na_2CO_3	0.2	40.4	2.1	» »
0.2	51.3	1.0	Na_2CO_3 + NaCl	0.5	54.1	1.3	» »
			Results at 35°.				Results at 60°.
11.0	5.4	15.3	Na 1 + NaCl	5.8	9.4	15.8	Na 1 + NaCl
4.6	14.7	11.8	» »	2.6	18.1	11.3	» »
1.4	24.9	7.0	» »	1.7	22.3	8.4	» »
0.3	40.8	1.8	» » + Na_2CO_3	0.5	33.2	4.3	» » + Na_2CO_3
1.0	49.0	1.2	Na_2CO_3 + NaCl	0.2	52.6	1.7	Na_2CO_3 + NaCl

The following temperatures of the fixed points were determined.

SOLID PHASES IN CONTACT WITH SOLUTION.

t°.		t°.	
21.0	Na 10 + NaCl + Na 7	31.0	Na 10 + Na 7 + 1.1.2
26.2	Na 7 + NaCl + Na 1	34.5	Na 7 + Na 1 + 1.1.2
19.7	Na 10 + NaH + 1.1.2		

CO Na 10 = $Na_2CO_3.10H_2O$; Na 7 = $Na_2CO_3.7H_2O$; Na 1 = $Na_2CO_3.H_2O$; NaH = $NaHCO_3$; 1.1.2 = $Na_2CO_3.NaHCO_3.2H_2O$ (sodium sesqui carbonate).

EQUILIBRIUM IN THE SYSTEM SODIUM CARBONATE, SODIUM CHLORATE AND WATER AT 24°.2.

(Iljinsky, 1924.)

The solutions were actively shaken at constant temperature and the attainment of equilibrium controlled by successive determinations of density and by analyses. The Na_2CO_3 was determined by titration with 0.1 *n* H Cl. The chlorate, by boiling with excess of Mohr's salt and titrating with chromate (?).

d of sat. sol.	Gms. per 100 gms. H_2O.		Solid Pase.	*d* of sat. sol.	Gms. per 100 gms. H_2O.		Solid Phase.
	Na_2CO_3.	$NaClO_3$.			Na_2CO_3.	$NaClO_3$.	
1.224	28.5	0.0	$Na_2CO_3.10H_2O$	1.433	22.0	66.3	$Na_2CO_3.7H_2O$
1.236	26.8	5.2	»	1.439	22.5	66.5	»
1.250	25.9	10.7	»	1.443	21.8	69.3	»
1.274	24.7	16.1	»	1.443	22.2	69.4	»
1.277	25.1	16.4	»	1.440	22.1	69.8	»
1.293	24.3	20.7	»	1.442	21.4	71.0	» + $NaClO_3$
1.299	24.3	22.6	»	1.444	20.7	71.8	$NaClO_3$
1.381	24.5	45.1	»	1.439	11.7	84.0	»
1.383	24.65	46.2	» + $Na_2CO_3.7H_2O$	1.431	5.3	91.8	»
1.391	24.8	47.3	$Na_2CO_3.7H_2O$	1.432	7.7	92.0	»
1.386	24.8	47.5	»	1.431	7.7	93.5	»
1.404	23.7	53.2	»	1.431	5.0	93.8	»
1.410	23.8	54.1	»	1.425	2.5	94.9	»
–	23.2	58.5	»	1.438	3.9	95.2	»
1.425	23.9	60.6	»	1.441	5.5	95.6	»
1.421	23.3	61.6	»	1.429	0.0	98.6	»
1.425	23.0	61.9	»	1.462	0.0	116.4	» (at 40°)
1.436	22.5	66.2	»	1.466	16.2	100.8	» + $Na_2CO_3.H_2O$ (at 40°)

EQUILIBRIUM IN THE SYSTEM SODIUM CARBONATE, SODIUM IODATE AND WATER.

(Foote and Vance, 1933.)

t^0	Gms. per 100 gms. sat. sol.		Solid Phase	t^0	Gms. per 100 gms. sat. sol.		Solid Phase
	$NaIO_3$	Na_2CO_3			$NaIO_3$	Na_2CO_3	
0	0.0	6.42	$Na_2CO_3.10H_2O$	40	0.0	32.83	$Na_2CO_3.H_2O$
"	0.82	6.29	" + $NaIO_3.5H_2O$	"	0.50	32.68	"
"	2.42	0.0	$NaIO_3.5H_2O$	"	1.79	32.04	" + $NaIO_3.H_2O$
25	0.0	22.60	$Na_2CO_3.10H_2O$	"	2.00	29.87	$NaIO_3.H_2O$
"	0.52	22.44	"	"	11.71	0.0	"
"	2.16	22.22	" + $NaIO_3.H_2O$	50	0.0	32.16	$Na_2CO_3.H_2O$
"	2.54	18.82	$NaIO_3.H_2O$	"	1.30	31.52	"
"	8.66	0.0	"	"	2.48	31.27	" + $NaIO_3.H_2O$
				"	3.34	25.44	$NaIO_3.H_2O$
				"	14.06	0.0	"

SOLUBILITY OF SODIUM CARBONATE IN AQUEOUS SOLUTIONS OF SODIUM NITRATE.

(Kremann and Zitek, 1909.)

t°.	Gms. per 100 Gms. H_2O.		Solid Phase.	t°.	Gms. per 100 Gms. H_2O.		Solid Phase.
	Na_2CO_3.	$NaNO_3$.			Na_2CO_3.	$NaNO_3$.	
10	11.98	0	$Na_2CO_3.10H_2O$	24.2	24.63	54.43	$Na_2CO_3.7H_2O$
10	8.75	70.48	" $+NaNO_3$	24.2	21.8	62.7	" $+NaNO_3$
10	0	80.5	$NaNO_3$	24.2	5.96	84.45	$NaNO_3$
24.2	28.55	0	$Na_2CO_3.10H_2O$	24.2	0	91.3	"
24.2	26.33	45.96	" $+Na_2CO_3.7H_2O$				

CO

SOLUBILITY OF SODIUM BICARBONATE IN AQUEOUS SODIUM NITRATE SOLUTIONS.

(Fedotieff and Koltunoff, 1914.)

t°.	Sp. Gr. of Sat. Sol.	Gms. per 100 Gms. H_2O.	
		$NaNO_3$.	$NaHCO_3$.
0	1.356	72.74	1.41
15	1.183	29.06	3.40
15	1.285	54.56	2.16
15	1.377	83.20	1.57
30	...	95.14	1.80

EQUILIBRIUM IN THE SYSTEM SODIUM CARBONATE, SODIUM HYDROXIDE AND WATER AT TEMPERATURES ABOVE 150°.

(Schroeder, Berk and Gabriel, 1936.)

t^0	Gms. per 100 gms. H_2O		t^0	Gms. per 100 gms. H_2O	
	Na_2CO_3	NaOH		Na_2CO_3	NaOH
150	37.5	0.0	250	11.5	21.4
"	26.2	7.2	"	10.0	40.0
"	13.4	19.5	350	2.0	0.0
250	20.0	0.0	"	4.9	8.1
"	14.2	8.1	"	12.7	20.2

EQUILIBRIUM IN THE SYSTEM SODIUM CARBONATE, SODIUM HYDROXIDE AND WATER. (Freeth, 1922.)

Saturation was secured by constant stirring in a thermostat. For the strong sodium hydroxide solutions silver bottles provided with mercury-sealed rotating stirrers were used. The composition of the solid phases was determined by the Schreinemakers « rest method ». CO_2 was determined gravimetrically by absorption in K OH, Cl by the Volhard silver nitrate titration and sodium hydroxide by titration with standard sulfuric acid solution.

t°.	Gms. per 100 gms. sat. sol.		Solid Phase.
	Na_2CO_3	NaOH.	
0...	6.4	0.0	$Na_2CO_3.10H_2O$
0...	2.6	8.1	»
0...	2.2	18.4	»
0...	2.7	20.9	»
0...	3.1	22.3	» + $Na_2CO_3.7H_2O$
0...	3.1	23.0	$Na_2CO_3.7H_2O$ + $Na_2CO_3.H_2O$
0...	1.2	28.9	$Na_2CO_3.H_2O$
0...	0.0	29.6	$NaOH.4H_2O$
15...	14.1	0.0	$Na_2CO_3.10H_2O$
15...	10.1	4.8	»
15...	7.5	13.8	»
15...	8.9	17.0	» + $Na_2CO_3.7H_2O$
15...	7.7	19.3	$Na_2CO_3.7H_2O$
15...	7.9	19.4	» + $Na_2CO_3.H_2O$
15...	6.3	20.8	$Na_2CO_3.H_2O$
15...	4.1	23.9	»
15...	1.2	30.6	»
15...	0.2	44.9	»
15...	0.6	47.3	» + Na_2CO_3
15...	0.7	49.8	Na_2CO_3
15...	0.0	51.2	$NaOH.H_2O$
15...	0.0	37.5	$NaOH.3\,^1/_2H_2O$
15...	0.0	41.5	»
20...	18.0	0.0	$Na_2CO_3.10H_2O$
20...	12.9	6.3	»
20...	11.6	12.7	»
20...	12.4	13.4	» + $Na_2CO_3.7H_2O$
20...	11.7	14.7	$Na_2CO_3.7H_2O$
20...	11.1	16.2	» + $Na_2CO_3.H_2O$
20...	5.2	22.0	$Na_2CO_3.H_2O$
20...	1.1	29.7	»
20...	0.3	39.8	$Na_2CO_3.H_2O$
20...	0.3	41.5	» + Na_2CO_3
20...	5.4	43.9*	Na_2CO_3
20...	9.6	43.8*	»
20...	0.0	52.1	$NaOH.H_2O$
25...	22.7	0.0	$Na_2CO_3.10H_2O$
25...	18.2	5.4*	»
25...	18.1	7.0	»
25...	18.0	9.3	» + $Na_2CO_3.7H_2O$
25...	21.0	5.8**	$Na_2CO_3.7H_2O$
25...	17.6	9.7	»
25...	16.7	10.7	»
25...	15.4	12.7	» + $Na_2CO_3.H_2O$
25...	1.2	30.6	$Na_2CO_3.H_2O$
25...	0.5	37.5	»
25...	0.5	42.4	» + Na_2CO_3
25...	4.5	47.1*	Na_2CO_3
25...	0.0	53.3	$NaOH.H_2O$
30...	28.4	0.0	$Na_2CO_3.10H_2O$
30...	26.5	3.1	»
30...	26.7	3.5	» + $Na_2CO_3.7H_2O$
30...	25.7	4.0	$Na_2CO_3.7H_2O$
30...	24.3	5.5	»
30...	21.9	7.9	» + $Na_2CO_3.H_2O$
30...	19.0	9.8	$Na_2CO_3.H_2O$
30...	13.7	13.8	»
30...	0.9	31.2	»
30...	15.1	35.0*	» + Na_2CO_3
30...	0.5	41.6	» »
30...	2.5	44.5*	Na_2CO_3
30...	6.1	49.1*	»
30...	0.0	54.3	$NaOH.H_2O$

* This solution was not clear. ** Supersaturated solution.

t°.	Gms. per 100 gms. sat. sol.		Solid Phase.
	Na_2CO_3.	NaOH.	
35...	32.9	0.0	$Na_2CO_3.7H_2O$
35...	32.0	0.6	» + $Na_2CO_3H_2O$
35...	25.3	4.9	$Na_2CO_3.H_2O$
35...	15.2	11.9	»
35...	7.5	18.7	»
35...	1.9	27.5	»
35...	0.5	34.2	»
35...	0.5	39.2	» + Na_2CO_3
35...	0.2	39.5	Na_2CO_3
35...	0.2	44.8	»
35...	0.2	50.2	»
35...	0.0	55.4	$NaOH.H_2O$
45...	0.5	37.8	$Na_2CO_3.H_2O$
45...	0.5	38.3	» + Na_2CO_3
45...	0.5	47.0	Na_2CO_3
45...	0.2	52.4	»
45...	0.0	57.8	$NaOH.H_2O$
60...	31.8	0.0	$Na_2CO_3.H_2O$
60...	22.5	6.1	»
60...	14.2	12.2	»
60...	6.9	19.4	»
60...	1.1	32.6	»
60...	0.8	34.4	» + Na_2CO_3
60...	0.7	35.4	Na_2CO_3

EQUILIBRIUM IN THE SYSTEM SODIUM CARBONATE, SODIUM SULFATE AND WATER AT 25°.

(Makarow and Jakimow, 1933.)

Gms. per 100 gms. sat. sol. Na_2CO_3	Gms. per 100 gms. sat. sol. Na_2SO_4	Solid Phase	Gms. per 100 gms. sat. sol. Na_2CO_3	Gms. per 100 gms. sat. sol. Na_2SO_4	Solid Phase
22.94	0.0	$Na_2CO_3.10H_2O$	18.61	14.59	$Na_2CO_3.10H_2O$
21.77	3.76	"	18.28	16.38	" + $Na_2SO_4.10H_2O$
21.05	6.01	"	15.14	16.64	$Na_2SO_4.10H_2O$
19.60	10.03	"	9.11	18.12	"
18.87	12.75	"	3.54	20.20	"
			0.0	21.97	"

EQUILIBRIUM IN THE SYSTEM SODIUM BICARBONATE, SODIUM SULFATE AND WATER AT 25°.

(Makarow, and Jakimow, 1933.)

Gms. per 100 gms. sat. sol. $NaHCO_3$	Gms. per 100 gms. sat. sol. Na_2SO_4	Solid Phase	Gms. per 100 gms. sat. sol. $NaHCO_3$	Gms. per 100 gms. sat. sol. Na_2SO_4	Solid Phase
9.39	0.0	$NaHCO_3$	4.16	20.68	$Na_2SO_4.10H_2O$
5.75	9.87	"	3.77	20.80	"
6.03	11.14	"	0.0	21.90	"
4.14	20.58	" + $Na_2SO_4.10H_2O$			

EQUILIBRIUM IN THE SYSTEM SODIUM CARBONATE, SODIUM SULFATE AND WATER AT 19°.1 AND 50°.

(Dawkins, 1922.)

The mixtures were constantly stirred in a thermostat. Both the saturated solutions and the undissolved residues were analyzed. The solid phase was mixed crystals in all cases.

CO

	At 19°.1.				At 50°.			
	Gms. per 100 gms. sat. sol.		Gms. per 100 gms. undissolved residue.		Gms. per 100 gms. sat. sol.		Gms. per 100 gms. undissolved residue.	
d of sat. sol.	Na_2CO_3.	Na_2SO_4.	Na_2CO_3.	Na_2SO_4.	Na_2CO_3.	Na_2SO_4.	Na_2CO_3.	Na_2SO_4.
1.19	15.97	4.97	28.29	2.34	28.64	5.35	66.20	3.35
1.22	14.92	9.05	30.82	3.19	28.52	5.87	52.91	11.77
1.23	14.82	9.50	26.88	4.80	25.71	7.52	26.87	36.86
1.29	14.53	10.47	19.31	16.88	19.37	12.92	22.10	45.36
1.28	13.84	10.69	6.84	29.42	12.55	20.35	16.69	47.06
1.26	12.13	11.06	6.37	28.04	10.52	22.47	11.53	63.05
1.21	9.22	11.89	4.54	29.30	10.21	23.10	6.53	61.86
1.15	4.85	13.17	2.30	31.87	5.06	27.31	1.56	80.58

EQUILIBRIUM IN THE SYSTEM SODIUM BICARBONATE, SODIUM SULFATE AND WATER.

Results at several temperatures.

(Nishizawa, 1920.)

t°.	Gm. mols. per 1000 gm. mols. H_2O. $NaHCO_3$.	Gm. mols. per 1000 gm. mols. H_2O. Na_2SO_4.	Solid Phase.
15.0...	18.53	0.0	$NaHCO_3$
15.0...	12.75	14.18	" + $Na_2SO_4.10H_2O$
30.0...	23.61	0.0	$NaHCO_3$
30.0...	8.55	48.84	" + $Na_2SO_4.10H_2O$
40.0...	26.92	0.0	$NaHCO_3$
40.0...	9.45	57.14	" + $Na_2SO_4.10H_2O$

Results at 35°.

(Fedoteiff and Kolosoff, 1923.)

d of sat. sol.	Gms. per 100 gms. H_2O. $NaHCO_3$.	Gms. per 100 gms. H_2O. Na_2SO_4.	Solid Phase.
1.05...	11.66	0.0	$NaHCO_3$
1.13...	8.81	7.10	"
1.22...	5.67	17.38	"
1.31...	4.69	36.05	"
1.41...	3.65	46.31	" + Na_2SO_4

The following results are also given by Nishizawa, 1920, for solutions simultaneousy saturated with sodium bicarbonate, sodium sulfate and the double salt, 1.1.4 = $Na_2SO_4.(NH_4)_2SO_4.4H_2O$.

t°.	Gms. mols. per 1000 gms. mols. H_2O. $NaHCO_3$.	Gms. mols. per 1000 gms. mols. H_2O. Na_2SO_4.	Gms. mols. per 1000 gms. mols. H_2O. $(NH_4)_2SO_4$.	Solid Phase.
15.0......	12.84	26.22	45.86	$NaHCO_3 + Na_2SO_4.10H_2O$ + 1.1.4
30.0......	7.85	55.03	31.83	$NaHCO_3 + Na_2SO_4$ + 1.1.4
40.0......	11.26	49.33	45.41	$NaHCO_3 + Na_2SO_4$ + 1.1.4

EQUILIBRIUM IN THE SYSTEM SODIUM CARBONATE, SODIUM SULFATE AND WATER AT VARIOUS TEMPERATURES. (Caspari, 1924.)

The mixtures were constantly rotated in a thermostat. Since the branches of the isotherms were nearly straight lines data are given only for the end points corresponding to the intersections.

S 10 = $Na_2SO_4.10H_2O$*; C 10 = $Na_2CO_3.10H_2O$; C 7 = $Na_2CO_3.7H_2O$; C 1 = $Na_2CO_3.H_2O$; 1.2 = $Na_2CO_3.2Na_2SO_4$.

t°.	Gms. per 100 gms. sat. sol.		Solid Phase.	t°.	Gms. per 100 gms. sat. sol.		Solid Phase.
	Na_2CO_3.	Na_2SO_4.			Na_2CO_3.	Na_2SO_4.*	
- 2.45.	5.21	2.06	C 10 + S 10 + Ice	30.0...	10.2	25.1	S 10 + Na_2SO_4
- 2.1...	5.75	0.0	C 10 + Ice	30.0...	0.0	29.3	»
15.0...	14.1	0.0	C 10	35.0...	33.0	0.0	C 7
15.0...	12.3	8.0	» + S 10	35.0...	30.0	5.7	» + 1.2
16.0...	0 0	11.8	S 10	35.0...	14.3	20.6	1.2 + Na_2SO_4
20.0...	17.75	0.0	C 10	35.0...	0.0	33.15	Na_2SO_4
20.0...	14.95	11.2	« + S 10	50.0...	32.2	0.0	C 1
20.0...	0.0	16.25	S 10	50.0...	29.7	5.5	» + 1.2
25.0...	22.6	0.0	C 10	50.0...	11.4	22.2	1.2 + Na_2SO_4
25.0...	17.9	16.2	» + S 10	50.0...	0.0	31.8	Na_2SO_4
25.0...	0.0	21.9	S 10	75.0...	31.45	0.0	C 1
30.0 ..	27.15	0.0	C 10	75.0...	29.0	4.8	» + 1.2
30.0...	25.8	8.6	» + 1.2	75.0...	7.6	24.2	1.2 + Na_2SO_4
30.0...	15.5	19.5	1.2 + Na_2SO_4	75.0...	0.0	39.4	Na_2SO_4

EQUILIBRIUM IN THE SYSTEM SODIUM CARBONATE, SODIUM SULFATE AND WATER AT TEMPERATURES UP TO 350°.

(Schroeder, Berk and Gabriel, 1936.)

CO These experiments were made in connection with studies upon boiler-feed water.

Results at 150°

Gms. per 100 gms. H_2O Na_2CO_3	Gms. per 100 gms. H_2O Na_2SO_4
1.5	41.3
2.8	40.6
3.1	40.0
4.3	35.0
8.2	26.6
12.9	20.3
17.8	15.6
22.2	12.3
32.3	7.2
34.7	6.2
36.2	4.7
37.0	3.0

Results at 200°

Gms. per 100 gms. H_2O Na_2CO_3	Gms. per 100 gms. H_2O Na_2SO_4
1.5	43.9
1.9	41.4
2.4	38.1
3.7	33.1
5.1	27.9
7.1	23.4
9.3	20.5
12.0	18.0
16.4	13.9
21.7	11.4
28.7	7.5

Results at 250°

Gms. per 100 gms. H_2O Na_2CO_3	Gms. per 100 gms. H_2O Na_2SO_4
0.5	43.4
0.9	41.4
1.5	38.8
1.9	37.9
2.3	37.4
2.6	35.2
3.1	29.8
3.7	27.6
4.4	23.4
6.5	18.5
9.1	15.3
11.7	13.2
14.0	11.9
19.6	10.8
21.1	10.0
21.8	8.2
22.7	7.9
23.1	7.6
20.0	3.0
20.4	3.0

Results at 300°

Gms. per 100 gms. H_2O Na_2CO_3	Gms. per 100 gms. H_2O Na_2SO_4
0.5	23.6
1.2	21.1
1.4	20.6

Results at 300° (con.)

Gms. per 100 gms. H_2O Na_2CO_3	Gms. per 100 gms. H_2O Na_2SO_4
1.7	19.1
2.6	19.2
2.6	16.3
2.6	17.2
2.7	16.5
3.0	17.6
3.0	16.3
3.0	15.1
3.6	12.7
5.4	9.0
10.7	6.7
10.4	6.4
10.7	4.0
10.4	6.4
10.7	4.0
11.0	3.4
9.4	1.7
	-

Results at 350°

Gms. per 100 gms. H_2O Na_2CO_3	Gms. per 100 gms. H_2O Na_2SO_4
0.2	2.5
0.4	1.6
0.8	1.9
2.1	1.2
2.0	0.4

These results when plotted give curves with branches corresponding to solutions in contact with Na_2SO_4, a compound of Na_2SO_4 and Na_2CO_3 and finally with Na_2CO_3 as solid phases. Experiments upon the identification of these solid phases are described. The authors also give results for the effect of sodium hydroxide upon the system Na_2CO_3 + Na_2SO_4 + H_2O at 150°, 250° and 350°.

SOLUBILITY OF SODIUM CARBONATE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL.

(Ketner, 1901-02.)

NOTE. — The mixtures were so made that alcoholic and aqueous layers were formed, and these were brought into equilibrium with the solid phase.

t°.	Gms. per 100 Gms. Alcoholic Layer.			Gms. per 100 Gms. Aq. Layer.			Solid Phase.
	C_2H_5OH.	Na_2CO_3.	H_2O.	C_2H_5OH.	Na_2CO_3.	H_2O.	
35	62.9	0.3	36.8	1	32.4	66.6	$Na_2CO_3.H_2O$
40	61	0.4	38.6	1.2	31.9	66.9	"
49	61	0.4	38.6	1.2	31.5	67.3	"
68	55.8	0.9	43.3	2.3	28.8	68.9	"
31.2	52.4	0.8	46.8	...	29.3	...	$Na_2CO_3.7H_2O$ (β)
31.9	54.8	0.7	44.5	1.7	29.8	68.5	"
32.3	56.1	0.6	43.3	1.5	30.2	68.3	"
33.2	58.1	0.5	42.4	1.4	31	67.6	"
27.7	Crit. sol. ± 14% C_2H_2OH ± 13% Na_2CO_3 ± 73% H_2O						
28.2	23.5	7.3	69.2	7.9	18.6	73.5	$Na_2CO_3.10H_2O$
29	32.7	3.8	63.5	4.3	22.7	73.0	"
29.7	40	2.1	57.9	2.9	25.5	71.6	"
30.6	47.8	1.2	51	2.3	27.8	69.9	"

SOLUBILITY OF $Na_2CO_3.10H_2O$ IN DILUTE ALCOHOL AT 21°.

(Ketner.)

Gms. per 100 Gms. Solution.			Gms. per 100 Gms. Solution.		
Na_2CO_3.	C_2H_5OH.	H_2O.	Na_2CO_3.	C_2H_5OH.	H_2O
18.5	0	81.5	1.2	39.2	59.6
12.7	6.2	81.1	0.2	58.2	41.6
6.9	15.3	77.8	0.1	67.1	32.8
3.2	26.1	70.7	0.06	73.3	26.64

CO

Isotherms showing the compositions of the conjugated liquids at 28.2°, 29.7° and 40° are also given.

SOLUBILITY OF SODIUM CARBONATE IN AQUEOUS ETHYL ALCOHOL AT 30°.

(Cocheret, 1911.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
Na_2CO_3.	C_2H_5OH.		Na_2CO_3.	C_2H_5OH.	
26.61	2.64	$Na_2CO_3.10H_2O$	0.40	63.20	$Na_2CO_3.7H_2O$
26.14	3.41*	"	0.11	73.06	" $+Na_2CO_3.H_2O$
1.38	44.81*	"	0.07	78.19	$Na_2CO_3.H_2O$
0.62	52.99	"	0.06	90.95	"
0.53	55.70	" $+Na_2CO_3.7H_2O$	0.03	95.06	" $+Na_2CO_3$
0.51	56.56	$Na_2CO_3.7H_2O$	...	98.46	Na_2CO_3

* Between these two concentrations, the mixtures separate into two liquid layers.

Results are also given for the solubility of Na_2CO_3 + NaBr and of Na_2CO_3 + NaCl in Aq. C_2H_5OH at 30°.

SOLUBILITY OF SODIUM CARBONATE IN AQUEOUS SOLUTIONS OF ETHYL AND OF PROPYL ALCOHOL AT 20°.

(Linebarger, 1892.)

Wt. Per cent Alcohol.	Gms. Na_2CO_3 per 100 Gms. Sol.		Wt. Per cent Alcohol.	Gms. Na_2CO_3 per 100 Gms. Sol.	
	In Ethyl.	In Propyl.		In Ethyl.	In Propyl.
28	..	4.4	48	0.9	1.3
38	...	2.7	50	0.84	1.2
44	1.7	1.7	54	0.80	0.9
46	1.13	1.5	62	...	0.4

EQUILIBRIUM IN THE SYSTEM SODIUM CARBONATE, NORMAL PROPYL ALCOHOL AND WATER AT 20°.

(Frankforter and Temple, 1915.)

(Note. In this paper the results for the binodal curve are reported in terms of gms. per 100 gms. solvent (water + alcohol), instead of gms. per 100 gms. of the homogeneous liquid (sodium carbonate + water + alcohol.)

Gms. per 100 Gms. Alcohol + Water.		
Na_2CO_3.	Alcohol.	Water.
16.568	3.409	96.591
15.363	4.472	95.528
11.696	6.595	93.405
8.415	9.176	90.824
6.669	11.221	88.779
4.138	15.785	84.215
2.878	21.099	78.901
1.990	31.537	68.463
1.338	40.796	59.204
0.930	46.933	53.067
0.567	53.875	46.125
0.208	59.507	40.493
0.160	63.568	36.432
0.109	75.159	24.841

EQUILIBRIUM IN THE SYSTEM SODIUM CARBONATE, ISO PROPYL ALCOHOL AND WATER AT 25°.

(Ginnings and Chen, 1931.)

The results which were determined by the titration method locate the binodal curve, a tie line, •, and the plait point, PP.

CO

Gms. per 100 gms. of the three constituents	
Na_2CO_3	Iso Propyl Alcohol
0.10	63.5 •
0.91	47.6
2.34	35.8
6.54	19.34
6.3	19.9 PP
9.35	12.8
11.70	8.96
14.50	5.61
17.33	3.24
19.18	2.15
19.60	1.60 •

EQUILIBRIUM IN THE SYSTEM SODIUM CARBONATE, TERTIARY BUTYL ALCOHOL AND WATER AT 30°.

(Ginnings and Robbins, 1930.)

The points on the binodal curve of this system were determined by observing the appearance or disappearance of clouding in a mixture of weighed amounts of Na_2CO_3 and one of the liquids upon addition of a weighed amount of the other. Tie lines, •, were located by determination of Na_2CO_3 in two liquid phases in contact with each other, and from these the plait point, PP, was found by plotting.

Gms. per 100 gms. of the 3 constituents	
Na_2CO_3	$(CH_3)_3COH$
—	97.0 •
—	70.0 •
—	55.0 •
0.7	52.3
1.0	50.0
1.3	41.3
1.8	35.4
2.0	35.0 PP.
2.1	30.8
2.8	26.2
3.3	22.4
4.0	19.7
4.5	— •
4.6	18.1
5.0	16.6
5.4	15.3
6.0	11.9
7.2	9.9
7.7	— •
8.0	8.6
9.7	6.8
10.4	6.1
11.2	5.2
12.9	4.0
14.1	3.3
15.3	3.1
16.0	2.5
18.9	1.5
25.2	0.6 •

The plait point, PP, of the above system at 25° was found by Ginnings, Herring and Webb, 1933, to have the composition

2.1 gms. Na_2CO_3 + 32.2 gms. $(CH_3)_3COH$ + 35.7 gms. H_2O.

These authors also give the following composition of the plait point of the system, sodium potassium carbonate + tertiary butyl alcohol + water at 25°.

2.6 gms. $NaKCO_3$ + 31.6 gms. $(CH_3)_3COH$ + 35.8 gms. H_2O.

The remaining points on the binodal curves for these systems are not given but only the values of a series of arbitrary constants calculated from them by means of empirical equations.

For results on the system sodium carbonate, allyl alcohol, water at 20° see last table, p 1245

100 gms. glycerol (d_{15} = 1.256) dissolve 98.3 gms. Na_2CO_3 at 15°–16°. (Ossendowski, 1907.)

100 gms. saturated solution in glycol contain 3.28–3.4 gms. sodium carbonate. (de Coninck, 1905.)

100 gms. H_2O dissolve 229.2 gms. sugar + 24.4 gms. Na_2CO_3, or 100 gms. sat. aq. solution contain 64.73 gms. sugar + 6.89 gms. Na_2CO_3 at 31.25°. (Köhler, 1897.)

SOLUBILITY OF SODIUM CARBONATE AND OF SODIUM BICARBONATE (EACH SEPARATELY) IN GLYCEROL AT 20°. (Holm, 1921, 1922.)

Solvent.	Gms. Na_2CO_3 per 100 gms. solvent.	Gms. $NaHCO_3$ per 100 gms. solvent.
86.5 % glycerol of $d = 1.2326$........	108–123	4.05
98.5 % » » $d = 1.2645$........	78–102	7.86

EQUILIBRIUM IN THE SYSTEM SODIUM CARBONATE, PYRIDINE, WATER. (Limbosch. 1909.)

Very pure materials were used. The boiling-point (cor.) of the pyridine was 115°–115.07°. Increasing amounts of this pyridine were added to aqueous CO solutions of sodium carbonate contained in glass tubes. After the tubes were sealed they were placed in a bath and the temperature noted at which the liquid mixture passed from a homogeneous to an opalescent condition. During the observation, the contents of the tubes were stirred by means of pieces of iron, moved with the aid of a magnet on the outside of the tube.

Per cent of Na_2CO_3.	Per cent of Pyridine.	t° of Sat.	Per cent of Na_2CO_3.	Per cent of Pyridine.	t° of Sat.	Per cent of Na_2CO_3.	Per cent of Pyridine.	t° of Sat.
0.129	66.2	12	2.50	50	199	6.12	23.5	120
0.129	66.4	25	2.50	53.3	197	6.12	25.5	132
0.129	67.7	36	2.50	59.4	173	6.12	28.4	152
0.129	69.2	44	2.50	69.2	123	6.99	13.8	54.2 (40.5)
0.129	73.5	53	2.50	73.8	110	6.99	15.4	81 (17)
0.129	74.8	51.5	2.50	74.8	*	6.99	19.5	117
0.129	76.1	25.5 (−64)	3.49	30.3	−0.5	6.99	22.7	142
0.129	77.8	11 (−59)	3.49	32.6	39	6.99	25.1	158
1.01	47.6	17	3.49	34.3	86.5	6.99	27.6	169
1.01	49.9	36	3.49	36.7	107	6.99	32.6	180+
1.01	51.2	55	3.49	37.4	123	9.36	8.50	64 (26)
1.01	52.2	72	3.49	42.5	194	9.36	9	78 (18)
1.01	56.1	107	3.49	69.6	157	9.36	11.4	106.5
1.01	60.6	111	3.49	71.2	*	9.36	13.8	127
1.01	66.8	110	5.23	23.3	63 (27.5)	9.36	16.3	148
1.01	75.1	86.5	5.23	23.7	70 (20.5)	9.36	20.1	169
1.01	76.9	71	5.23	24.6	79	9.36	25	180+
1.01	78.1	*	5.23	26.2	96	9.36	50	180+
2.50	36.3	22	5.23	28.7	111	18.1	2.12	48 (18)
2.50	37.9	53.25	5.23	32.5	155	18.1	2.25	66
2.50	39.2	74.5	5.23	36.6	196	18.1	2.70	79
2.50	40	94	5.23	37.2	200+	18.1	4.20	108
2.50	43.6	147	5.23	55.4	*	18.1	5.40	126
2.50	47.6	185				18.1	6.80	155

* Precipitate of Na_2CO_3. Results in parentheses show lower temperatures of saturation.

The binodal curve and plait point of the system Sodium Carbonate + Pyridine + Water at 25° has been determined by Ginnings, Webb and Hinohara, 1933, but the authors do not give their experimental results but only the values of a series of arbitrary constants calculated from them by means of empirical equations.

Fusion-point data for $Na_2CO_3 + NaCl$ are given by Le Chatelier (1894) and Sackur (1911–12). Results for $Na_2CO_3 + Na_2SO_4$ are given by Le Chatelier (1894), Sackur (1911–12) and by Amadori (1912). Results for $Na_2CO_3 + KCl$ are given by Sackur (1911–12).

CO

SODIUM Campho **CARBONATE** $C_{10}H_{15}O.COONa$.

SOLUBILITY OF SODIUM CAMPHO CARBONATE IN SEVERAL SOLVENTS AT 7°.

(Picon, 1931.)

Solvent	Formula	Gms. $C_{10}H_{15}OCOONa$ per liter sat. solution
Water	H_2O	323.2
Methyl Alcohol	CH_3OH	284.7
Ethyl Alcohol	C_2H_5OH	35.36
Chloroform	$CHCl_3$	37.18

SODIUM Thio **CARBONATE** Na_2CS_3.

100 gms. Ethyl Alcohol of d = 0.941 dissolve 5.55 gms. Na_2CS_3 at 15.5°.

SODIUM OXALATE $Na_2(COO)_2$.

COO

SOLUBILITY OF SODIUM OXALATE IN WATER.

The results of Flöttmann, 1928; Foote and Vance, 1933(a); Boulanger, 1936; and of Britton and Jarret, 1936(a), were plotted and the following values taken from the average curve.

t°	Gms. $Na_2C_2O_4$ per 100 gms. sat. sol.	t°	Gms. $Na_2C_2O_4$ per 100 gms. sat. sol.
0	2.62	40	4.01
10	2.96	50	4.37
15 (d = 1.0253)	3.13	60	4.70
20 (d = 1.0255)	3.30	70	5.05
25 (d = 1.0254)	3.48	80	5.40
30	3.67	100	6.10

SOLUBILITY OF MIXTURES OF SODIUM OXALATE AND OXALIC ACID IN WATER AT 25°. (Foote and Andrew, 1905.)

Gms. per 100 Gms. Solution.		Mols. per 100 Mols. H_2O.		Solid Phase.
$H_2C_2O_4$.	$Na_2C_2O_4$.	$H_2C_2O_4$.	$Na_2C_2O_4$.	
10.20	...	2.274	...	$H_2C_2O_4.2H_2O$
10.50	0.83	2.370	0.130	$H_2C_2O_4.2H_2O + HNaC_2O_4.H_2O$
9.15	0.71	2.032	0.106	Double Salt, $HNaC_2O_4.H_2O$
6.88	0.86	1.493	0.125	
1.14	1.25	0.234	0.172	
0.47	3.20	0.098	0.446	
0.42	3.85	0.090	0.541	$HNaC_2O_4.H_2O + Na_2C_2O_4$
...	3.60	...	0.502	$Na_2C_2O_4$

SOLUBILITY OF MIXTURES OF SODIUM OXALATE AND OTHER SODIUM SALTS IN WATER AT 15° AND AT 50°. (Colani, 1916.)

t°.	Gms. per 100 Gms. Sat. Solution.		Solid Phase.
15	0.027 $Na_2C_2O_4$	+ 26.28 NaCl	$Na_2C_2O_4$+NaCl
50	0.063 "	+ 26.64 "	" + "
15	0.86 "	+ 10.26 Na_2SO_4	$Na_2C_2O_4+Na_2SO_4.10H_2O$
50	0.22 "	+ 31.95 "	" $+Na_2SO_4$
15	0.051 "	+ 45.86 $NaNO_3$	$Na_2C_2O_4+NaNO_3$
50	0.047 "	+ 53.06 "	" + "

Data for equilibrium in the quarternary system COO

$Na_2C_2O_4 + H_2SO_4$ (or $H_2C_2O_4$) $+ Na_2SO_4 + H_2O$ at 24.71° are given by Elöd and Acker, 1938. The available results for the ternary systems were used and especial attention given to the determination of the monovariant points of the quarternary system. The results are expressed according to the Jänecke method in terms of gram molecules of H_2O to dissolve one gm. mol. of salt mixture of determined composition.

EQUILIBRIUM IN THE SYSTEM SODIUM OXALATE, URANYL OXALATE AND WATER AT 15° AND 50°. (Colani, 1917.)

Results at 15°.

Gms. per 100 Gms. Sat. Sol.		Solid Phase.
$Na_2C_2O_4$.	$UO_2C_2O_4$.	
3.09	0	$Na_2C_2O_4$
4.93	3.14	" +2.1.2.5
1.80	5.01	2.1.2.5+2.4.5.11
0.80	2.65	$2.4.5.11+UO_2C_2O_4.3H_2O$
0	0.47	$UO_2C_2O_4.3H_2O$

Results at 50°.

Gms. per 100 Gms. Sat. Sol.		Solid Phase.
$Na_2C_2O_4$.	$UO_2C_2O_4$.	
4.28	0	$Na_2C_2O_4$
9.03	13.69	" +2.1.2.5
4.62	12.33	2.1.2.5+2.2.3.5
3.60	9.84	2.2.3.5+2.4.5.11
1.01	3.58	$2.4.5.11+UO_2C_2O_4.3H_2O$
0	1	$UO_2.C_2O_4.3H_2O$

2.1.2.5 = $Na_2(UO_2)(C_2O_4)_2.5H_2O$, 2.2.3.5 = $Na_2(UO_2)_2(C_2O_4)_3.5H_2O$, 2.4.5.11 = $Na_2(UO_2)_4.(C_2O_4)_5.11H_2O$.

EQUILIBRIUM IN THE SYSTEM SODIUM OXALATE, SODIUM IODATE AND WATER.

(Foote and Vance, 1933a.)

Gms. per 100 gms. sat. sol.		Solid	Gms. per 100 gms. sat. sol.		Solid
$NaIO_3$	$Na_2C_2O_4$	Phase	$NaIO_3$	$Na_2C_2O_4$	Phase
Results at 0°			Results at 25°		
0.0	2.62	$Na_2C_2O_4$	0.0	3.56	$Na_2C_2O_4$
1.16	2.46	" + $NaIO_3.5H_2O$	4.28	3.01	"
2.42	0.0	$NaIO_3.5H_2O$	6.43	2.41	" + $NaIO_3.H_2O$
			8.66	0.0	$NaIO_3.H_2O$
Results at 40°			Results at 50°		
0.0	4.09	$Na_2C_2O_4$	0.0	4.37	$Na_2C_2O_4$
5.63	2.98	"	9.26	2.70	"
9.31	2.38	" + $NaIO_3.H_2O$	11.67	2.31	" + $NaIO_3.5H_2O$
10.26	1.25	$NaIO_3.H_2O$	12.69	1.13	$NaIO_3.5H_2O$
11.71	0.0	"	14.06	.0.0	"

EQUILIBRIUM IN THE SYSTEM SODIUM OXALATE, THORIUM OXALATE AND WATER AT 25°.

(Britton and Jarrett, 1936a.)

COO

Gm. Mols. per liter sat. sol.		Solid	Gm. Mols. per liter sat. sol.		Solid
$Na_2C_2O_4$	$Th(C_2O_4)_2$	Phase	$Na_2C_2O_4$	$Th(C_2O_4)_2$	Phase
0.2670	0.0	$Na_2C_2O_4$	0.1945	0.04430	2.1.6
0.2672	0.00361	"	0.1679	0.05128	" + $Th(C_2O_4)_2.6H_2O$
0.2793	0.01166	"	0.1408	0.04634	$Th(C_2O_4)_2.6H_2O$
0.3022	0.03036	"	0.09158	0.03051	"
0.3110	0.03490	"	0.07554	0.02998	"
0.3184	0.03900	"+2.1.6	0.05520	0.01550	"
0.3257	0.04543	2.1.6	0.04839	0.01338	"
0.2879	0.03852	"	0.03844	0.009055	"
0.2281	0.03920	"	0.02005	0.002762	"
			0.01002	0.000901	"

2.1.6 = $2Na_2C_2O_4.Th(C_2O_4)_2.6H_2O$.

EQUILIBRIUM IN THE SYSTEM SODIUM OXALATE, ZINC OXALATE AND WATER AT 18°.

(Britton and Jarrett, 1936c.)

Gm. Mols. per liter sat. sol.		Solid	Gm. Mols. per liter sat. sol.		Solid
$Na_2C_2O_4$	ZnC_2O_4	Phase	$Na_2C_2O_4$	ZnC_2O_4	Phase
0.240	0.000	$Na_2C_2O_4$	0.100	0.0052	$ZnC_2O_4.2H_2O$
0.254	0.0133	"	0.080	0.00326	"
0.262	0.0250	"	0.060	0.00191	"
0.273	0.0337	"	0.040	0.00110	"
0.245	0.0325	$ZnC_2O_4.2H_2O$	0.020	0.00055	"
0.224	0.0275	"	0.010	0.00026	"
0.200	0.0217	"	0.000	—	"
0.150	0.0120	"			

EQUILIBRIUM IN THE SYSTEM SODIUM OXALATE, ZIRCONIUM OXALATE AND WATER.

(Boulanger, 1936.)

Results at 39°		Results at 52°		Solid Phase at each Temp.
Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		
$Na_2C_2O_4$	$ZrOC_2O_4$	$Na_2C_2O_4$	$ZrOC_2O_4$	
4.0	0.0	4.40	0.0	$Na_2C_2O_4$
4.20	0.07	4.59	0.20	"
4.22	0.20	5.13	0.29	"
4.23	0.41	4.98	0.54	"
4.62	0.66	5.00	0.90	$Na_2C_2O_4.ZrOC_2O_4.H_2C_2O_4.2H_2O$(?)
4.80	0.66	5.14	0.99	"
4.50	0.64	5.19	1.12	"
4.41	0.63	5.20	1.14	"
4.31	0.77	5.34	1.36	"
4.21	0.82	5.29	1.40	"
3.95	0.99	5.00	1.30	Unfilterable gel
3.67	1.31	4.95	1.72	"
3.30	1.15	3.86	1.50	"

COO

100 gms. 95% formic acid dissolves 8.8 gms. $Na_2C_2O_4$ at 19.3°.
(Aschan, 1913.)

SODIUM Bi OXALATE $Na_2C_2O_4.H_2C_2O_4.2H_2O$.

SOLUBILITY OF SODIUM BIOXALATE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 20°.

(Trapp, 1936.)

Gms. per 100 gms. sat. solution		Solid Phase
HCl	$Na_2C_2O_4.H_2C_2O_4.2H_2O$	
0.0	1.86	$Na_2C_2O_4.H_2C_2O_4.2H_2O$
2.90	4.32	"
6.47	5.80	"
9.56	5.97	"

SODIUM CHLORIDE NaCl

Cl

SOLUBILITY IN WATER.

(Mulder; de Coppet, 1883; Andræ, 1884; Raupenstrauch, 1885; above 100°, Tilden and Shenstone, 1884; Berkeley, 1904; Etard, 1894, gives irregular results.)

t°.	Gms. NaCl per 100 Gms. H_2O.		Gms. NaCl per 100 g. Sol.	t°.	Gms. NaCl per 100 Gms. H_2O.		Gms. NaCl per 100 g. Sol.
0	35.7*	35.63†	26.28†	70	37.8*	37.51†	27.27†
10	35.8	35.69	26.29	80	38.4	38.00	27.54
20	36.0	35.82	26.37	90	39.0	38.52‡	27.80
25	36.12	35.92	26.43	100	39.8	39.12‡	28.12
30	36.3	36.03	26.49	118		39.8	28.46
40	36.6	36.32	26.65	140		42.1	29.63
50	37.0	36.67	26.83	160		43.6	30.37
60	37.3	37.06	27.04	180		44.9	30.98

* M.; de C. † A. ‡ B.

The original, very carefully determined figures of Berkeley, are as follows.

t°.	d of Sat. Sol.	Gms. NaCl per 100 Gms. H_2O.	t°.	d of Sat. Sol.	Gms. NaCl per 100 Gms. H_2O.
0.35	1.2090	35.75	61.70	1.1823	37.28
15.20	1.2020	35.84	75.65	1.1764	37.82
30.05	1.1956	36.20	90.50	1.1701	38.53
45.40	1.1891	36.60	107 b. pt.	1.1631	39.65

100 gms. H_2O dissolve 35.99 gms. NaCl at 30°. (Cocheret, 1911.)

SOLUBILITY OF SODIUM CHLORIDE IN WATER, DETERMINED BY THE FREEZING-POINT METHOD.

(Matignon, 1909a.)

t°.	Gms. NaCl per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. NaCl per 100 Gms. H_2O.	Solid Phase.
−0.4	0.69	Ice (Raoult)	−12.7	20	Ice
−0.8	1.37	" (Biltz)	−16.66	25	"
−2.86	4.9	" (Kahlenberg)	−21.3	30.7	" + $NaCl.2H_2O$
−3.42	5.85	" (Raoult)	−14	32.5	$NaCl.2H_2O$ (de Coppet)
−6.6	11	"	−12.25	32.9	" (Matignon)
−9.25	15	"	− 6.25	34.22	" (de Coppet)

Cl

THE ICE CURVE FOR AQUEOUS SOLUTIONS OF SODIUM CHLORIDE.

(Rodebush, 1918.)

The temperatures were measured with a thermoelement and the concentrations determined by conductivity.

t° of f. pt.	Gms. NaCl per 100 gms. H_2O.	t° of f. pt.	Gms. NaCl per 100 gms. H_2O	t° of. f. pt.	Gms. NaCl. per 100 gms H_2O
−3.48.....	6.11	− 9.41....	15.46	−16.21.....	24.75
−5.17.....	8.92	−11.04....	17.87	−18.73.....	27.70
−6.32.....	10.77	−14.33....	22.25	−20.56.....	29.70
−8.52.....	14.20	−14.77....	22.99	−21.12 Eutec..	30.40

Similar determinations by Klein and Svanberg, 1920, gave the following results.

t° of f. pt.	−0.350.	−0.853.	−1.688.
Normality of aq NaCl.............	0.1	0.25	0.5

More recent determinations of Cornec and Krombach, 1932; Iljinski and Sagaidotschny, 1931; Küpper, 1927,; Wright, 1927; Scott and Frazier, 1927; Cornec and Neumeister, 1929; Gerassimow, 1930; and Flöttmann, 1928; give an average curve from which the following results were taken.

t^0	Gms. NaCl per. 100 gms. sat. sol.	Solid Phase	t^0	Gms. NaCl per 100 gms. sat. sol.	Solid Phase
-21.1	23.0	Ice + $NaCl.2H_2O$	20 (d=1.2001)	26.40	NaCl
-15	24.25	$NaCl.2H_2O$	25 (d=1.19796)	26.406	"
-10	25.0	"	25 (d=1.1979)	26.47	"
- 5	25.6	"	30	26.52	"
+ 0.1	26.3	" + NaCl	40	26.67	"
10.0	26.34	"	60	27.07	"
15.0 (d=1.2024)	26.34	"	80	27.55	"
			100	28.15	"

SODIUM CHLORIDE

SOLUBILITY OF SODIUM CHLORIDE IN WATER AT TEMPERATURES ABOVE 100°.

The results of Cornec and Krombach, 1932; Achumow and Wassiljew, 1932; Froehlich, 1929; and Benrath, Gjedebo, Schiffers and Wunderlich, 1937, were plotted and the following values taken from the average curve.

t°	Gms. NaCl per 100 gms. sat. sol.	t°	Gms. NaCl per 100 gms. sat. sol.	t°	Gms. NaCl per 100 gms. sat. sol.
100	28.4	250	34.0(34.2)	400	46.4
150	29.7(29.6)	300	37.2(37.5)	450	50.8
200	31.6(31.6)	350	41.7(42.0)		

The results in parentheses are by Schroeder, Gabriel and Partridge, 1935.

Results for the Solubility of Sodium Chloride in Water at 30° under pressures up to 4000 bars (metric atmospheres) are given by Adams and Hale, 1931. Measurements of the volume changes at pressures up to 12,000 bars for aqueous sodium chloride solutions ranging from 0 to 25 weight percent concentration, are given by Adams, 1931. Other results for the influence of pressure upon the solubility of sodium chloride in water are given by v. Stackelberg, 1896; Cohen, Inouye and Euwen, 1910, and by Sill, 1916.

RELATIVE SOLUBILITY OF SODIUM CHLORIDE IN ORDINARY WATER AND IN HEAVY WATER (H_2H_2O).

(Taylor, Caby and Eyring, 1933.)

t°	Gms. NaCl per 100 gms.	
	Ordinary H_2O	Water containing 99% H_2H_2O
25	35.9	30.5

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SOLUTIONS SIMULTANEOUSLY SATURATED WITH OTHER SALTS.

The various papers of J. H. van't Hoff and collaborators, on this subject, have been collected by H. Precht and E. Cohn in a volume entitled "Untersuchungen über die Bildungsverhältnisse die Ozeanischen Salzablagerungen," Leipzig, 1912, p. 374. By far the larger part of the new data in these papers are for solutions simultaneously saturated with three or more salts and are, therefore, beyond the limits of complexity of mixture, set for the present volume. The various systems are described in detail and diagrams are given. A table summarizing much of the data (van't Hoff (1905)) is given on the following page.

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SOLUTIONS SIMULTANEOUSLY SATURATED WITH OTHER SALTS AT 25°.

(van't Hoff, 1905.)

Mols. per 1000 Mols. H_2O.					Solution Saturated with Respect to NaCl and:
Na_2Cl_2.	K_2Cl_2.	$MgCl_2$.	$MgSO_4$.	Na_2SO_4.	
1	0.5	105	...	...	$MgCl_2.6H_2O$ + Carnallite
2	5.5	70.5	...	...	KCl + Carnallite
44	20	...	...	4.5	" + Glaserite
44	10.5	...	...	14.5	Na_2SO_4 + "
46	...	...	16.5	3.0	" + Astrakanite
26	...	7	34	...	$MgSO_4.7H_2O$ + Astrakanite
4	...	67.5	12	...	" + $MgSO_4.6H_2O$
2.5	...	79	9.5	...	Kieserite + "
1	...	101	5	...	" + $MgCl_2.6H_2O$
23	14	21.5	14	...	KCl + Glaserite + Schönite
19.5	14.5	25.5	14.5	...	" + Leonite + "
9.5	9.5	47	14.5	...	" + " + Kainite
2.5	6	68	5	...	" + Carnallite + "
1	1	85.5	8 -	...	Kieserite + Carnallite + Kainite
42	8	...	16	6	Na_2SO_4 + Glaserite + Astrakanite
27.5	10.5	16.5	18.5	...	Schönite + Glaserite + Astrakanite
22	10.5	23	19	...	Leonite + Glaserite + Astrakanite
10.5	7.5	42	19	...	" + $MgSO_4.7H_2O$ + Astrakanite
9	7.5	45	19.5	...	" + " + Kainite
3.5	4	65.5	13	...	$MgSO_4.6H_2O$ + " + "
1.5	2	77	10	...	$MgSO_4.6H_2O$ + Kieserite + "
1	0.5	100	5	...	Carnallite + $MgCl_2.6H_2O$ + "
1	0.5	105	...	...	$MgCl_2.6H_2O$ + Carnallite
2	5.5	70.5	...	...	KCl + "
			$CaCl_2$.		
1	...	51.5	90.5	...	$MgCl_2.6H_2O$ + Tachhydrite
1	11	...	146	...	KCl + $CaCl_2.6H_2O$
1	...	35.5	121.5	...	Tachhydrite + $CaCl_2.6H_2O$
1	1.5	50.5	90.5	...	$MgCl_2.6H_2O$+Tachhydrite+Carnallite
1	9.5	5	141.5	...	$CaCl_2.6H_2O$ + KCl + Carnallite
1	2	34.5	121.5	...	$CaCl_2.6H_2O$+Tachhydrite+Carnallite

Cl

Carnallite = $KMgCl_3.6H_2O$, Glaserite = $K_3Na(SO_4)_2$, Astrakanite = $Na_2Mg(SO_4)_2.4H_2O$, Kieserite = $MgSO_4.H_2O$, Leonite = $MgK_2(SO_4)_2.4H_2O$, Schönite = $MgK_2(SO_4)_2.6H_2O$, Kainite = $MgSO_4.KCl.3H_2O$.

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS CALCIUM CHLORIDE SOLUTIONS AT 25°.

(Mills and Wells, 1918.)

d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat. Sol.		d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat. Sol.	
	$CaCl_2$.	NaCl.		$CaCl_2$.	NaCl.
1.207	1.103	25.30	1.225	9.50	17.55
1.210	2.160	24.32	1.233	11.48	15.91
1.209	3.220	23.37	1.241	17.77	10.54
1.216	5.451	20.43	1.257	21	8.05
1.220	7.398	19.17	1.276	24.58	5.63

SODIUM CHLORIDE

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 18°.

(Fricke and Brummer, 1936.)

d. of sat. sol.	Gms.Mols. per 1000 gms. sat. sol.		d. of sat. sol.	Gm. Mols. per 1000 gms. sat. sol.	
	HCl	NaCl		HCl	NaCl
1.2005	0.0	4.513	1.188	0.3610	4.151
1.199	0.0438	4.474	1.173	0.9263	3.605
1.197	0.0870	4.433	1.155	1.6677	2.889
1.194	0.1756	4.346	1.136	2.6740	2.055
			1.124	3.5670	1.408

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID.

(Engel, 1888; Enklaar, 1901.)

At 0°. (Engel.)

Mg. Mols. per 10 cc.		Sp. Gr. of Solution.	Gms. per 100 cc.	
HCl.	NaCl.		HCl.	NaCl.
0.0	54.7	1.207	0.0	32.0
1.0	53.5	1.204	0.365	31.3
1.85	52.2	1.202	0.674	30.5
5.1	48.5	1.196	1.859	28.4
9.28	44.0	1.185	3.38	25.7
15.05	37.9	1.173	5.49	22.2
30.75	23.5	1.141	11.20	13.7
56.35	6.1	1.119	20.54	3.6

At 10°–10.5°. (Enklaar.)

Mols. per 1000 gms. H_2O		Gms. per 100 gms. H_2O	
HCl.	NaCl.	HCl.	NaCl.
0.0	6.11	0.0	35.77
0.27	5.77	9.84	33.76
0.35	5.67	12.76	33.19
0.43	5.59	15.68	32.71
0.57	5.43	20.78	31.77
0.72	5.28	26.06	30.89
2.60	3.42	94.77	20.01
2.80	3.18	102.1	19.04
3.31	2.74	120.6	16.03

Cl

Results at 0° and at 25°.

(Armstrong and Eyre, 1910–11.)

Gms. HCl per Liter of Solvent.	Gms. NaCl per 100 Gms. Sat. Sol.	
	At 0°.	At 25°.
0	26.35	26.52 (d_{25} = 1.2018)
9.11	25.30	25.45 (d_{25} = 1.1970)
18.22	24.15	25.42 (d_{25} = 1.1915)
36.45	21.93	22.34 (d_{25} = 1.1822)
182.25	...	7.04 (d_{25} = 1.1238)

Results at 25°.

(Herz, 1911–12.)

Mols. per Liter.	
HCl.	NaCl.
0.607	4.850
1.032	4.467
1.590	3.782
2.117	3.297
3.283	2.343

Results at 30°.

(Schreinemakers, 1909–10.)

Gms. per 100 Gms. Sat. Sol.	
HCl.	NaCl.
0	26.47
6.93	16.16
12.50	9.35
17.35	4.52
35.60	0.11

Results at 30°. (Masson, 1911.)

d_{30} of Sat. Sol.	Gm. Mols. per Liter.		d_{30} of Sat. Sol.	Gms. Mols. per Liter.	
	HCl.	NaCl.		HCl.	NaCl.
1.2018	0	5.400	1.1427	3.052	2.463
1.1906	0.4575	4.932	1.1289	4.152	1.628
1.1801	0.969	4.386	1.1188	5.950	0.630
1.1633	1.786	3.589	1.1258	7.205	0.268
1.1512	2.412	2.978			

In the case of the results of Masson equilibrium was approached from above and the solutions were kept in a thermostat and shaken occasionally during 2–6 days.

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 25°.

(Ingham, 1928.)

d. of sat. sol.	Gm. Mols. per liter sat. sol.		d. of sat. sol.	Gm. Mols. per 1000 gms. sat. sol.	
	HCl	NaCl		HCl	NaCl
1.1981	0.0	5.4325	1.1200	4.500	1.333
1.1867	0.503	4.880	1.1160	5.253	0.907
1.1781	0.886	4.483	1.1158	6.101	0.544
1.1511	2.265	3.149	1.1213	7.073	0.293
1.1352	3.185	2.310	1.1302	7.976	0.158
1.1319	3.487	2.079	1.1458	9.236	0.091
1.1282	3.830	1.797	1.1970	13.41	0.017

The author also gives the yiscosities of the saturated solutions.

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS ETHYL ALCOHOL SOLUTIONS OF HYDROCHLORIC ACID ACID AT 25°.

(Akerlof, Teare and Turck, 1937.)

Gm. Mols. HCl per 1000 gms. solvent	Gm. Mols. NaCl per 1000 gms. solvent containing:					
	0% C_2H_5OH	10% C_2H_5OH	20% C_2H_5OH	30% C_2H_5OH	40% C_2H_5OH	50% C_2H_5OH
0.0	6.162	5.104	4.133	3.282	2.543	1.892
0.1	6.058	4.983	4.039	3.221	2.474	1.811
0.2	5.951	4.866	3.959	3.112	2.383	1.727
0.3	5.846	4.767	3.856	3.032	2.295	1.666
0.5	5.631	4.574	3.702	2.858	2.144	1.535
0.75	5.361	4.325	3.435	2.645	1.957	1.376
1.0	5.096	4.082	3.213	2.454	1.780	1.222
1.5	4.567	3.616	2.800	2.070	1.477	0.9267
2.0	4.054	3.146	2.397	1.730	1.165	0.7005
2.5	3.569	2.741	2.041	1.404	0.9079	0.5266
3.0	3.100	2.318	1.683	1.129	0.6878	0.3850
3.5	2.660	1.931	1.406	0.8801	0.5208	0.2706
4.0	2.261	1.605	1.112	0.6639	0.3757	0.1902

Cl

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROGEN PEROXIDE AT 25°

(Akerlof and Turk, 1936.)

Wt. Percent H_2O_2 in solvent	Gm. Mols. NaCl per 1000 gms. solvent	Wt. Percent H_2O_2 in solvent	Gm. Mols. NaCl per 1000 gms. solvent
0.0	6.162	21.17	5.292
5.30	6.028	26.24	5.058
10.73	5.792	31.43	4.823
15.72	5.539		

SOLUBILITY OF SODIUM CHLORIDE IN PURE HYDROGEN PEROXIDE, DETERMINED BY THE FREEZING-POINT METHOD.

(Maass and Hatcher, 1922.)

t° of f. pt.	Gms. NaCl per 100 gms. sat. sol.	t° of f. pt.	Gms. NaCl per 100 gms. sat. sol.	t° of f. pt.	Gms. NaCl per 100 gms. sat. sol.
—2.37.....	1.08	— 7.67....	8.61	—10.37....	15.63
—3.62.....	3.14	—10.7.....	11.81	0.0+...	17.0
—5.07....	5.42				

SOLUBILITY OF MIXTURES OF SODIUM CHLORIDE AND OTHER SALTS IN WATER, ETC.

Solvent.	t°.	Gms. per 100 Gms. Solvent.		Authority.
Water	17	26.4	$NaCl + 22.1 NH_4Cl$*	(Karsten.)
"	17	34.5	" + 4.1 $BaCl_2$	"
"	?	38.3	" + 29.5 KNO_3	"
"	25	38.5	" + 41.14 "	(Soch — J. Physic. Ch. 2, 46, '98.)
"	80	39.81	" + 168.8 "	"
Alcohol (40%)	25	15.78	" + 13.74 "	"
Water	20	30.54	" + 13.95 KCl	(Quoted by Euler — Z. physik. Ch. 49, 315, '04.)
"	25	28.90	" + 16.12 "	

* Sp. Gr. of solution at 17° = 1.179.

SOLUBILITY OF MIXTURES OF SODIUM CHLORIDE AND POTASSIUM SULFATE IN WATER AT VARIOUS TEMPERATURES.

(Precht and Wittgen, 1882.)

t°.	Grams per 100 Grams H_2O.			t°.	Grams per 100 Grams H_2O.		
	NaCl	K_2SO_4	KCl		NaCl	K_2SO_4	KCl
10	33.4	8.1	3.2	60	36.4	11.9	2.7
20	34.0	8.9	3.1	70	36.6	12.8	3.2
30	34.6	9.6	2.9	80	36.0	12.3	5.1
40	35.2	10.4	2.8	90	35.9	12.4	7.0
50	35.8	11.1	2.8	100	35.6	12.6	8.8

Cl

EQUILIBRIUM IN SYSTEMS COMPOSED OF SODIUM AND POTASSIUM CHLORIDES, NITRATES AND SULFATES.

Complete experimental data, including densities, in the form of tabular results and diagrams for these complex systems at temperatures between 0° and 90° are given by Cornec and Krombach, 1929 and Cornec, Krombach and Spack, 1930. These authors made use, wherever necessary of the results for the ternary systems previously reported from their own laboratory or by others including Chretien, 1929; Cornec and Hering, 1925-7, Cornec and Krombach, 1929; Meyerhoffer and Saunders, 1899; d'Ans, 1915 and Blasdale, 1918.

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SOLUTIONS OF:

(Herz and Hiebenthal, 1929.)

Potassium Chromate		Potassium DiChromate		Potassium Permanganate	
Gm. Mol. per liter sat. sol.		Gm. Mol. per liter sat. sol.		Gm. Mol. per liter sat. sol.	
$K_2CrO_4/6$	NaCl	$K_2Cr_2O_7/6$	NaCl	$KMnO_4/5$	NaCl
0.71	5.25	0.16	5.29	0.0	5.38
0.93	5.18	0.40	5.28	0.02	5.29
1.31	5.12	0.79	5.25	0.49	5.24
1.86	5.04	1.29	5.16	1.26	5.09
3.57	4.65	1.57	5.11	+1.53	5.15
+4.49	4.25	+2.06	5.03		

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS POTASSIUM NITRATE AT 25.°

(Ritzel, 1911.)

Gms. per 100 cc. Sat. Sol. KNO_3.	NaCl.	Gms. per 100 cc. Sat. Sol. KNO_3.	NaCl.
0	31.80	12	30.86
4	32.26	16	30.45
8	31.85	20	30.10

Data for the solubility of NaCl in aqueous $MgCl_2$ solutions are given by Feit and Przibylla (1909.)

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SOLUTIONS OF MAGNESIUM CHLORIDE.

(Achowmow and Wassilljew, 1937.)

t°	Gms. per 100 gms. H_2O $MgCl_2$	NaCl	Solid Phase	t°	Gms. per 1000 gms. H_2O $MgCl_2$	NaCl	Solid Phase
100	100	282	NaCl	175	100	330	NaCl
"	300	106	"	"	300	156	"
"	500	12	"	"	500	52	"
"(1.384)	718	8	" + $MgCl_2$	"	900	13	"
125	100	298	NaCl	"(1.442)	1220	trace	" + $MgCl_2$
"	300	120	"	200	100	354	NaCl
"	500	20	"	"	300	176	"
"(1.411)	902	5	" + $MgCl_2$	"	500	60	"
150	100	312	NaCl	"	700	28	"
"	300	138	"	"	900	20	"
"	500	34	"	"(1.462)	1315	trace	" + $MgCl_2$
"(1.425)	1072	2	" + $MgCl_2$				

The figures in parentheses are densities.

Data for the equilibrium in the system Sodium Chloride, Magnesium Sulfate and Water at -5°, -8°, -15° and -20° are given by Iljinski and Sagaidotschny, 1931.

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS AMMONIA AT 30°.

(Hempel and Tedesco, 1911.)

d_{30} of Sat. Sol.	Gms. per 1000 cc. Sat. Sol. NH_3.	NaCl.	d_{30} of Sat. Sol.	Gms. per 1000 cc. Sat. Sol. NH_3.	NaCl.
1.1735	29.535	293.38	1.1406	72.07	283.38
1.1656	40.655	292.5	1.1395	72.715	283.06
1.160	47.26	289.7.	1.1301	81.855	277.49
1.1494	60.78	286.5	1.1205	97.49	270.57

Data for equilibrium in the system sodium chloride, arsenic trioxide, water, at 30°, are given by Schreinemakers and deBaat (1915).

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE.

(Fedotieff, 1904.)

t°.	Wt. of 1 cc. Solution.	Mols. per 1000 Gms. H_2O.		Gms. per 1000 Gms. H_2O.	
		NH_4Cl.	NaCl.	NH_4Cl.	NaCl.
0	...	0	6.09	0	356.3
"	1.185	2.73	4.89	146.1	286.4
15	1.200	0	6.12	0	357.6
"	1.191	1.07	5.58	57.3	326.4
"	1.183	2.22	5.13	118.9	300
"	1.176	3.48	4.64	186.4	271.6
"	1.175	3.72	4.55	198.8	266.8
30	...	0	6.16	0	360.3
"	1.166	4.77	4.26	255.4	249
45	...	0	6.24	0	365
"	...	6.02	4	322.1	233.9

Results for the system NaCl + NH_4Cl + H_2O at 0°, 20°, 50° and 75° are given by Gerassimow, 1930.

Data for the solubility of Sodium Chloride and of Sodium Chloride Penta - Ammoniate, in mixtures of Ammonia and Water at temperatures between -40° and +25° are given by Guyer, Bieler and Schmid, 1934. The present paper, however, contains only the diagrams drawn from the experimental results published in the Dissertation of Z. Schmid E.T.H. Zurich, 1934.

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM BICARBONATE SATURATED WITH CO_2. (Fedotieff 1904.)

C1

t°.	Wt. of 1 cc. Solution.	Mols. per 1000 Gms. H_2O.		Gms. per 1000 Gms. H_2O.	
		$NaHCO_3$.	NaCl.	$NaHCO_3$.	NaCl.
0	...	0	6.09	0	356.3
"	1.208	0.09	6	7.7	350.1
15	1.203	0	6.12	0	357.6
"	1.203	0.12	6.06	10	354.6
30	1.196	0	6.16	0	360.3
"	1.199	0.17	6.12	13.9	358.1
45	1.189	0	6.24	0	365
"	1.198	0.23	6.18	19.5	361.5

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE, SODIUM CHLORATE AND WATER AT 20°.

(DiCapua and Scaletti, 1927.)

The authors results were plotted and the following values read from the curve.

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
NaCl	$NaClO_3$		NaCl	$NaClO_3$	
26.8	0.0	NaCl	10.	33.7	$NaClO_3$
20.0	13.0	"	7.5	37.5	"
15.0	24.0	"	5.0	41.5	"
13.0	29.5	" + $NaClO_3$	2.5	45.6	"
			0.0	49.6	"

SODIUM CHLORIDE

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE, SODIUM PERCHLORATE AND WATER AT SEVERAL TEMPERATURES.

(Cornec and Dickely, 1928.)

t°	Gms. per 100 gms. sat. sol. $NaClO_4$	$NaCl$	Solid Phase
0	23.86	15.44	NaCl
"	40.65	8.63	"
"	52.82	4.37	"
"	59.69	2.53	" + $NaClO_4.H_2O$
"	62.87	0.0	$NaClO_4.H_2O$
15(1.663)	65.63	0.0	"
25(1.683)	67.82	0.0	"
"(1.683)	66.58	1.37	" + NaCl
38(1.713)	70.38	0.0	"
"(1.713)	69.41	1.05	" + NaCl
50(1.749)	73.26	0	$NaClO_4.H_2O$
" (1.749)	72.46	0.81	" + NaCl
55(1.756)	73.94	0.0	$NaClO_4$
" (1.755)	73.00	0.78	" + NaCl
75(1.757)	75.01	0.0	$NaClO_4$
" (1.757)	74.15	0.83	" + NaCl
100(1.758)	76.75	0.0	$NaClO_4$
" (1.757)	75.79	0.88	" + NaCl
" (1.664)	69.32	1.44	NaCl
" (1.532)	50.23	3.06	"
" (1.567)	41.44	8.81	"

The figures in parentheses are densities.

Cl

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM DICHROMATE.

(Robertson, 1924.)

The mixtures of salts were dissoved in water at a temperature higher than that of the experiment and the flasks then placed in a thermostat. Constant agitation is not mentioned.

Results at 25°. Gms. per 100 gms. sat. sol. NaCl.	$Na_2Cr_2O_7$.	Results at 50°. Gms per 100 gms sat. sol. NaCl.	$Na_2Cr_2O_7$.	Results at 100°. Gms per 100 gms sat. sol. NaCl.	$Na_2Cr_2O_7$.	Solid Phase at Each Temperature.
24.0	5.18	24.2	5.87	25.1	6.28	NaCl
21.0	11.7	20.8	[illegible]	18.3	20.0	"
18.0	17.8	19.1	16.4	15.4	26.5	"
15.4	23.8	15.8	23.1	11.7	34.9	"
13.3	28.8	13.1	29.4	9.06	41.1	"
10.7	35.0	11.1	34.3	5.59	50.9	"
8.8	39.3	8.43	41.3	4.14	55.4	"
6.61	45.1	4.57	52.3	2.66	62.3	"
4.67	50.6	2.71	58.1	1.64	68.6	"
3.10	57.1	1.94	63.4	1.22	71.9	"
1.13	64.6	0.94	70.2	0.74	80.0	" + $Na_2Cr_2O_7\ 2H_2O$
0.0	65.5	0.0	70.3	0.0	80.1	$Na_2Cr_2O_7.2HO$*

* $Na_2Cr_2O_7$ at 100°.

Data for the 4 component system (K, Na) — (Cl, Cr_2O_7) — H_2O are also given.

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE, SODIUM DICHROMATE AND WATER.

(Gerassimow, 1930.)

Results at 0°		Results at 20°		Results at 50°		Results at 75°		
Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Solid Phase at each Temperature
NaCl	$Na_2Cr_2O_7$	NaCl	$Na_2Cr_2O_7$	NaCl	$Na_2Cr_2O_7$	NaCl	$Na_2Cr_2O_7$	
26.00	0.0	26.43	0.0	26.91	0.0	27.45	0.0	NaCl
24.35	4.10	10.45	38.43	23.56	7.09	23.24	9.00	"
5.81	50.81	3.44	57.42	17.02	21.48	15.66	26.64	"
—	—	2.46	59.82	11.73	32.46	9.30	41.96	"
—	—	—	—	11.47	33.12	2.95	63.76	"
—	—	—	—	1.06	68.22	1.52	71.52	"
2.49	58.69	1.74	62.50	1.21	68.79	1.25	76.18	"+$Na_2Cr_2O_7 2H_2O$
0.0	62.0	0.0	65.20	0.0	71.3	0.0	77.7	$Na_2Cr_2O_7.2H_2O$

Results are also given for the quarternary systems obtained with $Na_2Cr_2O_7$ + NH_4Cl + H_2O.

Cl

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE, SODIUM FLUORIDE AND WATER.

(Foote and Schairer, 1930.)

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms. sat. sol.		Solid Phase
	NaCl	NaF			NaCl	NaF	
25	26.40	0.0	NaCl	35	26.18	0.34	NaCl + NaF
"	26.12	0.31	" + NaF	"	26.13	0.29	"
"	26.24	0.12	" "	"	18.43	0.54	NaF
"	0.0	3.98	NaF	"	5.41	2.38	"
35	26.62	0.0	NaCl	"	0.0	4.00	"

The authors also give the following results for the eutectic and transition temperatures of the above system.

t°	Gms. per 100 gms. sat. sol.		Solid Phase
	NaCl	NaI	
-21.19	23.69	0.24	Ice + $NaCl.2H_2O$ + NaF
-20.94	23.18	0.0	" + $NaCl.2H_2O$
- 3.02	0.0	4.02	" + NaF
- 2.98	0.0	3.82	" + "
- 0.06	26.25	0.19	$NaCl_2.2H_2O$ + NaCl + NaF
+ 0.08	26.39	0.0	" + "
- 0.10	26.53	0.0	" + "

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE, SODIUM FLUORIDE, SODIUM SULFATE AND WATER.

(Foote and Schairer, 1930.)

Results at 25°

Gms. per 100 gms. sat. sol.			Solid Phase
Na_2SO_4	NaF	NaCl	
7.71	0.69	6.98	1.1
4.60	0.77	14.35	"
4.47	trace	18.41	"
4.35	0.60	21.48	"
9.72	trace	19.29	" + NaS
5.23	"	23.61	" + NaCl
14.76	"	13.78	" + NaS + NaS.10
6.98	"	22.73	" + " + NaCl
0.50	0.23	25.93	" + NaF + "
0.21	0.43	25.96	" + " + "

Results at 35°

Gms. per 100 gms. sat. sol.			Solid Phase
Na_2SO_4	NaF	NaCl	
1.51	trace	23.34	1.1
4.39	0.61	21.64	"
5.08	0.24	15.49	"
17.66	0.13	8.55	"
3.66	0.46	24.32	" + NaCl
6.89	trace	22.31	" + NaS
21.39	"	8.09	" + "
0.24	0.43	22.36	" + NaF
4.84	1.80	5.42	" + "
0.49	0.12	26.08	" + " + NaCl
0.17	0.31	26.18	" + " + "
6.14	trace	23.37	" + NaS + NaCl

1.1 = $Na_2SO_4.NaF$; NaS = Na_2SO_4; NaS.10 = $Na_2SO_4.10H_2O$.

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE, SODIUM IODATE AND WATER.

(Foote and Vance, 1929.)

Cl

Results at 0°

Gms. per 100 gms. sat. sol.		Solid Phase
$NaIO_3$	NaCl	
0.0	26.34	NaCl
0.35	26.31	" + D.S.
0.54	24.16	D.S.
0.73	22.66	"
1.03	20.86	" + NaI.5
0.83	16.30	NaI.5
2.42	0.0	"

Results at 15°

Gms. per 100 gms. sat. sol.		Solid Phase
$NaIO_3$	NaCl	
0.0	26.38	NaCl
0.97	26.19	" + D.S.
1.29	24.64	D.S.
1.70	23.14	" + NaI.1
1.75	20.73	NaI.1
1.87	16.32	"
2.34	9.46	" + NaI.5

Results at 15° (con.)

Gms. per 100 gms. sat. sol.		Solid Phase
$NaIO_3$	NaCl	
2.35	6.60	NaI.5
5.88	0.0	"

Results at 25°

Gms. per 100 gms. sat. sol.		Solid Phase
$NaIO_3$	NaCl	
0.0	26.50	NaCl
1.97	26.03	" + NaI.1
8.66	0.0	NaI.1

Results at 35°

Gms. per 100 gms. sat. sol.		Solid Phase
$NaIO_3$	NaCl	
0.0	26.66	NaCl
1.70	26.20	"
2.39	26.03	" + NaI.1
2.47	23.15	NaI.1
2.57	21.24	"
4.51	7.87	"
10.57	0.0	"

The following eutectics and transition points were also determined.

t°	Gms. per 100 gms. sat. sol.		Solid Phase
	$NaIO_3$	NaCl	
-21.8 Eutec.	0.36	23.28	Ice + D.S. + $NaCl.2H_2O$
-16.9 "	0.34	19.93	" + " + NaI.5
+ 0.04 tr.pt.	0.39	26.33	D.S. + NaCl + $NaCl.2H_2O$
6.8 "	1.66	20.76	" + NaI.1 + NaI.5
24.6 "	1.95	25.98	" + " + NaCl

D.S. = $3NaCl.2NaIO_3.10H_2O$; NaI.5 = $NaIO_3.5H_2O$; NaI.1 = $NaIO_3.H_2O$.

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE, SODIUM IODIDE AND WATER.

(Ricci and Yanick, 1936.)

t^0	d. of sat.	Gms. per 100 gms. sat. sol.		Solid Phase	t^0	d. of sat.	Gms. per 100 gms. sat. sol.		Solid Phase
		NaCl	NaI				NaCl	NaI	
10	—	19.91	12.67	NaCl	25	1.836	0.72	61.43	NaCl
"	—	10.43	32.36	"	"	1.887	0.45	63.97	"
"	—	3.86	48.45	"	"	1.904	0.40	64.33	"+$NaI.2H_2O$
"	—	0.67	62.00	"+$NaI.2H_2O$	50	—	15.37	22.75	NaCl
25	1.304	18.02	16.61	"	"	—	0.26	69.00	"+$NaI.2H_2O$
"	1.367	14.04	24.72	"	75	—	15.88	22.37	NaCl
"	1.464	9.14	35.24	"	"	—	0.18	74.45	"+NaI
"	1.593	4.59	46.48	"	100	—	16.70	22.18	NaCl
"	1.714	2.06	54.84	"	"	—	0.39	74.70	"+NaI

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM NITRATE AND VICE VERSA.

Cl

(Leather and Mukerji, 1913.)

Results at 30°.			Results at 40°.			Results at 91°.			
d_{30} of Sat. Sol.	Gms. per 100 Gms. H_2O.		d_{40} of Sat. Sol.	Gms. per 100 Gms. H_2O.		d_{91} of Sat. Sol.	Gms. per 100 Gms. H_2O.		Solid Phase in Each Case.
	$NaNO_3$.	NaCl.		$NaNO_3$.	NaCl.		$NaNO_3$.	NaCl.	
1.202	0	36.3	1.197	0	36.53	1.189	0	38.72	NaCl
1.276	24.21	31.16	1.284	27.31	30.53	1.296	37.43	30.21	"
1.343	48.15	26.35	1.323	54.82	26.50	1.381	79.65	23.17	"
1.379	63.08	23.50	1.409	73.96	21.87	1.487	127.2	17.05	"
1.388	63.40	23.40	1.397	74.01	21.71	1.519	141.4	15.93	" +$NaNO_3$
1.381	67.91	19.69	1.396	75.29	21.61	1.518	141.3	15.83	" $NaNO_3$
1.394	81.46	9.76	1.410	89.90	10.80	1.504	149.5	9.03	"
1.406	95.90	0	1.421	105.2	0	1.521	160.8	0	"

Results are also given at 20° which agree satisfactorily with those of Nicol. Additional results at 30°, agreeing fairly well with the above, are given by Coppadoro (1913). Data for the solubility of sodium chloride in dilute solutions of sodium nitrate at 0° and at 25° are given by Armstrong and Eyre (1910–11).

Data for equilibrium in the System $Na_2O + N_2O_5 + HCl + H_2O$, at 15°, 25° and 35° are given by Nikolajew, 1927.

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM NITRATE AND VICE VERSA AT SEVERAL TEMPERATURES. (Cornec and Chretien, 1924.)

d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase.
	NaCl.	$NaNO_3$.	
Results at 0°.			
1.209	26.4	0.0	NaCl
1.251	23.2	8.0	»
1.290	20.0	15.6	»
1.332	17.0	23.2	» $+NaNO_3$
1.332	12.2	28.0	$NaNO_3$
1.333	9.48	30.9	»
1.352	0.0	42.3	»
Results at 25°.			
1.198	26.6	0.0	NaCl
1.245	22.6	9.7	»
1.290	18.9	18.4	»
1.329	15.9	25.5	»
1.367	13.3	32.1	» $+NaNO_3$
1.371	9.58	36.0	$NaNO_3$
1.376	6.23	40.5	»
1.386	3.16	43.7	»
1.392	0.0	47.8	»
Results at 50°.			
1.185	26.9	0.0	NaCl
1.259	20.5	15.3	»
1.308	16.5	24.6	»
1.356	13.3	32.8	»
1.370	11.9	35.6	»
1.410	10.0	41.3	» $+NaNO_3$
1.414	7.44	44.5	$NaNO_3$
1.418	3.57	48.8	»
1.427	0.0	53.2	»
Results at 75°.			
1.176	27.5	0.0	NaCl
1.303	16.1	26.3	»
1.349	13.0	34.5	»
1.394	10.4	41.2	»
1.435	8.4	46.9	»
1.456	7.47	49.9	» $+NaNO_3$
1.458	6.13	51.2	$NaNO_3$
1.460	3.72	54.2	»
1.469	0.0	58.7	»
Results at 100°.			
1.164	28.6	0.0	NaCl
1.276	17.6	24.0	»
1.331	13.4	33.9	»
1.390	10.2	43.0	»
1.429	8.20	48.7	»
1.443	7.68	50.7	»
1.472	6.55	54.2	»
1.485	6.20	55.7	»
1.496	5.79	56.9	»
1.500	5.63 (6.6)*	57.4 (58.7)*	» $+NaNO_3$
1.501	3.97	59.4	$NaNO_3$
1.502	2.82	60.6	»
1.507	0.0	63.7	»
Results at 20°. (Findlay and Cruickshank, 1926.)			
-	18.49	18.62	NaCl
-	17.34	21.30	»
-	13.80	30.34	» $+NaNO_3$
-	9.56	34.85	$NaNO_3$
-	7.67	37.18	»

* This result is by Wurmser, 1922.

Cl

Additional results for the isotherms at 0°, 15°, 25°, 50°, 83° and 100°, agreeing for the most part with the above, are given by Hölzl and Crotogino, 1927:

EQUILIBRIUM IN THE QUARTERNARY SYSTEM SODIUM CHLORIDE, SODIUM NITRATE, SODIUM SULFATE AND WATER.

(Chretien 1926, 1927, 1929; See also Quillier, 1927 and Pfeiffenberger and Leimbach, 1928.)

The author gives in this very exhaustive paper the complete numerical and diagramatical results (with densities) for binary, ternary and quarternary equilibrium in this system at very frequent temperature intervals between -24.4° and +121.7°. The following are the values given for the quarternary equilibrium at 25°.

d. of sat. sol.	Gms. per 100 gms. sat. sol. $NaNO_3$	$NaCl$	Na_2SO_4	Solid Phase
1.281	7.08	9.98	14.9	Na_2SO_4 + $Na_2SO_4.10H_2O$
—	12.40	6.42	15.0	" + "
1.325	18.50	3.15	15.0	" + "
1.291	11.7	18.6	5.34	" + NaCl
1.322	18.2	16.6	4.50	" + " + D
1.319	20.0	13.0	5.92	" + D
1.325	22.0	8.68	8.19	" + "
1.333	23.9	4.32	10.8	" + "
—	22.6	15.3	3.30	NaCl + "
1.357	26.5	14.0	2.45	" + "
1.378	31.2	12.7	1.88	" + " + $NaNO_3$
1.387	37.7	6.41	2.51	$NaNO_3$ + D
1.396	41.0	3.43	2.8	" + "

D = Darapskite, $NaNO_3.Na_2SO_4.H_2O$.

Cl

Solubility studies made over a period of some ten years by many investigators including Cornec and his students have established the diagrams representing the equilibrium in aqueous solutions of the chloride, nitrate and sulfate of sodium at various temperatures. Using these results Graziadei, 1935, 1936, has worked out a graphic method of calculating the yield of nitrate obtained by cooling solutions of two and of three salts. A simple formula of practical application has been deduced.

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SODIUM HYDROXIDE SOLUTIONS.

(Engel; Winteler, 1900.)

At 0° (Engel).

Mg. Mols. per 10 cc. Na_2O.	NaCl.	Sp. Gr. of Solutions.
0	54.7	1.207
4.8	49.38	1.221
6.73	47.21	1.225
10.41	42.38	1.236
14.78	39.55	1.249
30.50	24.95	1.295
37.88	19.30	1.314
53.25	9.41	1.362

Gms. per Liter. NaOH.	NaCl.
0	320
38.4	288.9
53.8	276.2
83.2	247.9
118.2	231.4
244	146
303	112.9
426	55

At 20° (Winteler).

Gms. per Liter. NaOH.	NaCl.	Sp. Gr. of Solutions.
10	308	1.200
50	297	1.230
100	253	1.250
150	213	1.270
200	173	1.290
300	112	1.330
400	61	1.375
500	30	1.425
640	18	1.490

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SODIUM HYDROXIDE AT 30°.

(Schreinemakers, 1909–10, 1910.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
Na_2O.	NaCl.		Na_2O.	NaCl.	
0	26.47	NaCl	29.31	2.40	NaCl
4.47	21.49	"	37.85	1.12	"
12.22	13.62	"	41.42	0.97	" +$NaOH.H_2O$
24.48	4.36	"	±42	0	$NaOH.H_2O$

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SODIUM HYDROXIDE AT 25°.

(Akerlof and Short, 1937.)

Gm. Mols. per 1000 gms. H_2O		Gm. Mols. per 1000 gms. H_2O		Gm. Mols. per 1000 gms. H_2O		Gm. Mols. per 1000 gms. H_2O	
NaOH	NaCl	NaOH	NaCl	NaOH	NaCl	NaOH	NaCl
0.920	5.613	6.688	2.635	12.35	1.074	19.30	0.451
1.858	5.048	7.141	2.442	13.27	0.940	20.30	0.421
2.714	4.672	8.031	2.173	14.38	0.781	21.05	0.396
3.070	4.486	8.870	1.956	15.20	0.714	21.94	0.371
3.812	4.048	9.824	1.558	16.25	0.580	22.82	0.356
4.798	3.610	11.437	1.280	17.32	0.533	23.68	0.356
5.721	3.206	11.582	1.253	17.83	0.492	23.56	0.346

Cl

The solid phase is NaCl in all cases.

EUTECTIC POINTS OF THE SYSTEM SODIUM CHLORIDE, SODIUM HYDROXIDE AND WATER.

(von Antropoff, 1924.)

Eutec. t°.	Gms. per 100 gms sat. sol.		Solid Phase.	Eutec. t°.	Gms. per 100 gms. sat. sol.		Solid Phase.
	NaCl.	NaOH.			NaCl	NaOH.	
-30.15.	16.55	8.87	Ice+$NaCl.2H_2O$	20..	0.78	51.07	NaCl+$NaOHH_2O$
-21.30.	23.6	–	» + »	30..	0.85	53.09	» »
-32.8..	8.58	18.38	» + » +$NaOH.\gamma H_2O$	40..	0.98	55.11	» »
-29.8..	4.20	20.72	» +$NaOH.\gamma H_2O$	50..	1.28	57.58	» »
-28.25.	–	19.00	» »	60..	1.70	62.64	» »
-28.00.	-	22.55	» »	70..	2.40	70.40	» +NaOH
-21.3..	6.02	26.04	NaCl+$NaOH.\beta H_2O$(?)	80..	2.95	72.16	» »
-11.1..	5.89	27.08	» »	90..	3.45	72.73	» »
0.0..	4.85	29.06	» +$NaOH.3.5H_2O$	120..	4.86	73.39	» »
10.0..	3.24	33.24	» » »	150..	7.02	74.10	» »
0.0..	1.83	36.98	» » 3.11 »*	180..	8.75	76.05	» »
10.0..	0.87	47.19	» +$NaOH.2H_2O$				

* Unstable.

Additional data for this system are given by von Antropoff and Sommer, 1926

Solubility of Sodium Chloride in Aqueous Solutions of Sodium Hydroxide at Various Temperatures. (von Antropoff, 1924.)

Constant agitation was employed and equilibrium was approached from above and from below. Silver lined apparatus was used and the determinations were made with the greatest care. The results for 16 isotherms were plotted and the dissolved sodium chloride, and specific gravities of the solutions corresponding to regular intervals of concentration of sodium hydroxide, were read from the curves. The figures in parentheses are the specific gravities of the saturated solutions.

Gms. NaOH per 100 gms. sat sol.	Gms. NaCl dissolved per 100 gms. sat. solution at						
	− 21.3°.	− 11°.1.	0°.	+ 10°	20°	30°.	40°.
5...	20.1(1.2333)	21.0(1.229)	21.9(1.232)	22.0(1.227)	22.1(1.223)	22.2(1.218)	22.3(1.218)
10...	16.9(1.260)	17.5(1.259)	17.8(1.254)	17.9(1.250)	18.0(1.243)	18.1(1.243)	18.2(1.241)
15...	13.7(1.287)	13.9(1.286)	14.1(1.279)	14.2(1.276)	14.3(1.270)	14.4(1.271)	14.5(1.269)
20...	10.3(1.318)	10.4(1.313)	10.5(1.308)	10.6(1.306)	10.7(1.298)	10.8(1.297)	10.9(1.296)
25...	7.0(1.350)	7.1(1.342)	7.2(1.337)	7.3(1.334)	7.4(1.330)	7.5(1.329)	7.7(1.326)
30...	—	—	4.3(1.373)	4.5(1.370)	4.7(1.368)	4.9(1.363)	5.0(1.359)
35...	—	—	2.2(1.415)	2.5(1.412)	2.8(1.406)	3.0(1.400)	3.1(1.398)
40...	—	—	—	1.3(1.453)	1.6(1.446)	1.8(1.441)	2.0(1.438)
45...	—	—	—	0.9(1.501)	1.1(1.490)	1.3(1.484)	1.5(1.480)
50...	—	—	—	—	0.8(1.540)	1.0(1.530)	1.2(1.525)
55...	—	—	—	—	—	—	1.0(1.574)

Gms. NaOH per 100 gms. sat. sol.	Grams NaCl dissolved per 100 gms. sat. solution at							
	50°.	60°	70°.	80°.	90°.	120°.	150°.	180°.
5...	22.4(1.213)	22.8(1.211)	23.0(1.209)	23.4(1.205)	23.7(1.200)	24.6	25.6	27.0
10...	18.3(1.237)	18.7(1.236)	19.0(1.231)	19.3(1.229)	19.6(1.224)	20.4	21.8	23.0
15...	14.7(1.264)	14.9(1.262)	15.0(1.258)	15.5(1.256)	15.8(1.254)	16.8	18.0	19.6
20...	11.1(1.292)	11.4(1.290)	11.7(1.288)	12.1(1.287)	12.4(1.284)	13.3	15.0	16.3
25...	8.0(1.323)	8.4(1.322)	8.6(1.320)	9.1(1.320)	9.5(1.318)	10.5	12.1	13.8
30...	5.3(1.357)	5.8(1.360)	6.0(1.355)	6.6(1.356)	7.1(1.352)	8.2	10.0	11.8
35...	3.4(1.394)	3.9(1.400)	4.1(1-393)	4.7(1.397)	5.2(1.390)	6.5	8.3	10.0
40...	2.3(1.434)	2.7(1.437)	3.0(1.432)	3.5(1.435)	3.9(1.428)	5.2	7.0	8.9
45...	1.8(1.474)	2.0(1.472)	2.3(1.474)	2.7(1.472)	3.0(1.465)	4.4	6.1	8.0
50...	1.5(1.517)	1.7(1.515)	2.0(1.512)	2.4(1.510)	2.7(1.508)	3.8	5.6	7.7
55...	1.3(1.566)	1.7(1.563)	2.0(1.561)	2.3(1.560)	2.6(1.558)	3.6	5.4	7.4
60...	—	1.7(1.610)	2.1(1.510)	2.4(..609)	2.7(1.608)	3.8	5.7	7.7
65...	—	2.2	—	2.6	2.9(1.650)	4.1	6.0	7.9
70...	—	2.4	—	2.8	3.2(1.70)	4.5	6.5	8.1
75...	—	—	—	—	—	—	—	8.5

Results in close agreement with the above at 0°, 15°, 20°, 25°, 30°, 35°, 45° and 60° are given by Freeth, 1922.

Solubility of Sodium Chloride in Aqueous Solutions of Sodium Hydroxide at the Boiling-Point. (von Antropoff, 1924.)

t° of B. pt.	d of sat. sol.	Gms. per 100 gms. sat. sol. NaCl.	Gms. per 100 gms. sat. sol. NaOH.	t° of B. pt.	d of sat. sol.	Gms. per 100 gms. sat. sol NaCl.	Gms. per 100 gms. sat. sol NaOH.
108.8...	1.172	28.9	0.0	123.0...	1.346	8.7	30.0
110.0...	1.195	24.8	5.0	128.7...	1.381	7.4	35.0
111.5...	1.222	20.9	10.0	135.0...	1.416	6.5	40.0
113.3...	1.250	17.1	15.0	141.7...	1.452	5.9	45.0
115.4...	1.279	13.8	20.0	150.0...	1.487	5.6	50.0
118.4...	1.312	10.8	25.0	160.5...	1.522	5.9	55.0

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE SODIUM SULFATE AND WATER.

(Chretien, 1928, 1929.)

t°	Gms. per 100 gms. sat. sol.		Solid Phase
	NaCl	Na_2SO_4	
Results at 0°			
-21.7	22.8	0.12	Ice + Cl.2 + S.10
-21.32	23.43	0.31(1)	" + " + "
-21.6	22.9	0.0	" + Cl.2
-20.94	23.18	0.0 (1)	" - "
- 1.2	0.0	3.79	" + S.10
- 0.1	25.3	1.39	Cl.2 + S.10 + Cl
0.0	25.79	1.32(1)	" + " "
Results at 10.2°			
d.			
(1.102)	8.78	4.07	S.10
(1.159)	17.2	3.26	"
(1.224)	24.3	3.39	" + Cl
Results at 15°			
(1.236)	23.2	5.41	S.10 + Cl
Results at 17.5°			
(1.339)	8.12	8.51	S.10
(1.190)	16.9	6.8	"
(1.247)	22.3	7.31	" + Cl
Result at 17.9°			
—	22.3	7.57	S.10 + S + Cl
Results at 25°			
(1.207)	7.66	16.0	S.10
—	14.5	14.5	" + S
—	14.12	14.93(1)	" + S
—	13.61	15.18(3)	" + Cl
(1.239)	18.4	10.4	S
(1.243)	22.7	7.06	" + Cl
—	22.77	6.92(1)	" + "
—	22.98	6.80(3)	" + "
(1.216)	24.6	3.35	Cl

t°	Gms. per 100 gms. sat. sol.		Solid Phase
	NaCl	Na_2SO_4	
Results at 30°			
d.			
(1.283)	3.35	26.0	S.10
(1.291)	5.68	25.0	" + S
—	12.2	16.2	S
—	18.0	9.70	"
1.237	23.0	6.68	" + Cl
Results at 50°			
(1.247)	7.85	20.8	S
(1.216)	16.1	11.3	"
(1.223)	24.1	5.54	" + Cl
(1.203)	25.4	2.56	Cl
Results at 75°			
—	7.76	19.7	S
—	16.5	10.2	"
1.207	25.3	4.95	" + Cl
1.189	26.4	2.14	Cl
Results at 94.5 (2)			
—	23.2	26.3	S
—	15.56	10.8	"
—	25.8	4.42	" + Cl
—	27.15	2.43	Cl
Results at 100°			
—	7.67	18.6	S
—	18.4	8.75	"
1.194	25.9	4.51	" + Cl
1.777	27.2	1.84	Cl
Result at 109.1° (b.pt.)			
—	26.4	5.01	S + Cl

Cl.2 = $NaCl.2H_2O$; Cl = NaCl; S.10 = $Na_2SO_4.10H_2O$; S = Na_2SO_4.

(1) (Foote and Schairer, 1930.)

(2) (Pelling, 1925.)

(3) (Takejami, 1920, 1921.)

Additional results at 0° and at 25°, in terms of gm. mols. NaCl and of Na_2SO_4 per 1000 gm. mols. H_2O, are given by Kournakow and Zemcznzyj, 1924.

Chretien also gives very complete numerical and diagramatic results (with densities) for equilibrium in the quarternary system NaCl + Na_2SO_4 + $NaNO_3$ at frequent temperature intervals between -24.4° and + 121.7°.

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE, SODIUM SULFATE AND WATER AT SEVERAL TEMPERATURES.

(Seidell, 1902.)

Results at 10°.

Sp. Gr. of Solutions.	Gms. per 100 Gms. H_2O.	
	NaCl.	Na_2SO_4.
1.080	0.0	9.14
1.083	4.28	6.42
1.102	9.60	4.76
1.150	15.65	3.99
1.164	21.82	3.97
1.192	28.13	4.15
1.207	30.11	4.34
1.217	32.27	4.59
1.223	33.76	4.75

Results at 21.5°.

Sp. Gr. of Solutions.	Gms. per 100 Gms. H_2O.	
	NaCl.	Na_2SO_4.
1.164	0.0	21.33
1.169	9.05	15.48
1.199	17.48	13.73
1.214	20.41	13.62
1.243	26.01	15.05
1.244	26.53	14.44
1.244	27.74	13.39
1.244	31.25	10.64
1.243	31.80	10.28
1.245	32.10	8.43
1.219	33.69	4.73
1.212	34.08	2.77
1.197	35.46	0.00

Results at 27°.

Sp. Gr. of Solutions.	Gms. per 100 Gms. H_2O.	
	NaCl.	Na_2SO_4.
1.228	0.0	31.10
1.230	2.66	28.73
1.230	5.29	27.17
1.235	7.90	26.02
1.259	16.13	24.83
1.253	18.91	21.39
1.249	19.64	20.11
1.245	20.77	19.29
1.238	32.33	9.53

Results at 30°.

Sp. Gr. of Solutions.	Gms. per 100 Gms. H_2O.	
	NaCl.	Na_2SO_4.
1.281	0.0	39.70
1.282	2.45	38.25
1.284	5.61	36.50
1.290	7.91	35.96
1.276	10.61	31.64
1.270	12.36	29.87
1.258	15.65	25.02
1.249	18.44	21.30
1.244	20.66	19.06
1.236	32.43	9.06

Results at 33°.

Sp. Gr. of Solutions.	Gms. per 100 Gms. H_2O.	
	NaCl.	Na_2SO_4.
1.329	0.0	48.48
1.323	1.22	46.49
1.318	1.99	45.16
1.315	2.64	44.09
1.309	3.47	42.61
1.265	12.14	29.32
1.237	21.87	16.83
1.234	32.84	8.76
1.217	33.99	4.63
1.208	34.77	2.75

Results at 35°.

Sp. Gr. of Solutions.	Gms. per 100 Gms. H_2O.	
	NaCl.	Na_2SO.
1.324	0.0	47.94
1.314	2.14	43.75
1.256	13.57	26.26
1.238	18.78	19.74
1.231	31.91	8.28
1.193	35.63	0.00

Cl

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE, SODIUM SULFATE AND WATER AT 15°.

((Schreinemakers and de Baat, 1909.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
NaCl.	Na_2SO_4.		NaCl.	Na_2SO_4.	
5.42	7.86	$Na_2SO_4.10H_2O$	21.03	5.26	$Na_2SO_4.10H_2O$
11.51	5.87	"	23.39	5.64	" +NaCl
15.97	5.23	"	25.21	2.26	NaCl

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE, SODIUM SULFATE AND WATER AT 25°.

(Cameron, Bell and Robinson, 1907.)

d_{25} of Sat. Sol.	Gms. per 100 Gms. H_2O.		Solid Phase.	d_{25} of Sat. Sol.	Gms. per 100 Gms. H_2O.		Solid Phase.
	NaCl.	Na_2SO_4.			NaCl.	Na_2SO_4.	
1.2173	2.96	26.60	$Na_2SO_4.10H_2O$	1.2429	26.54	12.64	Na_2SO_4
1.2162	5.79	24.32	"	1.2438	31.06	9.98	"
1.2150	9.90	21.41	"	1.2451	32.41	9.93	"
1.2275	13.43	19.62	"	1.2453	33	9.84	" +NaCl
1.2385	15.82	19.64	"	1.2309	33.81	6.66	NaCl
1.2571	19.13	20.73	" +Na_2SO_4	1.2162	34.60	3.38	"
1.2476	23.22	16.28	Na_2SO_4	1.2002	35.80	0	"

Data are also given for the system sodium sulfate, sodium chloride, calcium sulfate and water at 25°.

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE, SODIUM THIOSULFATE AND WATER AT 25°.

(Radiscev, 1928.)

Cl

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$Na_2S_2O_3$	NaCl		$Na_2S_2O_3$	NaCl	
0	26.45	NaCl	32.98	9.86	NaCl + $Na_2S_2O_3.5H_2O$
4.54	24.11	"	33.80	9.03	$Na_2S_2O_3.5H_2O$
9.80	21.62	"	35.48	7.31	
16.66	18.00	"	39.52	3.37	"
25.67	13.37	"	43.10	0.0	"

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE, LEAD CHLORIDE AND WATER AT 25°.

(Deacon, 1927.)

Gms. per 100 gms. H_2O		Solid Phase	Gms. per 100 gms. H_2O		Solid Phase
NaCl	$PbCl_2$		NaCl	$PbCl_2$	
35.96	0.0	NaCl	10.00	0.214	$PbCl_2$
36.30	0.82	"	8.00	0.188	"
36.70	2.01	"	6.00	0.175	"
36.99	3.48	" + $PbCl_2$	5.00	0.167	"
32.0	2.15	$PbCl_2$	4.00	0.172	"
28.0	1.38	"	2.00	0.209	"
24.0	0.89	"	1.56	0.252	"
20.0	0.60	"	0.50	0.720	"
14.30	0.352	"	0.0	1.087	"

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS METHYL ALCOHOL.

(Armstrong and Eyre, 1910–11.)

Results at 0°.		Results at 25°.	
Solvent, Gms. CH_3OH per 1000 Gms. H_2O.	Gms. NaCl per 100 Gms. Sat. Sol.	Solvent, Gms. CH_3OH per 1000 Gms. H_2O.	Gms. NaCl per 100 Gms. Sat. Sol.
0	26.35	8.01	26.29
8.01	26.05	16.02	26.02
16.02	25.79	32.04	25.50
32.04	29.19	96.12	23.50

A sat. solution of NaCl in CH_3OH contains 0.1 gm. NaCl per 100 gms. solution at the critical temperature. (Centnerszwer, 1910.)

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SOLUTIONS OF METHYL ALCOHOL AT 25°.

(Akerlof and Turck, 1935.)

Wt. % CH_3OH in solvent	Gm. Mols. NaCl per 1000 gms. solvent	Wt. % CH_3OH in solvent	Gm. Mols. NaCl per 1000 gms. solvent
0.0	6.162	60.10	1.328
10.59	5.038	70.83	0.8656
20.49	4.096	80.45	0.5544
30.16	3.273	89.29	0.3685
39.80	2.552	100.00	0.2367
50.65	1.896		

Cl

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS ETHYL ALCOHOL.

t°	Wt. % C_2H_5OH in solvent	Gms. NaCl per 100 gms. solvent	Authority
20	50.0	9.8	Wright, 1927.
25	20.4	22.86	Flatt and Jordan, 1933.
"	42.5	12.84	" " " "
"	67.9	4.07	" " " "
100	50.0	12.1	Wright, 1927.

SOLUBILITY OF SODIUM CHLORIDE IN ALCOHOLS.

(At 18.5°, de Bruyn — Z. physik. Ch. 10, 782, '92; Rohland — Z. anorg. Ch. 18, 327, '98.)

t°.	Alcohol.	Gms. NaCl per 100 Gms. Alcohol	t°.	Alcohol	Gms. NaCl per 100 Gms. Alcohol
18.5	Abs. Methyl	1.41	room temp.	Methyl $d_{15}=0.799$	1.33
"	" Ethyl	0.065	"	Ethyl $d_{15}=0.81$	0.176
			"	Propyl $d_{15}=0.816$	0.033

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS ETHYL ALCOHOL SOLUTIONS.

(Bodländer — Z. physik. Ch. 7, 317, '91; Taylor — J. Phys. Ch. 1, 723, '97; also Bathrick — *Ibid.* 1, 159, '96.)

Results at 11.5° (B.).

Sp. Gr. of Solutions.	Gms. per 100 cc. Solution. C_2H_5OH.	H_2O.	NaCl
1.2035	0	86.62	31.73
1.1865	2.86	86.14	29.66
1.1710	5.41	83.93	27.77
1.1548	7.93	81.50	26.05
1.1350	10.84	78.78	24.28
1.1390	11.22	78.62	23.65
1.1088	16.85	73.40	20.63

Results at 13° (B.).

Sp. Gr. of Solutions.	Gms. per 100 cc. Solution. C_2H_5OH.	H_2O.	NaCl.
1.2030	0	88.70	31.60
1.1348	11.81	78.41	23.26
1.1144	15.99	74.64	20.81
1.0970	19.39	71.45	18.86
1.0698	24.95	65.80	16.23
1.0295	32.33	57.96	12.66
0.9880	40.33	49.34	9.13
0.9445	49.28	38.54	5.93
0.9075	57.91	29.37	3.47
0.8700	63.86	21.62	1.52
0.8400	72.26	11.24	0.50

Results at 30° and at 40° (T.).

Wt per cent Alcohol in Solvent.	At 30°, Gms. NaCl per 100 Gms. Solution.	Water.	At 40°, Gms. NaCl per 100 Gms. Solution.	Water.
0	26.50	36.05	26.68	36.38
5	24.59	34.29	24.79	34.69
10	22.66	32.57	22.90	33.00
20	19.05	29.40	19.46	30.20
30	15.67	26.53	16.02	27.25
40	12.45	23.70	12.75	24.37
50	9.34	20.60	9.67	21.42
60	6.36	16.96	6.65	17.82
70	3.36	12.75	3.87	13.10
80	1.56	7.95	1.69	8.68
90	0.43	4.30	0.50	5.10

100 gms. alcohol of 0.9282 Sp. Gr. = 45.0% by wt. dissolve at.

4°	10°	13°	23°	32°	33°	44°	51°	60°	
10.9	11.1	11.43	11.9	12.3	12.5	13.1	13.8	14.1	gms. NaCl

(Gerardin — Ann. chim. phys. [4] 5, 146, '56.)

100 gms. of a mixture of equal parts of 96% alcohol and 98% ether dissolve 0.11 gm. NaCl.

(Mayer — Liebig's Ann. 98, 205, '56.)

SOLUBILITY OF SODIUM CHLORIDE AT 20° IN AQUEOUS 30 PER CENT ETHYL ALCOHO CONTAINING INCREASING AMOUNTS OF BENZENE. (Wright, 1926.)

Per cent C_6H_6 in aq. 50 % alcohol...	0.0	1.91	4.10	5.34	7.95
Gms. NaCl per 100 gms. sat. sol.....	9.80	9.86	9.95	10.10	10.35

100 gms. 86.5 % glycerol ($d = 1.2326$) dissolve 10.37 gms. NaCl at 20°.
" 98.5 % " ($d = 1.2645$) " 8.28 gms. "

(Holm, 1921, 1922.)

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL.

(Armstrong and Eyre, 1910–11.)

Results at 0°.

Solvent Gms. C_2H_5OH per 1000 Gms. H_2O.	Gms. NaCl per 100 Gms. Sat. Sol.
0	26.46
11.51	25.97
23.03	25.48
46.06	24.41
138.18	20.95

Results at 25°.

d_{25} of Sat. Sol.	Solvent Gms. C_2H_5OH per 1000 Gms. H_2O.	Gms. NaCl per 100 Gms. Sat. Sol.
1.202	0	26.55
1.196	11.51	26.06
1.190	23.03	25.63
1.179	46.06	24.75
1.159	92.12	23.29
1.1115	230.3	19.35

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS ALCOHOL AT 28°.

(Fontein, 1910.)

Gms. per 100 Gms. Sat. Sol.			Gms. per 100 Gms. Sat. Sol.		
C_2H_5OH.	H_2O.	NaCl.	C_2H_5OH.	H_2O.	NaCl.
0	73.53	26.47	45.35	45.35	9.3
3.8	71.6	24.6	56.2	37.5	6.3
7.7	69.7	22.6	67.4	28.9	3.7
16.1	64.6	19.3	78.8	19.7	1.5
25.3	58.9	15.8	89.6	10	0.4
35	52.5	12.5			

Results are also given by Fontein showing the solubility of sodium chloride in mixtures of ethyl alcohol, amyl alcohol and water at 28°, both when one liquid phase is present and when conjugated liquid layers are formed.

Cl

RECIPROCAL SOLUBILITY OF SODIUM CHLORIDE AND OF SODIUM NITRATE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 25°.

(Hering, 1936.)

Gms. per 100 gms. H_2O			Solid Phase	Gms. per 100 gms. H_2O			Solid Phase
C_2H_5OH	$NaNO_4$	NaCl		C_2H_5OH	$NaNO_3$	NaCl	
25	0.0	28.8	NaCl	72.3	49.2	0.0	$NaNO_3$
25	16.1	25.4	"	150	0.0	16.0	NaCl
25	32.2	22.5	"	150	26.9	11.9	" + $NaNO_3$
25	47.0	20.3	" + $NaNO_3$	150	33.3	0.0	$NaNO_3$
25	57.2	10.2	$NaNO_3$	255	0.0	10.1	NaCl
25	69.7	0.0	"	255	19.3	8.1	" + $NaNO_3$
72.3	0.0	22.4	NaCl	255	22.7	0.0	$NaNO_3$
72.3	18.2	19.0	"	396	0.0	6.7	NaCl
72.3	36.3	16.3	" + $NaNO_3$	396	13.8	5.2	" + $NaNO_3$
72.3	42.2	8.0	$NaNO_3$	396	15.4	0.0	$NaNO_3$

SOLUBILITY OF SODIUM CHLORIDE IN SEVERAL ALCOHOLS AT 25°.

(Turner and Bissett, 1913.)

Alcohol.		Gms. NaCl per 100 Gms. Alcohol.
Methyl Alcohol,	CH_3OH	1.31
Ethyl Alcohol,	C_2H_5OH	0.065
Propyl Alcohol,	C_3H_7OH	0.012
Amyl Alcohol,	$C_5H_{11}OH$	0.002

Solubility of Sodium Chloride in Several Alcohols at 25°.

(Larson and Hunt, 1939.)

Alcohol	Formula	d. of sat. sol.	Gms. NaCl per 100 gms. solvent
Methanol	CH_3OH	0.7977	1.401
Ethanol	C_2H_5OH	0.7857	0.0649
1-Propanol	$CH_3CH_2CH_2OH$	0.8000	0.0124
1-Butanol	$CH_3(CH_2)_2CH_2OH$	0.8058	0.0050
2-Propanol (iso)	$CH_3CHOHCH_3$	0.7809	0.0027
2-Methyl-1propanol(iso butyl)	$(CH_3)_2CHCH_2OH$	0.7980	0.0020
1 Pentanol	$CH_3(CH_2)_3CH_2OH$	0.0899	0.00177
2 Butanol (Secondary)	$CH_3CH_2CHOHCH_3$	0.8022	0.00047

Solubility of Sodium Chloride in Concentrated Aqueous Ethyl Alcohol.

(Ferner and Mellon, 1934.)

Wt. Percent C_2H_5OH in solvent	Gms. NaCl per 100 gms. solvent at: 18°	25°	35°
86.4	0.5767	0.6417	0.6586
89.6	0.3711	0.4181	0.4345
92.3	0.2358	0.2670	0.2706
96.9	0.1183	0.1220	0.1335
100.0	0.0657	0.0657	0.0667

Solubility of Sodium Chloride in Several Alcohols at Different Temperatures.

(Kirn and Dunlap, 1931.)

Cl

Alcohol	Gm. Mols. NaCl per 100 gms mols. alcohol at. 20°	30°	35°	40°	45°	50°
Methanol	0.778	0.758	0.744	0.734	0.720	0.711
Ethanol	0.1147	0.1197	0.1242	0.1258	0.1293	0.1142
Propanol	0.00446	0.00434	0.00421	0.00417	0.00384	0.0037
Iso propanol	0.096	0.100	0.108	0.102	0.102	0.093
Butanol	0.00695	0.00710	—	0.00762	—	0.00774
Iso butanol	0.00280	0.00292	—	0.00341	—	0.00356

Solubility of Sodium Chloride in Anhydrous Acetic Acid.

(Davidson and Chappell, 1933))

t°	Mols. NaCl per 100 mols. sat. sol.	t°	Mols. NaCl per 100 mols. sat. sol.	t°	Mols. NaCl per 100 mols. sat. sol.
30	0.076	54	0.097	76	0.130
41	0.081	60	0.105	84	0.145
45	0.085	68	0.115	92	0.166

Solubility of Sodium Chloride in Aqueous Solutions of Ethylene Glycol at 30°

((Trimble, 1931.)

d. of sat. sol.	Gms. per 100 gms. sat. sol. CH_2OHCH_2OH	NaCl	d. of sat. sol.	Gms. per 100 gms. sat. sol. CH_2OHCH_2OH	NaCl
1.1960	0.0	26.52	1.1593	51.13	13.45
1.1816	14.93	22.14	1.1518	71.97	9.42
1.1694	32.11	17.67	1.1485	93.38	6.62

100 gms. sat. solution of Sodium Chloride in glycol contain 31.7 gms. NaCl at 14.8°. (de Coninck, 1905.)

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SOLUTIONS OF CARBAMIDE (UREA) AND OF FORMAMIDE AT 25°.

(Ritzel, 1911.)

In Aqueous Carbamide.		In Aqueous Formamide.	
Gms. $CO(NH_2)_2$ per 100 cc. Solution.	Gms. NaCl per 100 cc. Solution.	Gms. $HCO.NH_2$ per 100 cc. Solution.	Gms. NaCl per 100 cc. Solution.
0	31.80	0	31.80
5	30.63	2.3	30.98
9.6	29.05	5.3	30.86
13	28.46	8	30.40
18	27.65	11	29.11
23	27.24	15	28.52
28	26.56	18.8	27.76

According to results by Fastert (1912), the solubility of sodium chloride in aqueous solutions of urea increases slightly with increase of urea in solution, thus:

Gms. $CO(NH_2)_2$ per 100 cc. Sol.	10	20	30	40	50
Gms. NaCl per 100 cc. Sol.	31.92	32.17	32.51	32.93	33.40

Data for equilibrium in the system sodium chloride, succinic acid nitrile, water are given by Timmermans (1907).

100 gms. 95% formic acid dissolve 5.8 gms. NaCl at 19.7°. (Aschan, 1913.)

100 gms. hydroxylamine dissolve 14.7 gms. NaCl at 17.5°. (de Bruyn, 1892.)

100 cc. anhydrous hydrazine dissolve 8 gms. NaCl at room temp. (Welsh and Broderson, 1915.)

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS ACETONE SOLUTIONS AT 20°

(Frankforter and Cohen, 1914.)

Gms. per 100 Gms. Sat. Sol.			Gms. per 100 Gms. Sat. Sol.		
NaCl.	H_2O.	$(CH_3)_2CO$.	NaCl.	H_2O.	$(CH_3)_2CO$.
25.9	73.06	1.04	16.55	61.59	21.86*
24.19	71.18	4.03	0.45	13.75	85.8*
20.85	66.78	12.37	0.32	13.92	85.76
18.32	63.16	18.52	0.19	10.82	88.99
17.89	62.21	19.90	0.12	8.94	90.94

* Quad pt.

Between the concentration 21.86 and 85.8 per cent acetone, two layers are formed. The binodal curve corresponding to this range of concentration was determined and it is stated by the authors that tie lines were located but the analytical data for them are not given. The results for the binodal curve are as follows:

Gms. per 100 Gms. Homogeneous Liquid.			Gms. per 100 Gms. Homogeneous Liquid.		
NaCl.	H_2O.	$(CH_3)_2CO$.	NaCl.	H_2O.	$(CH_3)_2CO$.
0.59	15.46	83.95	5.87	40.19	53.94
0.79	17.58	81.63	6.45	42.12	51.43
0.93	18.83	80.24	7.53	46.12	46.35
1.27	22.19	76.54	8.87	49.39	41.74
1.57	23.89	74.54	9.47	50.92	39.61
2.31	27.27	70.42	10.35	53.06	36.59
4.87	36.79	58.34	15.87	59.71	24.42

Additional data, showing the effect of temperature on the above system, are also given

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SOLUTIONS OF:

Acetone at 20°.

(Herz and Knoch, 1904.)

cc. Acetone per 100 cc. Solvent.	NaCl per 100 cc. Solution.	
	Millimols.	Gms.
0	537.9	31.47
10	464.6	27.18
20	394.8	23.10
30	330.1	19.32
32 Lower layer	308.5	18.05
87 Upper layer	7.7	0.45
88	7.3	0.43
90	4.3	0.25

Glycerol at 25°.

(Herz and Knoch, 1905.)

Wt. Per cent Glycerol in Solvent.	NaCl per 100 cc. Solution.		Sp. Gr. of Solution.
	Millimols.	Gms.	
0	545.6	31.93	1.1960
13.28	501.1	29.31	1.2048
25.98	448.4	26.23	1.2133
45.36	370.2	21.66	1.2283
54.23	333.9	19.54	1.2381
83.84	220.8	12.91	1.2666
100 *	167.1	9.78	1.2964

* Sp. Gr. of Glycerol, 1.2592. Impurities about 1.5%.

1000 cc sat. solution of Sodium Chloride in pure Acetone contain 0.0000055 gm. mol. NaCl at 18° and 0.000006 gm. mol. at 37°, as determined by electrical conductivity measurements. (Lannung, 1932.)

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE, METHYL ETHYL KETONE AND WATER AT 25° (BINODAL CURVE).

(Frankforter and Cohen, 1916.)

Cl

Gms. per 100 Gms. Homogeneous Liquid.			Gms. per 100 Gms. Homogeneous Liquid.		
NaCl.	$CH_3.CO.C_2H_5$.	H_2O.	NaCl.	$CH_3.CO.C_2H_5$.	H_2O.
0.35	20.13	79.52	6.75	10.80	82.45
0.55	19.75	79.70	10.07	7.65	82.28
1.42	16.52	82.06	14.32	5.36	80.32
1.80	17.70	80.50	14.65	3.83	81.52
2.47	16.24	81.29	23.15	2.08	74.77
4.11	13.34	82.55	24.14	0.94	74.92

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS PROPYL ALCOHOL.

(Armstrong and Eyre, 1910–11.)

Aqueous propyl alcohol containing 15.01 gms. C_3H_7OH per 1000 cc. H_2O dissolves 25.71 gms. NaCl per 100 gms. sat. solution at 0° and 25.95 gms. at 25°.

Aqueous propyl alcohol containing 30.02 gms. C_3H_7OH per 1000 cc. H_2O dissolves 25.12 gms. NaCl per 100 gms. sat. solution at 0° and 25.37 gms. at 25°.

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE, NORMAL PROPYL ALCOHOL AND WATER AT 23–25°.

(Frankforter and Frary, 1913.)

The authors determined the binodal curve and quadruple points of the system but did not locate tie lines.

Gms. per 100 Gms. Homogeneous Liquid.			Gms. per 100 Gms. Homogeneous Liquid.		
NaCl.	C_3H_7OH.	H_2O.	NaCl.	C_3H_7OH.	H_2O.
0.55	87.7	11.75*	14.38	5.39	80.23
2.23	51.57	46.20	15.42	5.11	79.47
3.55	18.99	77.46	16.38	4.47	79.14
3.90	14.78	81.32	18.08	3.83	78.09
5.27	12.77	81.96	20.12	3.27	76.61
8.04	9.49	82.47	22.35	2.64	75.01
10.49	7.79	81.72	24.50	2.13	73.37
12.20	6.57	81.23	24.9	2.3	72.8*

* Quad. pt.

The effect of temperature upon the equilibrium in the above system was greater than observed in any of the other systems investigated and additional data, illustrating the extent of the temperature influence, are given.

100 gms. sat. sol. of NaCl in 99.6 per cent C_3H_7OH contain 0.04 gm. NaCl at 25°. (Frankforter and Frary, 1913.)

SODIUM CHLORIDE

SOLUBILITY OF SODIUM CHLORIDE IN CONCENTRATED SOLUTIONS OF 2-PROPANOL (ISO PROPYL ALCOHOL) IN WATER.

(Ferner and Mellon, 1934.)

Wt. Percent $CH_3CH_2OHCH_3$ in solvent	Gms. NaCl per 100 gms. solvent at: 15°	25°	35°
87.7	0.2650	0.2812	0.2968
92.6	0.0647	0.0630	0.0701
96.5	0.0169	0.0161	0.0183
100.0	0.0040	0.0041	0.0030

SOLUBILITY OF SODIUM CHLORIDE IN ISO PROPYL ALCOHOL CONTAINING SMALL AMOUNTS OF WATER AT 25°.

(Kraus and Seward, 1928.)

d. of solvent	% H_2O in solvent	Gm. mols. NaCl per liter solvent	d. of solvent	% H_2O in solvent	Gm. mols. NaCl per liter solvent
0.7849	0.0	0.0004246	0.7885	1.39	0.0008025
0.7854	0.084	0.0004399	0.7900	2.02	0.001100
0.7868	0.815	0.0006034	0.7985	5.88	0.004138

SOLUBILITY OF SODIUM CHLORIDE IN ISO PROPYL ALCOHOL CONTAINING INCREASING AMOUNTS OF SODIUM NITRATE AT 25°.

(Kraus and Seward, 1927, 1928.)

Gm. Mols. per liter $NaNO_3$	NaCl	Gm. Mols. per liter $NaNO_3$	NaCl	Gm. Mols. per liter $NaNO_3$	NaCl
0.00	0.0004246	0.0005907	0.0003625	0.0015574	0.0003244
0.00008	0.0004159	0.0005984	0.0003640	0.001959	0.0003074
0.0001672	0.0004050	0.0008539	0.0003480	0.002824	0.0002903
0.0004013	0.0003817	0.0013097	0.0003242		

The authors also give results for the Solubility of Sodium Chloride in Iso propyl Alcohol containing 2.02 percent H_2O and increasing amounts of Sodium Nitrate at 25°.

SOLUBILITY OF SODIUM CHLORIDE IN ISO PROPYL ALCOHOL CONTAINING INCREASING AMOUNTS OF AMMONIUM NITRATE AT 25°.

(Kraus and Seward, 1927, 1928.)

Gm. Mols. per liter NH_4NO_3	NaCl	Gm. Mols. per liter NH_4NO_3	NaCl
0.000	0.000455	0.0003537	0.000547
0.0000985	0.000481	0.0006938	0.000617
0.0001839	0.000503	0.0014024	0.000734

SODIUM CHLORIDE

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE, ISO PROPYL ALCOHOL AND WATER AT 25°.

(Ginnings and Chen, 1931.)

Points on the binodal curve of this system were determined by observing the appearance or disappearance of clouding in a mixture of weighed amounts of NaCl and one of the liquids, upon addition of weighed amounts of the other. Tie lines, *, were located by determination of NaCl in two liquid layers in contact with each other and the plait point, PP, was found by plotting.

Gms. per 100 gms. of the three constituents			Gms. per 100 gms. of the three constituents	
NaCl	$CH_3CH_2OHCH_3$		NaCl	$CH_3CH_2OHCH_3$
1.70	75.20*		10.62	23.90
2.95	64.35		13.70	15.70
5.20	49.50 PP		21.10	5.9 *
10.17	35.43			

Cl 100 gms. normal Butyl Alcohol ($CH_3(CH_2)_2CH_2OH$) of d. = 0.806 dissolve 0.014 gm. NaCl at 25°. (Willard and Smith, 1922, 1923.)

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE, TERTIARY BUTYL ALCOHOL AND WATER AT 30°.

(Ginnings and Robbins, 1930.)

The determinations were made as noted above.

Gms. per 100 gms. of the three constituents		Gms. per 100 gms. of the three constituents		Gms. per 100 gms. of the three constituents	
NaCl	$(CH_3)_3COH$	NaCl	$(CH_3)_3COH$	NaCl	$(CH_3)_3COH$
0.0	84.0*	4.3	27.7	10.7	—*
0.3	83.8	4.5	26.0	11.2	8.5
—	60.0*	4.6	23.0 PP	12.5	7.5
1.5	57.3	5.1	19.0	13.9	—
—	48.0*	6.7	14.5	14.1	6.7
2.4	44.4	9.0	11.5	15.6	5.8
3.2	36.4	10.0	10.0	18.4	4.2
				22.4	—*

The plait point PP, at 25° was found by Ginnings, Herring and Webb, 1933, to have the composition - 3.7 percent NaCl + 36.7 percent $(CH_3)_3COH$ + 59.6 percent H_2O. The original results for the remaining points on the binodal curve are not given but only the values of arbitrary constants derived by empirical equations.

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE, BUTYRIC ACID AND WATER AT 25°.

(Bury and Mende, 1939.)

The mixtures separate into two liquid layers at concentrations of butyric acid between 1.47 and 85.25 percent.

Results for Solutions in contact with NaCl

Gms. per 100 gms. sat. sol.	
$C_4H_8O_2$	NaCl
0.0	26.45
0.22	26.30
0.68	26.05
1.30	25.76
1.47	25.68
89.25	0.12
90.37	0.11
93.27	0.07
94.06	0.06
97.44	0.03
99.98	0.02

Results for mixtures yielding two liquid layers

Upper Layer		Lower Layer	
Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.	
$C_4H_8O_2$	NaCl	$C_4H_8O_2$	NaCl
34.86	1.90	32.70	2.0
36.50	1.69	31.75	2.07
38.73	1.58	28.90	2.20
41.50	1.49	27.10	2.26
44.78	1.42	22.76	2.50
50.78	1.35	18.64	3.20
60.42	0.9	12.62	4.44
70.20	0.85	7.76	10.15
76.38	0.65	5.65	14.05
85.65	0.50	3.00	21.15
88.12	0.31 (tr.pt.)	1.77	25.48

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE, ISO BUTYRIC ACID AND WATER AT 25°.

(Bury and Mende, 1939.)

Cl

Results for solutions in contact with NaCl

Gms. per 100 gms. sat. sol.	
Iso $C_4H_8O_2$	NaCl
0.24	26.31
0.73	26.11
1.17	25.88
95.53	0.06
96.24	0.04
98.24	0.03
99.99	0.01

Results for mixtures yielding two liquid layers

Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.	
Iso $C_4H_8O_2$	NaCl	Iso $C_4H_8O_2$	NaCl
57.26	0.0	24.10	0.0
69.34	0.10	15.80	1.25
78.40	0.11	10.80	3.95
86.86	0.14	5.59	10.63
90.10	0.14	3.67	15.54
94.13	0.14	2.43	20.88
94.78	0.14 (tr.pt.)	1.40	25.77

EQUILIBRIUM IN THE SYSTEMS SODIUM CHLORIDE, ALLYL ALCOHOL, WATER, AT 20° AND SODIUM CARBONATE, ALLYL ALCOHOL, WATER, AT 20°.

(Frankforter and Temple, 1915.)

Results for $NaCl + CH_2:CHCH_2OH + H_2O$.

Gms. per 100 Gms. Alcohol + Water.		
NaCl.	Alcohol.	Water.
3.509	69.867	30.133
4.452	64.858	33.142
5.079	60.821	39.179
6.712	54.683	45.317
8.776	47.132	52.868
10.650	40.392	59.608
12.535	33.224	66.776
14.925	27.261	72.739
18.557	19.705	80.295

Results for $Na_2CO_3 + CH_2:CH.CH_2OH + H_2O$.

Gms. per 100 Gms. Alcohol + Water.		
Na_2CO_3.	Alcohol.	Water.
0.456	61.112	38.888
0.708	56.334	43.666
1.011	51.930	48.070
1.468	48.109	51.891
2.580	41.052	58.948
3.414	37.126	62.874
4.739	32.166	67.834
7.774	23.753	76.247
10.079	18.407	81.593

SODIUM CHLORIDE

The binodal curve for the System Sodium Chloride, Allyl Alcohol and Water at 25° has been determined by Ginnings and Dees, 1935, but the authors do not give their experimental results but only the values of a series of arbitrary constants calculated by means of an empirical equation. From these the conclusion is drawn that allyl alcohol seems to be more difficult to salt out than either normal or iso propyl alcohol.

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE, DIOXAN AND WATER AT 25°.

(Herz and Lorentz, 1929.)

Vol. percent $C_4H_8O_2$ in solvent	Gm. Mol. NaCl per liter of solution
10	4.70
20	4.00
30	3.68

Between 23 and 85 Vol. percent Dioxan the mixtures separate into two liquid layers. The lower, H_2O rich layer, contains 3.28 gm. mol. NaCl per liter and the upper, dioxan rich layer, contains 0.01 gm. mol. NaCl per liter.

Cl

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SOLUTIONS OF TARTARIC ACID AT 25°.

(Herz and Hiebenthal, 1929.)

Gms. per liter		Solid Phase	Gms. per liter		Solid Phase
$C_4H_6O_6$	NaCl		$C_4H_6O_6$	NaCl	
0.0	314.5	NaCl	242.0	283.5	NaCl
92.0	308.7	"	630.0	229.7	"
161.0	298.1	"	733.0	216.3	" + $C_4H_6O_6$

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE ETHYL URETHAN AND WATER AT 25°.

(Palitzsch, 1928, 1929.)

Gm. Mols. per 1000 gms. H_2O		Solid Phase	Gm. Mols. per 1000 gms. H_2O		Solid Phase
NaCl	$NH_2COOC_2H_5$		NaCl	$NH_2COOC_2H_5$	
6.12	0.0	NaCl	2.20	21.78	Upper liquid layer
6.12	0.1123	"	4.65	1.785	$NH_2COOC_2H_5$
5.96	0.5612	"	3.55	3.531	"
5.86	1.119	" + $NH_2COOC_2H_5$	1.0	39.0	"
3.21	5.187	Lower liquid layer	0.0	53.09	"

100 cc sat. solution of Sodium Chloride in Ethyl Urethan contain 0.132 gm. NaCl at 60°. (Stuckgold, 1917.)

The binodal curve and plait point of the system Sodium Chloride, Pyridine and Water at 25 has been determined by Ginnings, Webb and Hinohara, 1933, but the authors do not give their experimental results but only the values of a series of constants calculated by means of empirical equations.

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SUCROSE AT 25° AND VICE VERSA. (Schoorl, 1923.)

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
NaCl.	$C_{12}H_{22}O_{11}$		NaCl.	$C_{12}H_{22}O_{11}$	
23.3	12.7	NaCl	8.6	62.2	1.1.2 + $C_{12}H_{22}O_{11}$
17.5	36.7	»	11.5	61.7	NaCl + »
16.2	43.0	» + 1.1.2	6.15	63.0	$C_{12}H_{22}O_{11}$
9.75	57.0	1.1.2	1.62	66.0	»

1.1.2 = $NaCl.C_{12}H_{22}O_{11}.2H_2O$

The author also gives very complete vapor tension data for this system.

100 gms. H_2O dissolve 236.3 gms. sugar + 42.3 gms. NaCl at 31.25°, or 100 gms. sat. aq. solution contain 62.17 gms. sugar + 11.13 gms. NaCl. (Köhler, 1897.)

Cl

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE, GLUCOSE AND WATER AT 24°.

(Matsuura, 1927.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase.
$C_6H_{12}O_6$	NaCl		$C_6H_{12}O_6$	NaCl	
0.0	26.46	NaCl	36.90	14.50	1.2.1
2.84	25.87	"	38.67	13.61	"
5.21	25.28	"	41.62	11.92	"
9.90	24.10	"	44.05	10.95	"
13.09	23.38	"	47.35	9.57	" + $C_6H_{12}O_6.H_2O$
19.77	21.90	"	47.23	8.28	$C_6H_{12}O_6.H_2O$
23.87	20.83	"	47.73	7.65	"
27.81	19.87	"	47.74	6.97	"
29.47	19.50	" + 1.2.1	48.08	5.60	"
31.70	18.10	1.2.1	48.12	4.04	"
33.74	16.87	"	48.55	2.49	"
34.92	15.98	"	48.68	0.00	"

1.2.1 = $NaCl.2[C_6H_{12}O_6].H_2O$.

SOLUBILITY OF SODIUM CHLORIDE IN LIQUID AMMONIA.

(Patscheke, 1933.)

The authors results were plotted and the following values taken from the curve. The results of Johnson and Kromboltz, 1933; Scherer, Jr., 1931; Linhard and Stephan, 1933, 1934; and Portinow and Rawdine, 1937, agree in general with those of Patscheke. The results of Hunt, 1932, at 25° are apparently too low.

t°	Gms. NaCl per 100 gms. sat. sol.	Solid Phase	t°	Gms. NaCl per 100 gms. sat. sol.	Solid Phase
-76.3	0.0	NH_3	-10	14.5	$NaCl.5NH_3$
-76.6	0.28	" + $NaCl.5NH_3$	- 8.5	16.3*	"*
-70.0	0.4	$NaCl.5NH_3$	- 9.5	15.4	"
-60.0	0.55	"	-11.5	16.3*	" + NaC
-50	1.15	"	- 5.0	13.4	NaCl
-40	2.10	"	0	11.5	"
-30	4.0	"	+10	7.85	"
-20	7.5	"	20	5.3	"
-15	10.6	"	30	3.2	"
-12.5	12.6	"	40	2.0	"
			45	1.8	"

* Metastable.

Cl

Data for the isotherms of the System Na Cl + NH_4Cl + NH_3 at -10°, 0° and +10° are given by Patscheke and Tanne, 1935. They also give results for the solution temperatures of mixtures in various ratios of NaCl and NH_4Cl as compared with the solution temperature of each salt separately.

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE, SODIUM NITRATE AND LIQUID AMMONIA AT 0°.

(Portnow and Rawdine, 1937.)

Gms. per 100 gms. sat. sol.			Solid Phase	Gms. per 100 gms. sat. sol.			Solid Phase
NaCl	$NaNO_3$	NH_3		NaCl	$NaNO_3$	NH_3	
11.60	0.0	88.40	NaCl	4.32	31.07	64.61	NaCl
10.76	3.51	85.73	"	2.21	41.60	56.19	"
9.34	11.30	79.30	"	0.95	49.64	49.41	"
7.41	18.77	73.82	"	0.92	50.70	48.38	"
6.79	21.96	21.25	"	0.83	55.12	44.05	"
6.43	22.80	20.77	"	0.0	56.04	43.95	"

SOLUBILITY OF SODIUM CHLORIDE IN LIQUID AMMONIA CONTAINING INCREASING AMOUNTS OF SODIUM NITRATE.

(Guyer, Bieler and Schmid, 1934.)

The results are presented only in the form of a diagram from which the following approximate values were read.

t°	Gms. NaCl per 100 gms. sat. solution in Liquid Ammonia Containing				
	0% $NaNO_3$	10% $NaNO_3$	20% $NaNO_3$	30% $NaNO_3$	40% $NaNO_3$
-30	4.3	4.2	4.1	3.5	3.0
-20	8.0	7.5	7.2	6.0	4.5(-21°)
- 9.5	15.4	12.0(-10°)	9.5(-11°)	7.2(-13°)	3.0
0	11.2	9.0	7.0	4.5	2.0
+10	7.5	6.5	4.5	3.5	2.0
20	5.0	4.2	3.0	3.0	2.0

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORIDE, SODIUM NITRATE AND LIQUID AMMONIA AT 25°.

(Hunt and Boncyk, 1933.)

0.25 gm. of the less soluble salt was mixed with variable amounts of the more soluble salt and ammonia added in excess. Ammonia was then allowed to escape from the solution until a single crystal of salt separated from solution. Identical results were obtained by approaching the saturation point from opposite sides.

Gm. Mols. per 100 gms. Mols. NH_3		Gm. Mols. per 100 gm. Mols. NH_3	
NaCl	$NaNO_3$	NaCl	$NaNO_3$
0.088	0.0	0.0686	1.694
0.087	0.46	0.0590	1.787
0.0746	1.232	0.0524	1.80
0.0700	1.482	0.0	1.95

Cl

100 gms. liquid Sulfur Dioxide dissolve 0.016 gm. NaCl at 0°. (Jander and Wickert, 1936; Jander & Ruppolt, 1937.)

100 gms. sat. solution of Sodium Chloride in Selenium Oxy Chloride ($SeOCl_2$) contain 0.57 gm. NaCl at 25°. (Wise, 1923.)

Fusion-point data are given for:

NaCl + Na_2CrO_4	(Sackur, 1911-12.)
" + NaF	(Ruff and Plato, 1903; Walters, 1910; Plato, 1907.)
" + NaOH	(Scarpa, 1915.)
" + NaI	(Ruff and Plato, 1903; Amadori, 1912a.)
" + $NaNO_2$	(Meneghini, 1912.)
" + $Na_4P_2O_7$	(LeChatilier, 1894.)
" + Na_2SO_4	(Ruff and Plato, 1903; Jänecke, 1908; Wolters, 1910; Sackur, 1911-12.)
" + $SrCl_2$	(Vortisch, 1914; Sackur, 1911-12; Scholich, 1920.)
" + $SrCO_3$	(Sakur, 1911-12.)
" + TlCl	(Sandonnini, 1911, 1914.)

C10

SODIUM HYPOCHLORITE $NaClO.5H_2O$.

SOLUBILITY OF SODIUM HYPOCHLORITE IN WATER, DETERMINED BY THE FREEZING-POINT METHOD. (Sanfourche and Gardnet, 1924.)

t°.	Gms. NaClO per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. NaClO per 100 gms. sat. sol.	Solid Phase.
− 2.6....	5.0	Ice	23.0....	39.0	$NaClO.5H_2O$
− 7.0....	10.0	»	24.0....	42.0	»
−12.0....	15.0	»	24.5 m. pt.	44.0	»
−16.6....	19.2	Ice + $NaClO.5H_2O$	24.0....	46.0	»
−12.0....	20.0	$NaClO.5H_2O$	23.0 tr. pt.	48.5	$NaClO.5H_2O + NaClO.2,5H_2O$
0......	22.7	»	30.0....	50.0	$NaClO.2,5H_2O$
+10.0....	26.7	»	40.0....	52.5	»
15.0....	30.6	»	50.0....	56.5	»
20......	34.8	»	56.0....	61.2	»

SODIUM CHLORATE $NaClO_3$.

SOLUBILITY IN WATER.

(Carlson, 1910; Le Blanc and Schmandt, 1911; Osaka, 1903–08.)

t°.	d of Sat. Sol.	Gms. $NaClO_3$ per 100 Gms. H_2O.	t°.	d of Sat. Sol.	Gms. $NaClO_3$ per 100 Gms. H_2O.
−15	1.380	72	40	1.472	126 (115 Le B. & S.)
0	1.389	79 (80 Le B. & S.)	50	...	140 (126 “
10	...	89 (87 “	60	1.514	155
15	1.419	95 (91 “	70	...	172
20	1.430	101 (95.7 “	80	1.559	189
25	1.44	106 (101 O.)	100	1.604	230
30	...	113 (105 Le B. & S.)	122 (b. pt.)	1.654	286

SOLUBILITY OF SODIUM CHLORATE IN WATER.

Results of Billiter, 1920.

t°.	Gms. $NaClO_3$ per 100 cc. sat. sol.	t°.	Gms. $NaClO_3$ per 100 cc. sat. sol.
20....	72.2	70....	96.0
30....	77.0	80....	100.2
40...	82.0	90....	106.0
50....	86.6	100....	111.0
60....	91.3		

Results of Bell, 1903.

t°.	Gms. $NaClO_3$ per 100 gms. sat. sol.	t°.	Gms. $NaClO_3$ per 100 gms. sat. sol.
0....	44.32	30....	51.30
10....	46.70	35....	52.38
20....	48.95	40....	53.54
25....	50.13	100....	67.10

Saturation was secured in both cases by constant agitation in a thermostat.

C10

SOLUBILITY OF SODIUM CHLORATE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE

(Billiter, 1920.)

t°.	Gms. $NaClO_3$ per 100 cc. sat. solution in		
	Aq. 10 % NaCl.	Aq. 20 % NaCl.	Aq. 32 % NaCl.
20...............	66	57.4	41.8
40...............	75	65	42
60...............	83.5	70	42.4
80...............	92	77	43.3
100...............	102	87	44

SOLUBILITY OF SODIUM CHLORATE IN AQUEOUS SODIUM CHLORIDE SOLUTIONS AT 20°.

(Winteler, 1900.)

Sp. Gr. of Solutions.	Gms. per Liter.		Sp. Gr. of Solutions.	Gms. per Liter.	
	NaCl.	$NaClO_3$.		NaCl.	$NaClO_3$.
1.426	5	668	1.365	175	393
1.419	25	638	1.345	200	338
1.412	50	599	1.319	225	271
1.405	75	559	1.289	250	197
1.398	100	522	1.256	275	120
1.389	125	484	1.235	290	78
1.379	150	442	1.217	300	55

100 gms. H_2O dissolve 24.4 gms. NaCl + 50.75 gms. $NaClO_3$ at 12°.
100 gms. H_2O dissolve 11.5 gms. NaCl + 249.6 gms. $NaClO_3$ at 122°. (Schlosing, 1871.)

SODIUM CHLORATE

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORATE, SODIUM SULFATE AND WATER.

(Ricci and Yanick, 1937.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$NaClO_3$	Na_2SO_4	
	Results at 15°		
1.406	47.91	0.0	$NaClO_3$
1.423	45.86	2.19	"
1.422	44.34	3.83	"
—	42.66	5.59*	"
1.424	41.85	6.44*	" + Na
1.393	35.93	8.91*	Na
1.422	44.12	4.06	$NaClO_3$ + Na.10
—	43.07	3.89	Na.10
1.372	39.37	4.02	"
1.323	34.75	4.06	"
1.200	19.86	5.52	"
1.106	0.0	11.60	"
	Results at 25°		
	50.14	0.0	$NaClO_3$
	47.62	2.80	"
	46.64	3.86*	" + Na
	46.62	3.87	" + 1.3
	44.10	4.76*	1.3
	39.75	6.70*	"
	34.36	9.61*	"
	30.80	11.90*	"
	25.26	15.72*	"
	46.31	4.01	" + Na
	44.76	4.60	Na
	38.07	7.21	"
	32.47	9.86	"
	28.02	12.53*	"
	17.09	19.89*	"
	6.03	28.62*	"
	0.0	33.97*	"
	29.90	12.26*	1.3 + Na.10
	29.52	12.20*	Na.10
	28.90	12.12	" + Na
	27.36	12.06	Na.10

Gms. per 100 gms. sat. sol.		Solid Phase
$NaClO_3$	Na_2SO_4	
Results at 25° (con.)		
23.45	12.64	Na.10
18.05	13.90	"
12.30	15.77	"
6.58	18.20	"
0.0	21.78	"
Results at 45°		
54.59	0.0	$NaClO_3$
53.10	1.77	" + 1.3
50.22	2.40	1.3
40.14	5.85*	"
28.23	12.66*	"
20.10	18.68*	"
51.46	2.38*	Na
49.71	2.57	" + 1.3
45.88	3.55	"
36.12	6.87	"
17.88	17.52	"
0.0	32.08	"
Results at 75°		
61.40	0.0	$NaClO_3$
60.73	1.0	" + 1.3
58.34	1.37	1.3
56.25	1.62	"
52.84	1.94*	"
46.82	3.27*	"
41.42	5.11*	"
57.81	1.61*	Na
55.71	1.52	" + 1.3
51.85	2.09	"
45.51	3.19	"
27.19	10.56	"
6.26	24.70	"
0.0	30.33	"

C10

* = Metastable; Na = Na_2SO_4; Na.10 = $Na_2SO_4.10H_2O$; 1.3 = $NaClO_3.3Na_2SO_4$.

Results for this system at 0°, 20° and 40° are given by Babaew, 1936, but the author failed to find the double salt, $NaClO_3.3Na_2SO_4$, or trace the metastable portions of the curves.

EQUILIBRIUM IN THE SYSTEM SODIUM CHLORATE, SODIUM IODATE AND WATER.

(Ricci, 1938.)

Results at 25°				Results at 50°		
d. of sat. sol.	Gms. per 100 gms. sat. sol. $NaIO_3$	Gms. per 100 gms. sat. sol. $NaClO_3$	Solid Phase	Gms. per 100 gms. sat. sol. $NaIO_3$	Gms. per 100 gms. sat. sol. $NaClO_3$	Solid Phase
—	0.0	50.14	$NaClO_3$	0.0	55.74	$NaClO_3$
1.444	1.16	49.52	"	1.26	54.98	"
1.444	1.29	49.38	" + $NaIO_3.H_2O$	1.69	54.71	" + $NaIO_3$
1.440	1.30	49.19	$NaIO_3.H_2O$	1.75	53.83	$NaIO_3$
1.425	1.33	48.13	"	2.14	47.86	"
1.404	1.39	46.27	"	2.2	45.0	"+$NaIO_3.H_2O$
1.396	1.46	44.56	"	2.50	43.4*	"
—	1.52	42.99	"	1.87	54.59	$NaClO_3$ + "
1.332	1.69	38.66	"	1.92	53.20*	$NaIO_3.H_2O$
1.273	1.97	32.57	"	2.12	48.95*	"
1.204	2.43	24.67	"	2.41	43.71	"
1.146	3.14	16.50	"	3.23	33.33	"
1.098	4.51	8.36	"	5.69	16.36	"
1.075	8.57	0.0	"	7.67	10.02	"
				13.49	0.0	"

* = Metastable.

ClO

SOLUBILITY OF SODIUM CHLORATE IN AQUEOUS ETHYL ALCOHOL.

(Carlson, 1910.)

t°.	Gms. $NaClO_3$ per Liter of Sat. Sol. in Aqueous Alcohol of: 50 Per cent.	75 Per cent	90 Per cent.
20	313.3	110.8	16.1
40	321.8	133.5	22.9
60	326.8	155.8	29
70	...	161.3	...

100 gms. alcohol of 77 Wt. per cent dissolve 2.9 gms. $NaClO_3$ at 16°. (Wittstein.)
100 gms. alcohol dissolve 1 gm. $NaClO_3$ at 25°, and 2.5 gms. at b. pt.
100 gms. glycerol dissolve 20 gms. $NaClO_3$ at 15.5°. (Ossendowski, 1907.)
100 cc. anhydrous hydrazine dissolve 66 gms. $NaClO_3$ at room temperature. (Welsh and Broderson, 1915.)

SODIUM Per CHLORATE $NaClO_4.H_2O$.

SOLUBILITY OF SODIUM PERCHLORATE IN WATER.

(Cornec and Dickely, 1927.)

t°	d. of sat. sol.	Gms. $NaClO_4$ per 100 gms. sat. sol.	Solid Phase	t°	d. of sat. sol.	Gms. $NaClO_4$ per 100 gms. sat. sol.	Solid Phase
0	—	62.87	$NaClO_4.H_2O$	25	1.757	73.21*	$NaClO_4$
15	1.663	65.63	"	38	1.757	72.83*	"
25	1.683	67.82	"	55	1.756	73.94	"
38	1.713	70.38	"	75	1.757	75.01	"
50	1.749	73.26	"	100	1.758	76.75	"
15	1.758	71.68*	$NaClO_4$	143	1.789	79.03(1)	"

* Metastable; (1) Carlson, 1910. The results of this author at 15° and 50° are considered too low.

SOLUBILITY OF SODIUM PERCHLORATE IN WATER. (Freeth, 1924.)

Saturation was secured by constant agitation in a thermostat.

t°.	Gms. $NaClO_4$ per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. $NaClO_4$ per 100 gms. sat. sol.	Solid Phase.
− 3.0...	10.00	Ice	15.0...	65.51	$NaClO_4.H_2O$
− 6.8...	20	"	30.0...	68.71	"
−11.1...	30	"	40.0...	70.88	"
−17.8...	40	"	50.0...	73.16	"
−22.0...	45	"	50.8...	73.3	" $+NaClO_4$
−32.0...	56	Ice $+ NaClO_4.H_2O$	60.0...	74.3	$NaClO_4$
0.0...	62.64	$NaClO_4.H_2O$	75.0...	75.0	"

EQUILIBRIUM IN THE SYSTEM SODIUM PERCHLORATE, SODIUM CHLORIDE AND WATER.

(Cornec and Dickely, 1927.)

t°	d. of sat.	Gms. per 100 gms. sat. sol.		Solid Phase	t°	d. of sat.	Gms. per 100 gms. sat. sol.		Solid Phase
		$NaClO_4$	NaCl				$NaClO_4$	NaCl	
0	—	62.87	0	$NaClO_4.H_2O$	55	1.755	73.00	0.78	$NaCl+NaClO_4$
"	—	59.69	2.53	" + NaCl	75	1.757	74.15	0.83	" + "
"	—	52.82	4.37	NaCl	100	1.758	76.75	0.0	$NaClO_4$
"	—	40.65	8.63	"	"	1.757	75.79	0.88	" + NaCl
"	—	23.86	15.44	"	"	1.664	69.32	1.44	NaCl
25	1.683	66.58	1.37	"$+NaClO_4.H_2O$	"	1.532	59.23	3.06	"
38	1.723	69.41	1.05	" "	"	1.367	41.44	8.81	"
50	1.749	72.46	0.81	" "					

C10

EQUILIBRIUM IN THE SYSTEM SODIUM PERCHLORATE, SODIUM SULFATE AND WATER AT 35° AND AT 60. (Freeth, 1924.)

Results at 25°.			Results at 60°.		
Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
$NaClO_4$.	Na_2SO_4.	Solid Phase.	$NaClO_4$.	Na_2SO_4.	Solid Phase
67.60	0.0	$NaClO_4.H_2O$	74.30	0.0	$NaClO_4$
67.67	0.26	" $+Na_2SO_4$.	74.40	0.29	" $+ Na_2SO_4$
53.58	1.24	Na_2SO_4	64.65	0.37	Na_2SO_4
41.68	4.28	"	52.47	1.11	"
31.24	9.07	$Na_2SO_4 + Na_2SO_4.10H_2O$	31.55	6.95	"
18.72	12.56	$Na_2SO_4.10H_2O$	17.70	14.90	"
5.79	18.15	"	0.0	31.90	"
0.0	21.71	"			

The author also gives complete data for the quarternary equilibria in the system $NaClO_4 + (NH_4)_2SO_4 + NH_4ClO_4 + Na_2SO_4 + H_2O$ at 25° and at 60°.

SOLUBILITY OF ANHYDROUS SODIUM PERCHLORATE IN SEVERAL SOLVENTS AT 25°.

(Willard and Smith, 1923.)

Solvent.	$d_{\frac{25}{4}}$ of sat. sol.	Gms. $NaClO_4$ per 100 gms. sat. sol.	Solvent.	$d_{\frac{25}{4}}$ of sat. sol.	Gms. $NaClO_4$ per 100 gms. sat. sol.
Water	1.6821	67.70	*n* Butyl alcohol	0.8167	1.83
Methyl alcohol	1.0561	33.93	*iso* "	0.8031	0.78
Ethyl alcohol	0.8685	12.82	Acetone	1.0732	34.10
n Propyl alcohol	0.8308	4.66	Ethyl acetate	0.9574	8.80

SOLUBILITY OF SODIUM PERCHLORATE IN NORMAL BUTYL ALCOHOL CONTAINING INCREASING PERCENTAGES OF PERCHLORIC ACID AT 25° ± 3°.0 AND AT THE BOILING-POINT. (Smith, 1923 *a.*)

The results are given only in the form of a diagram, from which the following approximate values were read.

Gms. $HClO_4.2H_2O$ per 100 gms. solvent.	Gms. $NaClO_4$ per 100 gms. sat. sol. at 25° ± 3°.0.	b. pt.	Gms. $HClO_4.2H_2O$ per 100 gms. solvent.	Gms. $NaClO_4$ per 100 gms. sat. sol. at 25° ± 3°.0.	b. pt.
0.0 (= abut'l alc.)	2.8	7.5	0.6	3.05	8.2
0.2	2.9	7.8	0.8	3.0	8.35
0.4	3.0	8.0	1.0	2.8	9.0

C10

SOLUBILITY OF ANHYDROUS SODIUM PERCHLORATE IN MIXTURES OF ETHYL ACETATE AND ALCOHOLS AT 25° ± 0°.1. (Smith, 1925.)

Volume % alcohol in solvent.	Gms. $NaClO_4$ per 100 gms. sat. sol. in solvent composed of ethyl acetate and Methyl alcohol.	Ethyl alcohol.	93 % Ethyl alcohol.	*n* Butyl alcohol.	*n* Butyl* alcohol.	Ethyl** alcohol.
0.0 (= Ethyl acetate	8.8	8.8	8.8	8.8	8.8	26.32
5.0	–	13.83	14.12	-	11.97	–
10.0	19.39	16.05	16.92	12.34	13.00	29.32
20.0	23.37	18.55	20.00	13.16	14.32	31.16
30.0	25.85	19.66	21.75	–	14.75	32.44
40.0	27.81	20.08	22.79	12.82	14.71	33.26
50.0	29.38	20.07	23.30	11.99	13.98	33.63
60.0	30.50	19.67	23.39	10.54	13.09	33.61
70.0	31.61	18.78	22.73	–	11.66	33.20
80.0	32.56	17.53	21.92	6.70	9.85	32.56
90.0	33.44	15.82	20.96	4.35	7.87	31.56
95.0	-	14.80	21.31	–	6.97	31.10
100.0	34.33	12.87	20.60	2.19	4.27	29.80

* A different sample of *n* Butyl alcohol of $d_{\frac{25}{4}} = 0.8065$ and b. pt. 112°-118°.

** The solid phase in this case was $NaClO_4.H_2O$ instead of the anhydrous salt

SODIUM Di CHROMATE $Na_2Cr_2O_7.2H_2O$.

CrO

SOLUBILITY OF SODIUM DICHROMATE IN WATER.

The results of Mylius and Funk, 1900; Gerassimow, 1930 and Rakowski and Nikitina, 1931 were plotted and the following values taken from the average curve.

t°	Gms. $Na_2Cr_2O_7$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Na_2Cr_2O_7$ per 100 gms. sat. sol.	Solid Phase
0	62.0	$Na_2Cr_2O_7.2H_2O$	60	72.9	$Na_2Cr_2O_7.2H_2O$
15	63.9	"	80	79.0	"
25	65.5	"	82.5	79.9	" + $Na_2Cr_2O_7$
40	68.3	"	90	80.2	$Na_2Cr_2O_7$
50	70.5	"	100	80.6	"

SODIUM CHROMATES (Mono, Di, etc.)

SOLUBILITY IN WATER.

(Mylius and Funk, 1900; see also Salkowski, 1901.)

Sodium Monochromate.

t°.	Gms. Na_2CrO_4 per 100 Gms. Solution.	Mols. Na_2CrO_4 per 100 Mols H_2O.	Solid Phase.
0	24.07	3.52	$Na_2CrO_4.10H_2O$
10	33.41	5.55	"
18*	40.10	7.43	"
18.5	41.65	7.94	"
19.5	44.78	9.01	"
21	47.40	10.00	"
25.6	46.08	9.52	$Na_2CrO_4.4H_2O$
31.5	47.05	9.90	"
36	47.98	10.2	"
40	48.97	10.6	"
45	50.20	11.6	"
49.5	50.93	11.5	"
54.5	52.28	12.2	"
59.5	53.39	12.7	"
65	55.23	13.7	Na_2CrO_4
70	55.15	13.6	"
80	55.53	13.8	"
100	55.74	14.0	"

Sodium Dichromate.

t°.	Gms. $Na_2Cr_2O_7$ per 100 Gms. Solution.	Mols. $Na_2Cr_2O_7$ per 100 Mols. H_2O.	Solid Phase.
0	61.98	11.2	$Na_2Cr_2O_7.2H_2O$
17	63.82	12.1	"
18‡	63.92	12.16	"
34.5	67.36	14.2	"
52	71.76	17.4	"
72	76.9	22.8	"
81	79.8	27.1	"
93	81.19	29.6	$Na_2Cr_2O_7$
98	81.25	29.8	"

Sodium Tri Chromate.

t°	Gms. $Na_2Cr_3O_{10}$ per 100 Gms. Solution.	Mols $Na_2Cr_3O_{10}$ per 100 Mols. H_2O	Solid Phase.
0	80.03	19.9	$Na_2Cr_3O_{10}.H_2O$.
15†	80.44	20.4	"
18	80.60	20.56	"
55	82.68	23.7	"
99	85.78	29.9	"

* Sp. Gr. of sat. sol. at 18° = 1.432. † Sp. Gr. of sat. sol. at 18° = 2.059

‡ Sp. Gr. of sat. solution at 18° = 1.745.

Sodium Tetrachromate.

t°	Gms. $Na_2Cr_4O_{13}$ per 100 Gms. Solution.	Mols. $Na_2Cr_4O_{13}$ per 100 Mols. H_2O.	Solid Phase.
0	72.96	10.5	$Na_2Cr_4O_{13}.4H_2O$
16	74.19	11.2	"
18*	74.60	11.27	"
22	76.01	12.3	"

* Sp. Gr. of sat. solution at 18° = 1.926.

Tetrasodium Chromate.

t°	Gms. Na_4CrO_5 per 100 Gms. Solution.	Mols. Na_4CrO_5 per 100 Mols. H_2O.	Solid Phase.
0	33.87	4.11	$Na_4CrO_5.13H_2O$
10	35.58	4.42	"
18†	37.50	4.81	"
27.7	40.09	5.38	"
37	45.13	6.62	"

† Sp. Gr. of sat. solution at 18° = 1.446.

A new hydrate of sodium chromate, $Na_2CrO_4.6H_2O$, was found by Salkowski, (1901) and the following data for its range of existence were determined.

t°.	Gms. Na_2CrO_4 per 100 Gms. Solution.	Mols. Na_2CrO_4 per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. Na_2CrO_4 per 100 Gms. Sol.	Mols. Na_2CrO_4 per 100 Mols. H_2O.	Solid Phase.
17.7	43.65	8.62	$Na_2CrO_4.10H_2O$	25.9	46.3*	9.57	$Na_2CrO_4.6H_2O$ $+Na_2CrO_4.4H_2O$
19.2	44.12	8.77	"				
19.525	44.2*	...	" $+Na_2CrO_4.6H_2O$	28.9	46.47	9.64	$Na_2CrO_4.4H_2O$
21.2	44.64	8.96	$Na_2CrO_4.6H_2O$	29.7	46.54	9.67	"
24.7	45.75	9.37	"	31.2	47.08	9.88	"

* This determination by Richards and Kelley (1911).

SOLUBILITY OF SODIUM CHROMATES IN WATER AT 30°.

(Schreinemakers, 1906.)

Composition in weight per cent:

Of Solution.		Of Residue.		
% CrO_3.	% Na_2O.	% CrO_3.	% Na_2O.	Solid Phase.
0	±42	...	...	$NaOH.H_2O$
2.00	41.44	5.83	42.64	$NaOH.H_2O + Na_2CrO_4$
2.04	40.89	...	...	Na_2CrO_4
4.23	35.51	27.52	36.57	"
6.64	32.34	27.72	34.60	"
15.19	27.06	37.07	32.20	"
10.22	29.39	15.48	28.41	$Na_2CrO_4 + Na_4CrO_5.13H_2O$
8.93	28.49	18.09	26.89	$Na_4CrO_5.13H_2O$
8.62	26.91	...	...	"
13.12	23.91	18.57	25.92	"
18.44	22.86	...	...	"
19.26	22.98	21.54	25.31	$Na_4CrO_5.13H_2O + Na_2CrO_4.4H_2O$
17.84	24.21	26.24	24.98	$Na_2CrO_4.4H_2O$
28.82	17.88	31.97	23.47	"
38.93	16.30	40.70	20.83	"
48.70	16.49	47.49	19.75	$Na_2CrO_4.4H_2O + Na_2Cr_2O_7.2H_2O$
50.68	15.72	...	...	$Na_2Cr_2O_7.2H_2O$
58.08	13.89	62.76	17.38	"
66.13	13.70	69.48	16.06	$Na_2Cr_2O_7.2H_2O + Na_2Cr_3O_{10}.H_2O$
65.98	14.15	69.46	15.15	$Na_2Cr_3O_{10}.H_2O$
68.46	10.95	73.88	13.38	$Na_2Cr_3O_{10}.H_2O + Na_2Cr_4O_{13}.4H_2O$
66.88	9.85	71.27	10.67	$Na_2Cr_4O_{13}.4H_2O$
70.06	11.85	83.95	9.57	" (?)
69.04	11.04	81.80	6.43	CrO_3
67.84	9.81	82.85	5.42	"
64.48	4.51	79.49	2.71	"
62.28	0.0		...	"

100 gms. of a saturated aqueous solution contain at 30°:
46.627 gms. Na_2CrO_4, or 100 gms. H_2O dissolve 87.36 gms. Na_2CrO_4.
66.4 gms. $Na_2Cr_2O_7$, or 100 gms. H_2O dissolve 197.6 gms. $Na_2Cr_2O_7$.
100 gms. absolute methyl alcohol dissolve 0.345 gms. Na_2CrO_4 at 25°.

(de Bruyn, 1892.)

Data for equilibrium in the system sodium chromate, sodium sulfate and water at 15° and at 25° are given by Takenchi (1915). The mixtures were rotated at constant temperature until attainment of equilibrium and both the saturated solutions and the undissolved residues were analyzed. Very extensive tables of results are given. The decahydrates of sodium and chromium are isomorphous and the results show that these two salts are mutually miscible in all proportions at 15°. At 25° the solubility curve consists of three branches. The solutions of the first branch are in equilibrium with decahydrated mixed crystals, those of the second branch with anhydrous sulfate and those of the third with both anhydrous sodium sulfate and hexahydrated sodium chromate.

SODIUM CHROMATE Na_2CrO_4.

EQUILIBRIUM IN THE SYSTEM SODIUM CHROMATE, SODIUM SULFATE AND WATER.

(Osaka and Yoshida, 1922.)

This is a continuation of the work of Takenchi, 1925 (see remarks at bottom of the preceding page) Data are now given for the isotherms at 28°, 31° and 33°. The results are, however, expressed in accordance with the formula 100 $m\,H_2O$, $x\,Na_2CrO_4\,(100 - x)\,Na_2SO_4$, and the tables show only numerical values corresponding to x and m.

Results for the system $Na_2Cr_7O + Na_2SO_4 + H_2O$ at 0°, 15°, 25°, 40°, 80° and 98°, and for $Na_2Cr_2O_7 + NaHSO_4 + H_2O$ at 20° are given by Rakowski and Nikitina, 1931.

Results for the systems $Na_2Cr_2O_7 + NH_4Cl + H_2O$ and $Na_2Cr_2O_7 + (NH_4)_2Cr_2O_7 + H_2O$ at 0°, 20°, 50° and 75°, are given by Gerassimow, 1930.

CrO

SOLUBILITY OF SODIUM DICHROMATE IN ALCOHOL AT 19.4°.

(Reinitzer, 1913.)

An excess of $Na_2Cr_2O_7.2H_2O$ was shaken with absolute alcohol for 10 minutes and the mixture filtered. The filtrate contained 5.132 gms. $Na_2Cr_2O_7.2H_2O$ per 100 cc. and its $d_{19.4}$ was 0.8374. The solution decomposed within a few minutes with production of a brown precipitate and evolution of an aldehyde odor. The results are, therefore, only approximately correct.

SOLUBILITY OF SODIUM CHROMATE IN MIXTURES OF BENZENE AND ACETIC ACID.

(Anders, 1933.)

t°	Percent CH_3COOH in solvent	Gms. Na_2CrO_4 per 100 gms. sat. sol.
0	13.627	0.054
"	27.599	0.395
"	49.773	3.728
15	11.649	0.074
"	29.264	0.863
15	53.186	7.354
28	11.489	0.138
"	28.154	1.282
"	52.378	8.750

The authors also give data for the lowering of the eutectic point of $CH_3COOH + C_6H_6$ by additions of Na_2CrO_4, I, S, and $AgClO_4$.

SODIUM FLUORIDE NaF

F

FREEZING-POINTS OF AQUEOUS SOLUTIONS OF SODIUM FLUORIDE.

(Matheson and Maass, 1929.)

t°	Gms. NaF per 100 gms. sat. sol.	Solid Phase
-1.1	0.6	Ice
-1.9	1.03	"
-2.9 Eutectic	1.4	" + NaF

SOLUBILITY OF SODIUM FLUORIDE IN WATER.

The results of Jehn and Huddleston, 1924; Carter, 1928; Foote and Schairer, 1930; Nowasselowa, 1934; Nagcrski and Nowasselowa, 1935 and Payne, 1937, fall quite irregularly when plotted, and the average curve from which the following values were taken, can be only approximately correct.

t°	d. of sat. sol.	Gms. NaF per 100 gms. sat. sol.	t°	Gms. NaF per 100 gms. sat. sol.
0	—	3.53	40	4.21
20	—	3.90	50	4.35
25	1.0384	3.98	60	4.47
30	—	4.05	80	4.66
35	1.0354	4.13	100	4.83

SODIUM FLUORIDE NaF.

F

SOLUBILITY OF SODIUM FLUORIDE IN AQUEOUS SOLUTIONS OF HYDROFLUORIC ACID AT 20°.

(John and Hudleston, 1924.)

Saturation was obtained by constant stirring in a thermostat for 14 and 30 days. Paraffine bottles were employed.

Gms. per 100 gms. H_2O.		Solid Phase.	Gms. per 100 gms. H_2O.		Solid Phase.
NaF.	HF.		NaF.	HF.	
3.96	0.0	NaF	2.46	1.16	NaF.HF
4.14	0.081	»	2.49	1.20	»
4.19	0.104	»	2.20	1.55	»
4.23	0.135	»	2.04	2.22	»
4.51	0.420	»	2.01	2.70	»
4.56	0.484	»+NaF.HF	1.88	4.17	»
3.45	0.660	NaF.HF	1.83	8.68	»
2.99	0.831	»	1.79	10.28	»

SOLUBILITY OF SODIUM FLUORIDE IN AQUEOUS SOLUTIONS OF HYDROGEN PEROXIDE AT 25°.

(Akerlof and Turck, 1938.)

Wt. Percent H_2O_2 in Solvent	Gms Mols. NaF per 1000 gms. solvent
0.0	0.9989
15.72	1.216
31.43	1.457

FREEZING-POINTS OF HYDROGEN PEROXIDE SOLUTIONS OF SODIUM FLUORIDE.

(Matheson and Maas, 1929.)

t°	Gm. Mols. NaF per 100 gm. mols. H_2O + NaF	Solid Phase	t°	Gm. Mols. NaF per 100 gm. mols. H_2O + NaF	Solid Phase
- 5.2	3.8	H_2O_2	-12.1	9.8	H_2O_2
- 9.1	7.4	"	-13.9	11.1	"
-10.6	8.0	"	-15.2 Eutec.	12.3	" + NaF

SOLUBILITY OF MIXTURES OF SODIUM FLUORIDE AND SODIUM BERYLLIUM FLUORIDE IN WATER.

(Nowasselowa, 1934.)

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms. sat. sol.		Solid Phase
	NaF	Na_2BeF_4			NaF	Na_2BeF_4	
0	3.81	0.22	NaF + Na_2BeF_4	60	3.85	0.47	NaF + Na_2BeF_4
20	3.84	0.26	" "	80	3.85	0.57	" "
40	3.76	0.45	" "	94	3.85	0.80	" "

SOLUBILITY OF SODIUM FLUORIDE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE.

(Nagorski and Nowosselow, 1935.)

Wt. Percent NaOH in Solvent	Gms. NaF per 100 gms. sat. solution at:				
	0°	20°	40°	80°	94°
0.0(= H_2O)	3.99	4.10	4.47	4.48	4.73
0.81	3.49	3.40	3.51	3.56	3.47
1.67	—	2.89	—	—	—
2.30	2.65	2.70	2.81	2.82	3.03
2.70	2.37	2.45	2.70	2.84	2.73
5.66	—	1.68	—	—	—
7.90	—	1.25	—	—	—
18.40	—	0.38	—	—	—

Phase studies of the system Sodium Fluoride, Sodium Phosphate and Water at 25° and at 40° are given by Mason and Ashcraft, 1939. The results show that the supposed octahedral $Na_3PO_4.10H_2O$ is really the double salt $NaF.2Na_3PO_4.19H_2O$, in samples of tri sodium phosphate containing as F
little as 0.1 percent Sodium Fluoride.

EQUILIBRIUM IN THE SYSTEM SODIUM FLUORIDE, SODIUM SULFATE AND WATER.

(Foote and Schairer, 1930.)

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms. sat. sol.		Solid Phase
	Na_2SO_4	NaF			Na_2SO_4	NaF	
-3.0	0.0	3.92	Ice + NaF	25	8.67	2.35	NaF + 1.1
-1.12	4.07	0.0	" + Na.10	"	11.48	1.74	1.1
-3.06	1.68	3.42	" + "+NaF	"	21.34	0.37	" + Na.10
10.	0.0	3.92	NaF	"	31.71	0.0	Na.10
"	3.95	3.20	"	33.26	33.10	trace	" + Na.10+Na
"	6.39	2.98	" + Na.10	35	0.0	4.02	NaF
"	8.34	0.0	Na.10	"	4.34	3.18	"
15	0.0	3.93	NaF	"	8.62	2.50	" + 1.1
"	9.50	2.50	" + Na.10	"	9.58	2.09	1.1
"	11.70	0.0	Na.10	"	11.60	1.57	"
17.47	12.58	1.91	1.1+Na.10+NaF	"	18.11	0.62	"
25	0.0	3.98	NaF	"	32.80	trace	" + Ni
"	4.48	3.13	"	"	32.96	0.0	Na

Na.10 = $Na_2SO_4.10H_2O$; Na = Na_2SO_4; 1.1 = $NaF.Na_2SO_4$.

Results for the quarternary system NaF + NaCl + Na_2SO_4 + H_2O at 25° and at 35° are also given.

100 gms. Liquid Ammonia (NH_3) dissolve 0.35 gm. NaF at 25°. (Hunt, 1932.)
100 gms. Liquid Sulfur Dioxide (SO_2) dissolve 0.029 gm. NaF at 0°.
(Jander and Ruppolt, 1937.)

SOLUBILITY OF SODIUM FLUORIDE IN SEVERAL ALCOHOLS, EACH DETERMINED SEPARATELY.

(Germuth, 1931.)

t^o	Gms. NaF per 100 gms. sat. solution in: Methyl Alcohol CH_3OH	Ethyl Alcohol C_2H_5OH	n Butyl Alcohol $CH_3(CH_2)_2CH_2OH$
20	0.413	0.095	0.0030
30	0.440	0.108	0.0041
40	0.458	0.119	0.0043
50	0.476	0.158	0.0049
55	0.484	0.179	0.0054

SOLUBILITY OF SODIUM FLUORIDE IN ACETONE.

(Lannung, 1932.)

t^o	d. of sat. sol.	Gms. NaF per 1000 per Acetone
18	0.792	0.000024
37	0.770	0.000027

Fusion-point data are given for

F $NaF + FeF_3$ (Puschin and Baskov, 1913.)
" $+ ZnF_3$ " "
" $+ NaI$ (Ruff and Plato, 1903.)
" $+ NaOH$ (Scarpa, 1915.)
" $+ Na_2SO_4$ (Wolters, 1910.)
" $+ Na_2SiO_3$ (Booth and Starrs, 1931.)
" $+ Na_2Si_4O_9$ (Booth, Starrs and Bahnsen, 1933.)

SODIUM Aluminum FLUORIDE (Cryolite) Na_3AlF_6.

100 cc sat. solution of Sodium Aluminum Fluoride in Water contain 0.061 gms. Na_3AlF_6 at 25°. (Carter, 1928.)

SODIUM Beryllium FLUORIDE Na_2BeF_4.

SOLUBILITY OF SODIUM BERYLLIUM FLUORIDE IN WATER.

(Nowasselowa, 1934.)

t^o	Gms. Na_2BeF_4 per 100 gms. sat. sol.	t^o	Gms. Na_2BeF_4 per 100 gms. sat. sol.
0	1.31	60	2.19
20	1.41	80	2.55
40	1.88	94	2.70

SODIUM (Double) **PHOSPHATE, FLUORIDE** $Na_3PO_4.NaF.12H_2O$.

100 gms. water dissolve 12 gms. of the double sodium salt at 25°, and 57.5 gms. at 70°. Sp. Gr. of solution at 25° = 1.0329; at 70° = 1.1091. (Briegleb, 1856.)

SODIUM Silico FLUORIDE $NaSiF_6$.

SOLUBILITY OF SODIUM SILICO FLUORIDE IN WATER.

(Carter, 1930.)

t°	Gms. $NaSiF_6$ per 100 cc sat. sol.	t°	Gms. $NaSiF_6$ per 100 cc sat. sol.	t°	Gms. $NaSiF_6$ per 100 cc sat. sol.
0	0.435	25	0.762	55	1.328
16	0.637	35	0.940	78	1.822
20 (d=1.0054)	0.737 (1)	45	1.120	100	2.45 (2)

F

(1) Worthington and Haring, 1931; (2) Stolba, 1872.

SODIUM Silico FLUORIDE

SOLUBILITY OF SODIUM SILICO FLUORIDE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE.

(Rees and Hudleston, 1931.)

Results at 17°		Results at 20°	
Gm. Mols. Na_2SO_4 per 1000 gms. solvent	Gm. Mols. Na_2SiF_6 per 1000 gms. sat. sol.	Gm. Mols. Na_2SO_4 per 1000 gms. solvent	Gm. Mols. Na_2SiF_6 per 1000 gms. sat. sol.
0.000	0.0329	0.000	0.0363
0.050	0.0143	0.0050	0.0336
0.125	0.0068	0.0100	0.0309
0.250	0.0042	0.0150	0.0284
0.375	0.0034	0.0250	0.0201
0.500	0.0029	0.0500	0.0168

SODIUM Titano FLUORIDE Na_2TiF_6.

SOLUBILITY OF SODIUM TITANO FLUORIDE IN WATER AND IN ETHYL ALCOHOL.

(Ginsberg, 1932.)

t°	Solvent	Gms. Na_2TiF_6 per 100 cc sat. sol.
20-22	Water	6.5
20-22	98% C_2H_5OH	0.0031

SODIUM GERMANATE $Na_2GeO_3 \cdot 7H_2O$.

SOLUBILITY OF SODIUM GERMANATE IN WATER.

(Pugh, 1932.)

GeO

t°	Gms. Na_2GeO_3 per 100 gms. H_2O	Solid Phase	t°	Gms. Na_2GeO_3 per 100 gms. H_2O	Solid Phase
- 0.7	2.38	Ice	30	28.65	$Na_2GeO_3 \cdot 7H_2O$
- 2.0	8.04	"	35	32.6	"
- 3.0	12.40	"	45	42.0	"
- 3.2 Eutec.	13.1	" + $Na_2GeO_3 \cdot 7H_2O$	52.5	52.7	"
0	14.5	$Na_2GeO_3 \cdot 7H_2O$	63.5	72.0	"
+15.2	21.4	"	70.5	85.5	"
20.2	23.7	"	75.5	99.6	"
25.0	25.9	"	83.5	132.0	"

SODIUM IODIDE $NaI.2H_2O$.

SOLUBILITY IN WATER.

(de Coppet, 1883; see also Etard, 1884; and Kremers, 1856a.)

t°.	Grams NaI per 100 Gms.		Solid Phase.	t°.	Grams NaI per 100 Gms.		Solid Phase.
	Water.	Solution.			Water.	Solution.	
20	148.0	59.7	$NaI.2H_2O$	60	256.8	72.0	$NaI.2H_2O$
0	158.7	61.4	"	65	278.4	73.6	"
10	168.6	62.8	"	67	293	74.6	NaI
20	178.7	64.1	"	70	294	74.6	"
25	184.2	64.8	"	80	296	74.7	"
30	190.3	65.6	"	100	302	75.1	"
40	205.0	67.2	"	120	310	75.6	"
50	227.8	69.5	"	140	321	76.3	"

The eutectic mixture of Ice + $NaI.5H_2O$ is at −31.5° and contains about 39 per cent NaI. (Meyerhoffer, 1904.)

The tr. pt. for $NaI.5H_2O$ + $NaI.2H_2O$ is at −13.5 and the saturated solution contains 60.2 gms. NaI per 100 gms. (Panfiloff, 1893a.)

The tr. pt. for $NaI.2H_2O$ + NaI is at 64.3° and the saturated solution contains 74.4 gms. NaI per 100 gms. (Panfiloff, 1893.)

100 gms. H_2O dissolve 172.4 gms. NaI at 15° and the d_{15} of the sol. is 1.8937. (Greenish, 1900.)

100 gms. sat. solution in H_2O contain 65.5 gms. NaI at 30°. (Cocheret, 1911.)

More recent very careful determinations of the Solubility of Sodium Iodide in Water by Scott and Durham, 1930; Ricci and Yanick, 1936; Hill, Willson and Bishop, 1933; and Ricci, 1934; 1936, give a very smooth curve from which the following values were read.

t°	d. of sat. sol.	Gms. NaI per 100 gms. sat. sol.	Solid Phase	t°	d. of sat. sol.	Gms. NaI per 100 gms. sat. sol.	Solid Phase
0	1.8612	61.54	$NaI.2H_2O$	63.13	2.1068	72.95	$NaI.2H_2O$
15	1.881	63.33	"	68.1	2.1550	74.85	" + NaI
25	1.919	64.76	"	75.4	2.1544	74.82	NaI
35	1.951	66.35	"	92.23	2.1425	75.05	"
50	2.017	69.42	"	100.0	—	75.14	"

EQUILIBRIUM IN THE SYSTEM SODIUM IODIDE, SODIUM IODATE AND WATER.

(Ricci, 1934.)

d. of sat. sol.	Gms. per 100 gms. sat. sol. NaI	Gms. per 100 gms. sat. sol. $NaIO_3$	Solid Phase
Results at 20°			
1.318	30.43	1.58	DS20
1.409	38.26	0.513	"
1.686	54.96	0.062	"
1.811	61.36	0.042	"
Results at 25°			
1.075	0.0	8.569	$NaIO_3.H_2O$
—	31.57	2.42	" + DS20
1.355	33.06	1.96	DS20
—	34.29	1.62	"
1.391	36.56	1.18	"
1.443	40.42	0.704	"
1.494	43.91	0.455	" + DS15
—	46.06	0.314	DS15
1.605	54.42	0.102	"
1.884	63.71	0.069	"
—	64.70	0.075	" + $NaI.2H_2O$
1.904	64.71	0.0	$NaI.2H_2O$

Gms. per 100 gms. sat. sol. NaI	Gms. per 100 gms. sat. sol. $NaIO_3$	Solid Phase
Results at 40°		
0.0	11.70	$NaIO_3.H_2O$
40.84	3.02	$NaIO_3$ + DS15
48.20	0.95	DS15
56.16	0.36	"
62.52	0.30	"
65.39	0.32	" + DS10
66.40	0.31	DS10
66.89	0.30	"
67.10	0.30	" + $NaI.2H_2O$
67.35	0.0	$NaI.2H_2O$
Results at 55°		
60.97	0.82	DS10
63.59	0.67	"
66.78	0.60	"
68.03	0.61	"
69.11	0.59	"

I

DS20 = $3NaI.2NaIO_3.20H_2O$; DS15 = $3NaI.2NaIO_3.15H_2O$; DS10 = $3NaI.2NaIO_3.10H_2O$.

Additional results for this system at 8°, 25° and 40° are given by Hill, Willson and Bishop, 1933, but these authors failed to determine the true nature of the solid phases. They reported the presence of solid solutions (mixed crystals) instead of the double salt here shown to exist

EQUILIBRIUM IN THE SYSTEM SODIUM IODIDE, SODIUM NITRATE AND WATER AT 25°.

(Ricci, Budiah and Dorodulla, 1937.)

Gms. per 100 gms. sat. sol. $NaNO_3$	Gms. per 100 gms. sat. sol. NaI	Solid Phase
0.0	64.71	$NaI.2H_2O$
2.57	63.12	"
3.93	62.06	"
5.48	61.13	" + $NaNO_3$
5.63	60.88	$NaNO_3$
6.77	57.64	$NaNO_3$
8.73	52.70	"
10.64	49.22	"
14.38	42.48	"
22.57	30.49	"
47.87	0.0	"

EQUILIBRIUM IN THE SYSTEM SODIUM IODIDE, SODIUM SULPATE AND WATER.

(Ricci, 1936.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
	Na_2SO_4	NaI		Na_2SO_4	NaI	
	Results at 15°			Results at 25° (con.)		
1.881	0.0	63.35	$NaI.2H_2O$	7.97	31.21*	Na_2SO_4
1.881	0.03	63.32	" + Na_2SO_4	14.91	21.22*	"
1.875	0.02	62.89	Na_2SO_4	26.65	7.60*	"
1.733	0.15	56.92	"	33.97	0.0 *	"
1.613	0.93	50.15	"	7.63	31.77	"+$Na_2SO_4.10H_2O$
1.542	2.21	44.83	" + $Na_2SO_4.10H_2O$	7.94	30.05	$Na_2SO_4.10H_2O$
1.532	2.13	44.07	$Na_2SO_4.10H_2O$	8.70	26.84	"
1.490	2.10	41.78	"	9.37	24.81	"
1.460	2.15	39.67	"	10.81	20.30	"
1.367	2.51	33.16	"	14.87	11.50	"
1.106	11.60	0.0	"	17.54	6.77	"
				21.78	0.0	"
	Results at 25°			Results at 45°		
—	0.0	64.79	$NaI.2H_2O$			
—	0.06	64.75	" + Na_2SO_4	0.0	68.32	$NaI.2H_2O$
—	0.14	62.05	Na_2SO_4	0.43	52.75	Na_2SO_4
—	0.30	56.54	"	2.22	42.85	"
—	0.70	51.91	"	6.73	31.73	"
—	2.06	45.01	"	17.19	16.52	"
—	4.09	38.58	"	32.09	0.0	"

I

* Metastable

EQUILIBRIUM IN THE SYSTEM SODIUM IODIDE, ANTIMONY IODIDE AND WATER.

(Francois and Delwaulle, 1936.)

Numerical results are not given but only a diagram from which the following approximate values were read

Results at 15°		Results at 35°		Results at 60°		
Gms. per 100 gms. H_2O		Gms. per 100 gms. H_2O		Gms. per 100 gms. H_2O		Solid Phase at each temperature
SbI_3	NaI	SbI_3	NaI	SbI_3	NaI	
0.0	173	0.0	197	0.0	256	$NaI.2H_2O$
—	—	15.0	200	50	260	"
10	175	25	205	85	275	" + 2.1.8
12	150	35	165	80	240	2.1.8
30	125	55	130	90	170	"
50	100	80	110	150	140	"
65	90	100	105	175	140	" + 1.1.6
60	75	100	90	185	120	1.1.6
—	—	—	—	200	110	" + SbI_3
—	—	—	—	130	70	SbI_3

2.1.8 = $2NaI.SbI_3.8H_2O$; 1.1.6 = $NaI.SbI_3.6H_2O$.

SOLUBILITY OF SODIUM IODIDE IN AQUEOUS ETHYL ALCOHOL AT 30°.

(Cocheret, 1911.)

Gms. per 100 Gms. Sat. Sol. NaI.	Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. NaI.	Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	Solid Phase.
65.52	0	$NaI.2H_2O$	38.5	53.2	$NaI.2H_2O$
64	3.42	"	37.49	55.37	" + NaI
54.2	18.5	"	35.65	59.24	NaI
48.8	28.5	"	33.24	61.78	"
42.35	41.7	"	30.90	68.70	"

Data are also given for the solubility of mixtures of NaI + Na_2CO_3 in aqueous ethyl alcohol at 30°.

EQUILIBRIUM IN THE SYSTEM SODIUM IODIDE, ACETONE AND WATER AT 25°.

(Macy and Thomas, 1926.)

The materials were carefully purified. Saturation was secured by constant stirring in a thermostat.

d of sat. sol.	Gms. per 100 gms. sat. sol. NaI.	Gms. per 100 gms. sat. sol. CH_3COCH_3.	Solid Phase.	d of sat. sol.	Gms. per 100 gms. sat. sol. NaI.	Gms. per 100 gms. sat. sol. CH_3COCH_3.	Solid Phase.
1.927	67.0	0.0	$NaI.2H_2O$	1.240	40.5	53.4	NaI
1.753	60.2	8.2	»	1.192	37.7	58.0	»
1.565	54.3	19.4	»	1.144	34.7	62.9	»
1.450	49.9	30.1	»	1.067	29.4	70.6	» (unstable)
1.358	46.3	40.3	»	1.062	25.8	71.5	$NaI.3(CH_3COCH_3)$
1.320	44.5	46.1	» — NaI				

SOLUBILITY OF SODIUM IODIDE IN PURE METHYL ALCOHOL.

(Lloyd, Brown, Glynwyn, Bonnell and Jones, 1928.)

t°	Gms. NaI per 100 gms. CH_3OH	Solid Phase	t°	Gms. NaI per 100 gms. CH_3OH	Solid Phase
10	65.0	$NaI.3CH_3OH$	28	81.8	$NaI.3CH_3OH$
20	72.9	"	30	81.4	NaI
25	78.0	"	40	80.7	"
27	81.3	"	50	80.1	"
			60	79.4	"

SOLUBILITY OF SODIUM IODIDE IN ETHYL ALCOHOL AT 25°.

(King and Partington, 1926.)

The authors used the greatest possible care in the purification of the alcohol and sodium iodide. They used a special apparatus designed to prevent the entrance of moisture and kept the solution in contact with dry hydrogen. The mixture was constantly stirred for 16 hours. The mean of 10 determinations gave 42.57 gms. Na I per 100 gms C_2H_5OH and the $d_{\frac{25}{4}}$ of the sat. sol. was 1.037.

SOLUBILITY OF SODIUM IODIDE IN ABSOLUTE ETHYL ALCOHOL AT TEMPERATURES UP TO THE CRITICAL POINT.

(Tyrer, 1910a.)

t°.	Gms. NaI per 100 Gms. C_2H_5OH	t°.	Gms. NaI per 100 Gms. C_2H_5OH.	t°.	Gms. NaI per 100 Gms. C_2H_5OH.
10	43.77	120	45.2	240	32.7
30	44.25	160	45	250	26.2
50	44.50	180	44.3	255	21
80	45	200	42.3	260	10.8
100	45.1	220	38.5	261.5*	8.6
		230	36.2		

* crit. t. of solution.

The mixtures were placed in sealed glass tubes which were heated in a specially constructed, electrically heated air bath. The temperature at which the last trace of salt just dissolved was determined in each case. The experiments were made with very great care. Results are also given for the solubility of sodium iodide in the vapor of ethyl alcohol above the critical point.

SOLUBILITY OF SODIUM IODIDE IN ALCOHOLS AT 25°.

(Turner and Bissett, 1913.)

100 gms.	Methyl alcohol,	CH_3OH	dissolve	90.35	gms. NaI.
"	Ethyl "	C_2H_5OH	"	46.02	"
"	Propyl "	C_3H_7OH	"	28.22	"
"	Amyl "	$C_5H_{11}OH$	"	16.30	"

I

SOLUBILITY OF SODIUM IODIDE IN MIXTURES OF ALCOHOLS AT 25°.

(Herz and Kuhn, 1908.)

In $CH_3OH + C_2H_5OH$.			In $CH_3OH + C_3H_7OH$.			In $C_2H_5OH + C_3H_7OH$.		
Per cent CH_3OH in Mixture.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. NaI per 100 cc. Sat. Sol.	Per cent C_3H_7OH in Mixture.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. NaI per 100 cc. Sat. Sol.	Per cent C_3H_7OH in Mixture.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. NaI per 100 cc. Sat. Sol.
0	1.0806	35.15	0	1.3250	63.22	0	1.0806	35.15
4.37	1.1029	37.68	11.11	1.2853	58.45	8.1	1.0732	34.60
10.4	1.1123	38.71	23.8	1.2528	54.64	17.85	1.0720	34.05
41.02	1.1742	45.98	65.2	1.1387	40.71	56.6	1.0276	28.41
80.69	1.2741	57.44	91.8	1.0420	29.14	88.6	1.0130	26.13
84.77	1.2886	58.92	93.75	1.0178	26.49	91.2	1.0104	25.88
91.25	1.3056	61.10	100	0.9968	24.11	95.2	1.0020	24.74
100	1.3250	63.22				100	0.9968	24.11

SOLUBILITY OF SODIUM IODIDE IN SEVERAL SOLVENTS.

(At 22.5°, de Bruyn, 1892; at ord. temp. Rohland, 1898; Walden, 1906.)

Solvent.	t°.	Gms. NaI per 100 Gms. Solvent.	Solvent.	Gms. NaI per 100 cc. Sat. Solution.	
				at 0°.	at 25°.
Absolute Ethyl Alcohol	22.5	43.1	Acetonitrile	22.09	18.43
Ethyl Alcohol, $d_{15} = 0.810$	ord. temp.	58.8	Propionitrile	9.00	6.23
Absolute Methyl Alcohol	22.5	77.7	Nitro Methane	0.34	0.48
Methyl Alcohol, $d_{15} = 0.799$	ord. temp.	83.3	Acetone	very soluble	
Propyl Alcohol, $d_{15} = 0.816$	ord. temp.	26.3	Furfural	..	25.10

SOLUBILITY OF SODIUM IODIDE IN SEVERAL SOLVENTS AT 25°.

(Larson and Hunt, 1939.)

Solvent	Formula	d. of sat. sol.	Gms. NaI per 100 gms. solvent
Methanol	CH_3OH	1.2615	80.53
Ethanol	C_2H_5OH	1.0466	43.32
1-Propanol	$CH_3CH_2CH_2OH$	0.9699	27.65
1-Butanol	$CH_3(CH_2)_2CH_2OH$	0.9397	21.60
2-Propanol (iso)	$CH_3CHOHCH_3$	0.9422	26.32
2-Methyl-1-propanol (iso butyl)	$(CH_3)_2CHCH_2OH$	0.9085	17.68
1-Pentanol	$CH_3(CH_2)_3CH_2OH$	0.9127	16.31
2-Butanol (Sec.)	$CH_3CH_2CHOHCH_3$	0.8068	15.02

SOLUBILITY OF SODIUM IODIDE IN ETHYL ALCOHOL CONTAINING INCREASING AMOUNTS OF LITHIUM PERCHLORATE AT 25°.

(Hawkins and Partington, 1930.)

d. of sat. sol.	Gms. per 100 gms. C_2H_5OH			Solid Phase
	NaI	$LiClO_4$	Total Solids*	
1.0460	42.85	0.0	42.85	NaI
1.0522	43.15	0.864	43.88	"
1.0554	43.14	1.760	44.81	"
1.0569	43.02	2.33	45.24	"
1.0572	42.79	2.775	45.39	" + $NaClO_4$ + LiI I
1.0553	42.34	2.39	44.73	" " "
1.0558	42.10	1.85	43.58	" " "

* Determined by evaporation.

SOLUBILITY OF SODIUM IODIDE AT 25° IN ETHYL ALCOHOL IN PRESENCE OF:

(King and Partington, 1927.)

Lithium Iodide			Sodium Thiocyanate		
d. of sat. sol.	Gms. per 100 gms. C_2H_5OH		d. of sat. sol.	Gms. per 100 gms. C_2H_5OH	
	NaI	LiI		NaI	NaCNS
1.0460	42.85	0.0	1.0460	42.85	0.0
1.0471	34.71	8.08	1.0422	41.81	1.17
1.0476	29.56	13.31	1.0360	39.18	3.93
1.0561	15.57	27.75	1.0309	36.70	6.48
1.0975	3.18	46.80	1.0305	36.25	6.91
1.1099	2.56	49.44	1.0299	35.65	7.61
—	0.0	250.8	0.8825	0.0	20.99

SOLUBILITY OF SODIUM IODIDE IN ALCOHOLS.

(Partington, and Winterton, 1934.)

Alcohol	Formula	t°	Gms. NaI per 100 gms. sat. solution
Allyl Alcohol	$CH_2{:}CHCH_2OH$	25	22.17
Benzyl Alcohol	$C_6H_5CH_2OH$	25	12.59

SOLUBILITY OF SODIUM IODIDE IN ACETONE.

Results of Macy and Thomas, 1926.				Results of Wadsworth and Dawson, 1926.		
t°.	d of sat sol.	Gms. NaI per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. NaI per 100 gms. CH_3COCH_3.	Solid Phase.
—34.0...	–	3.2	$NaI.3(CH_3COCH_3)$	—20.0...	5.5	$NaI.3(CH_3COCH_3)$
—12.3...	0.873	7.4	»	—10.0...	7.8	»
0.0...	0.899	11.6	»	0.0...	11.8	»
+15.9...	0.984	21.0	»	10.0...	18.2	»
25.0...	1.062	28.5	»	20.0...	30.0	»
25.7...	1.070	29.2	» + NaI	25.7...	40.7	» + NaI
25.0...	1.067	29.4	NaI (unstable)	30.0...	39.2	NaI
32.2...	1.043	32.2	NaI	40.0...	35.6	»
40.2...	–	26.8	»	50.0...	32.0	»
50.0...	–	25.0	»	60.0...	28.6	»
57.2...		23.6	»	70.0...	25.1	»
59.8...		23.0	»	80.0...	21.8	»

SOLUBILITY OF SODIUM IODIDE IN ABSOLUTE ACETONE.

(Bell, Rowlands, Bamford, Thomas and Jones, 1931.)

I

t°	Gms. NaI per 100 gms. CH_3COCH_3	Solid Phase	t°	Gms. NaI per 100 gms. CH_3COCH_3	Solid Phase
0	11.5	$NaI.3(CH_3COCH_3)$	30	38.9	NaI
10	18.2	"	35	36.7	"
15	23.2	"	37	33.1 (1)	"
18	24.7 (1)	"	40	34.8	"
20	29.9	"	45	32.9	"
25	40.1	"	50	30.9	"
			55	29.3	"

(1) Lannung, 1932.

100 gms. pure acetone sat. with CO_2 and NaI contain 23.4 gms. NaI at 16°. A saturated solution of NaI in acetone, through which a stream of CO_2 is passed, yields crystals of $NaI.3(CH_3COOCH_3)$.

SOLUBILITY OF SODIUM IODIDE IN ACETAMIDE.

(Menschutkin, 1908.)

t°.	Gms. per 100 Gms. Sat. Sol.		Solid Phase	t°.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
	$NaI.2CH_3CONH_2$	= NaI.			$NaI.2CH_3CONH_2$	= NaI.	
82	m. pt. of pure acetamide		CH_3CONH_2	50	59	33	$NaI.2CH_3CONH_2$
78	9.5	5.32	"	60	60.5	33.9	"
74	18	10.08	"	70	62.2	34.8	"
70	25.5	14	"	80	64.2	35.9	"
66	31.9	17.86	"	90	66.5	37.2	"
62	37.3	20.9	"	100	69.2	38.7	"
58	41.9	23.44	"	110	72.6	40.6	"
54	46.1	25.8	"	120	78.7	44	"
50	50	28	"	125	84.7	47.4	" +NaI
46	53.7	30.1	"	150	85.1	47.7	NaI
41.5	57.7	32.3	" $+NaI.2CH_3CONH_2$	175	85.5	47.9	"

100 cc. anhydrous hydrazine dissolve 64 gms. NaI at room temp.

(Welsh and Broderson, 1915.)

SOLUBILITY OF SODIUM IODIDE IN METHYL ETHYL KETONE.

(Wadsworth and Dawson, 1926.)

t.	Gms. NaI per 100 gms. $CH_3CO.C_2H_5$.	Solid Phase.	t°.	Gms. NaI per 100 gms. $CH_3COC_2H_5$	Solid Phase.
—70.....	7.3	$NaI.3(CH_3CO.C_2H_5)$	—10.....	17.4	NaI
—60.....	10.0	"	20.....	15.0	"
—50.....	14.0	"	30.....	12.7	"
—30.....	28.0	" + NaI	40.....	10.7	"
—20.....	25.0	NaI	50.....	8.9	"
—10.....	22.8	"	60.....	7.4	"
0.....	20.1	"	70.....	6.2	"

SOLUBILITY OF SODIUM IODIDE IN LIQUID AMMONIA.

I

t°	Gms. NaI per 100: gms. sat. sol.	Gms. NaI per 100: cc sat. sol.	Authority
-42.2	—	44.8	(Sherer, 1931.)
-37.8	—	48.8	" "
-35.2	—	51.3	" "
-31.5	—	54.6	" "
0	56.88	—	(Linhard and Stephan, 1933, 1934.)
25	59.40	—	(Hunt, 1932.)

100 gms. Liquid Sulfur Dioxide (SO_2) dissolve 15.0 gms. NaI at 0° (Jander and Ruppolt, 1937.)

Results for the vapor pressure-temperature relations in the system NaI + SO_2 are given by Foote and Fleischer, 1931.

Fusion-point data for NaI + NaOH are given by Scarpa, 1915.

SODIUM Mercuric IODIDE

A saturated solution at 24.75°, prepared by adding NaI and HgI_2 in excess to water, contained 4.59% Na, 25% Hg, 58.25% I and 12.2% H_2O, corresponding to 0.20 mol. alkali, 0.12 mol. Hg and 0.45 mol. I. (Dubois, 1905.)

SODIUM IODATE $NaIO_3.H_2O$.

IO

SOLUBILITY OF SODIUM IODATE IN WATER.

(Foote and Vance, 1928; Cornec and Spack, 1931; Hill and Donovan, 1931.)

t°	d. of sat. sol.	Gms. $NaIO_3$ per 100 gms. sat. sol.	Solid Phase	t°	d. of sat. sol.	Gms. $NaIO_3$ per 100 gms. sat. sol.	Solid Phase
- 0.35	—	2.38	Ice+$NaIO_3.5H_2O$	40	1.102	11.71	$NaIO_3.H_2O$
0	1.024	2.42	$NaIO_3.5H_2O$	50	1.119	14.0	"
5	1.028	3.30	"	60	1.142	16.5	"
10	1.041	4.39	"	70	1.164	19.0	"
15	1.052	5.86	"	80	1.190	22.2*	"
19.85	1.070	7.83	"+$NaIO_3.H_2O$	73.4	1.172	20.0	" + $NaIO_3$
25.0	1.077	8.67	$NaIO_3.H_2O$	67.0	—	19.0*	$NaIO_3$
25.0	1.075	8.57(1)	"	80	1.180	21.0	"
30	1.085	9.63	"	90	1.192	22.8	"
35	1.093	10.58	"	100	1.204	24.8	"

* Metastable; (1) Ricci, 1934.

EQUILIBRIUM IN THE SYSTEM SODIUM IODATE, IODIC ACID AND WATER AT 30°.

(Meerburg, 1905.)

Gms. per 100 Gms. Sat. Sol. HIO_3.	Gms. per 100 Gms. Sat. Sol. $NaIO_3$.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. HIO_3.	Gms. per 100 Gms. Sat. Sol. $NaIO_3$.	Solid Phase.
0	9.36	$NaIO_3.1\frac{1}{2}H_2O$	11.20	7.54	$Na_2O.2I_2O_5$
1.98	9.52	"	11.82	7.20	" $+NaIO_3.2HIO_3$
4.86	10.22	"	11.62	5.65	$NaIO_3.2HIO_3$
5.86	11.04	"	23.23	3.69	"
7.40	11.60	" unstable	32.68	2.91	"
9.73	14.73	" "	46.62	2.67	"
6.70	11.21	" $+Na_2O.2I_2O_5$	55.48	2.12	"
7.80	10.30	$Na_2O.2I_2O_5$	65.47	1.83	"
9.15	9	"	76.19	1.42	" $+HIO_3$
9.93	8.71	"	76.70	0	HIO_3

EQUILIBRIUM IN THE SYSTEM SODIUM IODATE, SODIUM NITRATE AND WATER.

The isotherms at 8°, 25°, and 35° are given by Foote and Vance, 1929(a); those for 5°, 25° and 50° by Hill and Donovan, 1931; and that for 0° and the triple points for various temperatures up to 100° are given by Cornec and Spack, 1931.

Results at 0°

10

d. of sat. sol.	Gms. per 100 gms. sat. sol. $NaNO_3$	Gms. per 100 gms. sat. sol. $NaIO_3$	Solid Phase
1.357	42.0	0.53	$NaNO_3$
1.360	41.8	0.82	" + DS
1.351	40.8	0.85	DS
1.286	33.5	1.25	"
1.278	32.5	1.34	" + Na5
1.251	29.6	6.25	Na5

Results at 5°

d. of sat. sol.	Gms. per 100 gms. sat. sol. $NaNO_3$	Gms. per 100 gms. sat. sol. $NaIO_3$	Solid Phase
1.300	34.1	2.02	DS+Na5+Na.1
1.042	4.50	1.58	Na.5
1.182	22.59	1.55	"
1.214	26.38	1.65	"
1.255	30.70	1.87	"
1.275	32.48	2.07	"
1.291	34.34	1.94	" + DS
1.308	36.69	1.76	DS
1.324	38.38	1.60	"
1.336	40.40	1.41	"
1.359	42.74	1.28	" + $NaNO_3$
1.359	42.94	1.01	$NaNO_3$

Results at 8°

d. of sat. sol.	Gms. per 100 gms. sat. sol. $NaNO_3$	Gms. per 100 gms. sat. sol. $NaIO_3$	Solid Phase
—	43.99	0.0	$NaNO_3$
—	43.24	1.67	" + DS
—	40.80	1.88	DS
—	39.54	1.96	" + Na.1
—	39.36	2.02	Na.1

Results at 8° (con.)

d. of sat. sol.	Gms. per 100 gms. sat. sol. $NaNO_3$	Gms. per 100 gms. sat. sol. $NaIO_3$	Solid Phase
—	32.23	2.27	Na.1
—	30.93	2.24	" + Na5

Results at 25°

d. of sat. sol.	Gms. per 100 gms. sat. sol. $NaNO_3$	Gms. per 100 gms. sat. sol. $NaIO_3$	Solid Phase
1.078	3.26	6.38	Na.1
1.092	7.32	4.80	"
1.149	16.08	3.68	"
1.232	27.16	3.06	"
1.328	38.19	2.60	"
1.408	46.81	2.33	" + $NaNO_3$
1.396	47.44	1.09	$NaNO_3$

Results at 50°

d. of sat. sol.	Gms. per 100 gms. sat. sol. $NaNO_3$	Gms. per 100 gms. sat. sol. $NaIO_3$	Solid Phase
—	5.74	9.63	Na.1
—	17.03	6.22	"
—	28.13	4.82	"
—	39.15	3.92	"
—	41.53	3.84	" + Na
—	42.26	3.77	Na
—	45.23	3.46	"
—	49.23	3.09	"
—	51.86	2.91	" + $NaNO_3$
—	52.55	1.58	$NaNO_3$
t° = 70°	55.7	3.16	" + Na
t° = 100°	61.5	3.94	" + "

Na5 = $NaIO_3.5H_2O$; Na.1 = $NaIO_3.H_2O$; Na = $NaIO_3$; DS = $2NaIO_3.3NaNO_3.15H_2O$.

SODIUM IODATE

EQUILIBRIUM IN THE SYSTEM SODIUM IODATE, SODIUM SULFATE AND WATER.

(Foote and Vance, 1930.)

Gms. per 100 gms. sat. sol.		Solid Phase
$NaIO_3$	Na_2SO_4	
Results at 25°		
3.76	12.64	$NaIO_3.H_2O$
3.17	17.52	"
2.79	21.18	" + $Na_2SO_4.10H_2O$
2.20	21.30	$Na_2SO_4.10H_2O$
Results at 29.5°		
2.71	25.01	$NaIO_3.H_2O$ + 1.3
1.90	25.68	1.3
1.52	26.85	"
1.57	27.72	" + $Na_2SO_4.10H_2O$
Results at 35°		
4.47	15.30	$NaIO_3.H_2O$
3.73	19.33	"
3.59	20.70	"
3.33	22.57	" + 1.3
2.39	23.79	1.3
Results at 35° (con.)		
1.29	35.97	1.3
0.83	28.84	" + 1.4
0.30	30.35	1.4
0.28	31.06	"
0.10	32.82	"
0.15	32.88	" + Na_2SO_4
Results at 50°		
5.30	19.97	$NaIO_3.H_2O$ + 1.3
4.01	21.21	1.3
2.75	22.85	"
1.87	23.96	"
1.25	25.93	"
1.03	27.42	" + 1.4
0.63	28.53	1.4
0.28	30.02	"
0.15	31.67	"
0.15	31.65	" + Na_2SO_4

1.3 = $NaIO_3.3Na_2SO_4$; 1.4 = $NaIO_3.4Na_2SO_4$.

IO

SODIUM Per IODATE $NaIO_4.3H_2O$.

SOLUBILITY OF SODIUM PER IODATE IN WATER.

(Hill, 1928.)

t°	d. of sat. sol.	Gms. $NaIO_4$ per 100 gms. sat. sol.	Solid Phase
5.8	1.048	3.93	$NaIO_4.3H_2O$
15.0	1.060	7.2	"
20	1.073	9.3	"
25	1.103	12.62	"
30	1.143	16.6	"
31.5	1.161	18.2	"
33.0	1.175	19.6	"
34.5	—	21.3	$NaIO_4.3H_2O + NaIO_4$
31.5	1.173	19.8*	$NaIO_4$
33.0	1.185	20.6*	"
35	1.192	21.5	"
38	1.202	22.6	"
44.2	1.218	24.9	"
51.5	1.251	28.0	"

* = Metastable.

EQUILIBRIUM IN THE SYSTEM SODIUM PERIODATE, SODIUM HYDROXIDE AND WATER AT 25°.

(Hill, 1928.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$NaIO_4$	NaOH			$NaIO_4$	NaOH	
1.103	12.62	0.0	$NaIO_4.3H_2O$	1.006	0.30	0.55	$Na_2H_3IO_6$
1.103	12.51	0.0	" + $Na_2H_3IO_6$	1.004	0.33	0.57	" + $Na_3H_2IO_4$
1.094	11.59	trace	$Na_2H_3IO_6$	1.006	0.19	0.60	$Na_3H_2IO_4$
1.057	7.63	0.02	"	1.010	0.15	1.00	"
1.011	1.85	0.01	"	1.032	0.08	2.41	"
0.999	0.22	0.045	"	1.111	0.02	10.04	"
1.000	0.15	0.17	"	—	0.004	22.3	"
1.002	0.31	0.45	"	1.319	trace	30.75	"

SOLUBILITY OF SODIUM PERIODATE IN AQUEOUS PERIODIC ACID AT 25°.

(Hill, 1928.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$NaIO_4$	HIO_4	
1.103	12.62	0.0	$NaIO_4.3H_2O$
1.150	11.43	5.23	"

MoO **SODIUM MOLYBDATE** Na_2MoO_4.

SOLUBILITY IN WATER.

(Funk, 1900a.)

t°.	Gms. Na_2MoO_4 per 100 Gms. Solution.	Mols. Na_2MoO_4 per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. Na_2MoO_4 per 100 Gms. Solution.	Mols. Na_2MoO_4 per 100 Mols. H_2O.	Solid Phase.
0	30.63	3.86	$Na_2MoO_4.10H_2O$	15.5	39.27	5.65	$Na_2MoO_4.2H_2O$
4	33.83	4.47	"	18	39.40	5.70	"
6	35.58	4.83	"	32	39.82	5.78	"
9	38.16	5.39	"	51.5	41.27	6.14	"
10	39.28	5.65	$Na_2MoO_4.2H_2O$	100	45.57	7.32	"

d of the sat. sol. at 18° is 1.437.

100 gms. H_2O dissolve 3.878 gms. sodium trimolybdate, $Na_2Mo_3O_{10}$, at 20°, and 13.7 gms. at 100°. (Ullik, 1867.)

100 cc. H_2O dissolve 28.39 gms. $Na_2O.4MoO_3.6H_2O$ at 21°, d_{21} = 1.47. (Wempe, 1912.)

SODIUM MOLYBDATES, Para and Tri.

SOLUBILITY OF EACH IN WATER AT 30°. (Rosenheim, 1916.)

Compound.	Formula.	Gms. anhydrous compound per 100 gms. sat. sol.
Sodium para molybdate...	$5Na_2O.12MoO_3.38H_2O$	54.06
Sodium tri molybdate.....	$Na_2Mo_3O_{10}.7H_2O$	13.68

Fusion-points of Na_2MoO_4 + MoO_3 are given by Hoermann, 1929.

Fusion-point data for $Na_2MoO_4 + Na_2WO_4$ and $Na_2MoO_4 + Na_2SO_4$ are given by Boeke (1907).

Solubility of Sodium Azide in Water.

(Wohlgemuth, 1934.)

t°	Gms. NaN_3 per 100 gms. sat. sol.	Solid Phase	t°	Gms. NaN_3 per 100 gms. sat. sol.	Solid Phase
- 6	10.0	Ice	0	28.0	NaN_3
-15.1 Eutec	21.6	" + $NaN_3.3H_2O$	+16	28.7(1)	"
-20 "	26.8*	" + NaN_3	20	29.0	"
- 8	24.0	$NaN_3.3H_2O$	100	35.6	"
- 2.1 tr. pt.		" + NaN_3			

* Metastable; (1) Curtius and Risson, 1898.

100 gms alcohol of $d_{17} = 0.799$ dissolve 0.22 gms. NaN_3 at 0° and 0.46 gms. at the b. pt.; 100 gms. benzene dissolve 0.10 gms. NaN_3 at the b. pt.

(Cranston and Livingstone, 1926.)

SODAMMONIUM $Na_2(NH_3)_2$.

100 gms. liquid ammonia dissolve 60.5 gms. $Na_2(NH_3)_2$ at −23°, 56.4 gms. at 0°, 56 gms. at +5° and 55 gms. at 9°. (Joannis, 1906.)

SODIUM NITRITE $NaNO_2$.

Solubility of Sodium Nitrite in Water.

(Bureau, 1934, 1937.)

t°	Gms. $NaNO_2$ per 100 gms. sat. sol.	Solid Phase	t°	d. of sat. sol.	Gms. $NaNO_2$ per 100 gms. sat. sol.	Solid Phase
- 2.8	5.92	Ice	15	1.345	43.7	$NaNO_2$
- 3.8	10.0	"	22	1.350	45.07	"
- 8.7	16.3	"	56.8	1.408	52.00	"
-11.5	21.0	"	64.7	1.422	54.07	"
-15.2	25.0	"	79.5	1.455	56.95	"
-19.5 Eutec	28.1	" + $NaNO_2.\frac{1}{2}H_2O$	99.9	1.514	61.5	"
- 7.6	37.8	$NaNO_2.\frac{1}{2}H_2O$	103	—	62.6 (Oswald)	"
- 5.1	41.6	" + $NaNO_2$	128	—	68.7 "	"
0	41.65	$NaNO_2$				

NO

The author shows that the previous results of Helberg, 1925, and Oswald, 1912, 1914, in the vicinity of the eutectic point, are erroneous. These authors also failed to detect the hemihydrate.

Equilibrium in the System Sodium Nitrite, Sodium Carbonate and Water at 23.1°.

(Bureau, 1937.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	Na_2CO_3	$NaNO_2$			Na_2CO_3	$NaNO_2$	
1.352	0.0	45.25	$NaNO_2$	1.363	30.18	11.61	Na.1+Na.10
1.368	42.95	2.69	"	1.358	28.59	12.63	Na.10
1.376	40.50	5.92	"	1.350	25.50	12.80	"
1.381	38.70	6.55	" + Na.1	1.292	17.85	13.40	"
1.379	37.40	7.84	Na.1	1.279	14.60	14.25	"
1.373	34.40	9.15	"	1.246	10.01	16.10	"
1.372	32.45	10.0	"	1.123	0.0	19.60	"

Na.1 = $Na_2CO_3.H_2O$, Na.10 = $Na_2CO_3.10H_2O$.

EQUILIBRIUM IN THE SYSTEM SODIUM NITRITE, SODIUM BICARBONATE AND WATER AT 23.1°.

(Bureau, 1937.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$NaHCO_3$	$NaNO_2$			$NaHCO_3$	$NaNO_2$	
1.352	0.0	45.25	$NaNO_2$	1.288	1.58	36.92	$NaHCO_3$
1.359	1.42	45.20	" + $NaHCO_3$	1.256	1.20	32.90	"
1.348	1.00	44.0	$NaHCO_3$	1.200	2.20	25.65	"
1.320	0.80	40.80	"	1.121	4.33	12.55	"
				2.082	9.91	0.0	"

The author also gives results for the system $NaNO_2$ + $NaNO_3$ at 0°, 18.5°, 56.1°, and 98.5°. His results agree closely with the following results of Oswald at 0°, His results at 18.5° are practically identical with those of Rakowski and Slavina, 1931, at 15°. His results at 56.1° are all under those of Oswald at 51° but at 98.5 °they exceed Oswald's values at 103°, in the region where both salts are in excess.

SOLUBILITY OF SODIUM NITRITE IN AQUEOUS SOLUTIONS OF SODIUM NITRATE AND VICE VERSA AT SEVERAL TEMPERATURES.

(Oswald, 1912, 1914.)

NO

Results at 0°.		Results at 21°.		Results at 52°.		Results at 103°.	
Gms. per 100 Gms. H_2O.		Gms. per 100 Gms. H_2O.		Gms. per 100 Gms. H_2O.		Gms. per 100 Gms. H_2O.	
$NaNO_2$.	$NaNO_3$.	$NaNO_2$.	$NaNO_3$.	$NaNO_2$.	$NaNO_3$.	$NaNO_2$.	$NaNO_3$.
73	0	84.75	0	108.8	0	166	0
68	19	81.1	9.6	104.3	20.6	153.3	33.2
67	36.3	79.7	23.5	99.5	43.2	148.8	58.8
64.9	41.7*	73.8	50.8	98.8	82 *	142.4	116 *
50.3	46.8	73.1	54.5*	65.2	88	100	126.8
30.2	55.4	64.2	56.7	44.2	92.9	60.1	142.9
0	74.2	46.8	62.8	27.2	101.4	0	181.2
		21.6	74.7	14.7	109		
		0	89.3	0	118		

* Both salts in solid phase.

Similar results are also given for 18°, 65°, 81° and 92°.

100 gms. H_2O, simultaneously saturated with both salts, contain 53.9 gms. $NaNO_2$ + 11.8 gms. Na_2SO_4 at 16°. (Oswald, 1914.)

SOLUBILITY OF MIXTURES OF SODIUM NITRITE AND SILVER NITRITE IN WATER AT 14° AND AT 22°.

(Oswald, 1912, 1914.)

Results at 14°.		Results at 22°.		Solid Phase in Each Case.
Gms. per 100 Gms. H_2O.		Gms. per 100 Gms. H_2O.		
$NaNO_2$.	$AgNO_2$.	$NaNO_2$.	$AgNO_2$.	
55	15.2	58.3	21.5	$AgNO_2+Na_2Ag_2(NO_2)_4.H_2O$
74.7	11.3	78.3	13.4	$NaNO_2+Na_2Ag_2(NO_2)_4.H_2O$

100 gms. abs. methyl alcohol dissolve 4.43 gms. $NaNO_2$ at 19.5°.

100 gms. abs. ethyl alcohol dissolve 0.31 gm. $NaNO_2$ at 19.5°. (de Bruyn, 1892.)

100 gms. sat. solution of Sodium Nitrite in 94.9 Volume percent ethyl alcohol (d_{25} = 0.810) contain 1.424 gms. $NaNO_2$ (of 96.86% purity) at 25°. (Schnellbach and Rosin, 1929.)

F. pt. data for mixtures of $NaNO_2$ + $NaNO_3$ are given by Bruni and Meneghini, 1909, 1910.

SODIUM RHODONITRITE $Na_6Rh_2(NO_2)_{12}$.

100 gms. H_2O dissolve 40 gms. at 17°, and 100 gms. at 100°. (Leidie, 1890.)

SODIUM NITRATE $NaNO_3$.

SOLUBILITY IN WATER.

(Mulder; Berkeley, 1904; see also Ditte, 1875; Maumee, 1864; Etard, 1894.)

t°.	Gms. $NaNO_3$ per 100 Gms. Solution.	Gms. $NaNO_3$ per 100 Gms. Water.	Mols. per Liter.	t°.	Gms. $NaNO_3$ per 100 Gms. Solution.	Gms. $NaNO_3$ per 100 Gms. Water.	Mols. per Liter.
0	42.2	72.9– 73	* 6.71*	80	59.7	148 –148. *	10.35*
10	44.7	80.8– 80.5	7.16	100	64.3	180 –175.8	11.30
20	46.7	87.5– 88	7.60	120	68.6	218 –208.8†	12.22†
25	47.6	91 – 92	7.80	180	78.1	356.7	
30	48.7	94.9– 96.2	8.06	220	83.5	506	
40	50.5	102 –104.9	8.51	225	91.5	1076	
50	52.8	112 –114	8.97	313‡	100	∞	
60	54.9	122 –124	9.42	...			

* Berkeley. † at 119°. ‡ m.pt.

NO

More recent determinations of the Solubility of Sodium Nitrate in Water are as follows:

t°	d. of sat. sol.	Gms. $NaNO_3$ per 100 gms. sat. sol.	t°	d. of sat. sol.	Gms. $NaNO_3$ per 100 gms. sat. sol.
-18.1	Eutec.	38.07(1)	50	1.469	53.3(2) 53.1(4) 53.2(3)
-17.7	"	37.83(2)	65	—	56.0(5)
0	1.352	42.3 (2)(3)	75	1.469	58.6(2)(6)
15	—	45.93(4)	100	1.507	63.7(2)(3)
25	1.392	47.9(2) 47.8(4)(5)	118	1.535	67.4(2)

(1) Nikolajew, 1926; (2) Chretien, 1929; (3) Cornec & Neumeister, 1929; (4) Benrath et al. 1928; (5) Kurnakow & Nikolajew, 1926; (6) Schroder, 1930;

FREEZING-POINTS OF AQUEOUS SOLUTIONS OF SODIUM NITRATE.

(Klein and Svanberg, 1920; Rodebush, 1918.)

t° of f. pt.	Gms. $NaNO_3$ per 100 cc. sat. sol.		t° of f. pt.	Gms. $NaNO_3$ per 100 gms. H_2O.	t° of f. pt.		Gms. $NaNO_3$ per 100 gms. H_2O.
—0.340.....	0.85	(K and S)	— 6.67.....	20.83	—12.85.....		44.56
—0.822.....	2.125	"	— 8.78.. ..	28.77	—15.08.....		53.14
—1.583.....	4.25	"	—10.17.....	34.15	—17.46	Eutec.	62.50

100 gms. H_2O dissolve 84.86 gms. $NaNO_3$ at 16°.2, 87.81 gms. at 20° and 92.02 gms. at 25°. (Mondain-Monval, 1925.)

SOLUBILITY OF SODIUM NITRATE IN WATER AT TEMPERATURES UP TO ITS MELTING POINT.

(Kracek, 1931.)

t°	Gms. $NaNO_3$ per 100 gms. sat. sol.	Gms. $NaNO_3$ per 100 gms. H_2O	t°	Gms. $NaNO_3$ per 100 gms. sat. sol.	Gms. $NaNO_3$ per 100 gms. H_2O
94.05	62.39	165.90	218.90	86.70	651.69
106.80	65.02	185.84	224.70	87.78	718.48
114.90	66.78	200.07	242.25	90.81	987.54
136.90	71.05	245.46	253.55	92.59	1248.80
151.60	74.06	285.53	260.90	93.71	1489.8
168.90	77.33	341.05	270.00	95.07	1926.2
178.00	79.11	378.72	289.20	97.59	4052.1
183.80	80.25	406.22	295.35	98.31	5828.9
201.60	83.57	508.62	309.5	100.0	—

More recent determinations agreeing in general with the above extremely accurate values of Kracek are given by Benrath, Gjedebo, Schiffers and Wunderlich, 1937.

SOLUBILITY OF SODIUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 0°.

(Engel, 1887; see also Schultz, 1860.)

NO

Equivalents per 10 cc. Solution.		Sp. Gr. of Solutions	Grams per 100 cc. Solution.	
$NaNO_3$.	HNO_3.		$NaNO_3$.	HNO_3.
66.4	0	1.341	56.5	0.00
63.7	2.65	1.338	54.2	1.67
60.5	5.7	1.331	51.48	3.59
56.9	8.8	1.324	48.42	5.55
52.75	12.57	1.312	44.88	7.92
48.7	16.9	1.308	41.44	10.65
39.5	27.0	1.291	33.61	17.02
35.1	32.25	1.285	29.86	20.33
31.1	37.25	1.282	26.46	23.48
23.5	48.0	1.276	20.0	30.26
18.0	57.25	1.276	15.32	36.09
12.9	71.0	1.291	10.97	44.76

SOLUBILITY OF SODIUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID.

(Kazantzev, 1923, 1925.)

Results at 15°.				Results at 75°.			
Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.	
$NaNO_3$.	HNO_3.	$NaNO_3$.	HNO_3.	$NaNO_3$.	HNO_3.	$NaNO_3$.	HNO_3.
45.4	0.0	2.5	64.6	58.3	0.0	6.8	63.7
33.0	9.5	2.3	74.6	38.5	17.2	6.2	70.8
29.0	13.0	3.5	80.9	25.6	30.5	5.9	78.3
14.5	28.3	4.9	84.8	19.7	38.0	7.4	87.0
5.0	49.7	7.8	89.3	17.2	41.7	7.7	87.7
						8.1	88.9

SOLUBILITY OF SODIUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID.

(Saslawsky, Ettinger and Eserowa, 1935.)

Results at 0°			Results at 20°		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$NaNO_3$	HNO_3		$NaNO_3$	HNO_3	
42.77	0.0	$NaNO_3$	46.27	0.0	$NaNO_3$
20.99	20.50	"	23.69	18.98	"
4.32	42.70	"	6.14	41.52	"
2.10	62.81	"	2.13	59.66	"
1.59	72.76	"	2.00	72.01	"
4.39	85.88	"	5.53	84.77	"

The authors also give results for the quarternary system $Al(NO_3)_3$ + $NaNO_3$ + HNO_3 + H_2O at 0° and 20°.

SOLUBILITY OF SODIUM NITRATE IN AQUEOUS SOLUTIONS OF HYDROGEN PEROXIDE AT 25°.

(Akerlof and Turck, 1935.)

Wt. Percent H_2O_2 in solvent	Gm. Mols. $NaNO_3$ per 1000 gms. solvent
0.0	10.825
15.72	9.252
31.43	7.554

NO

SOLUBILITY OF SODIUM NITRATE IN HYDROGEN PEROXIDE.

(Maass and Hatcher, 1922.)

The temperature were determined at which the last trace of solid disappeared in mixtures of weighed amounts of the two constituents.

t°.	Gms $NaNO_3$ per 100 gms. sat. sol.	t°.	Gms. $NaNO_3$ per 100 gms. sat. sol.	t°.	Gms. $NaNO_3$ per 100 gms. sat. sol.
−2.47	1.62	−5.62	10.11	−10.82	22.25
−2.82	3.23	−6.97	13.19	+11.8	25.22
−3.72	5.11	−8.12	16.66	32.3	28.25
−4.72	7.58	−9.52	20.19	49.3	31.53

SOLUBILITY OF MIXTURES OF SODIUM NITRATE AND POTASSIUM NITRATE IN WATER AT 20°.

(Carnelly and Thomson, 1888.)

Per cent $NaNO_3$ in Mixtures Used	Gms. per 100 Gms. H_2O.		Per cent $NaNO_3$ in Mixtures Used.	Gms. per 100 Gms. H_2O.	
	$NaNO_3$.	KNO_3.		$NaNO_3$.	KNO_3.
100	86.8	0	45.7	53.3	34.7
90	96.4	13.2	40	45.6	35.5
80	98.0	38.5	20	20.8	33.3
60	90.0	47.6	10	9.4	31.5
50	66.0	40.0	0	0.0	33.6

100 gms. H_2O dissolve 24.9 gms. NaCl + 53.6 gms. $NaNO_3$ at 20°.

(Rüdorff, 1873; Karsten; Nicol, 1891.)

SOLUBILITY OF MIXTURES OF SODIUM NITRATE AND SODIUM CHLORIDE IN WATER AT VARIOUS TEMPERATURES.

(Nikolajew, 1929.)

t°	Gms. per 100 gms. sat. sol. NaCl	NaNO3	Solid Phase	t°	Gms. per 100 gms. sat. sol. NaCl	NaNO3	Solid Phase
15	16.54	23.68	$NaNO_3 + NaCl$	130	3.92	66.09	$NaNO_3 + NaCl$
25	13.34	31.47	" "	162	4.10	72.21	" "
35	11.62	36.12	" "	185	4.8	76.8	" "
72.6	7.66	49.33	" "	196	6.2	79.8	" "
100	5.54	58.25	" "	210	7.4	82.2	" "

The author also gives results for the effect of varying concentrations of HCl and NaOH upon the simultaneous solubility of $NaNO_3$ and NaCl at 15° and at 25°. The results show the partition of NaOH between HCl and HNO_3.

Results for the Reciprocal Salt Pair $Na_2(NO_3)_2 + MgSO_4 + H_2O$ at various temperatures are given by Benrath, 1928, and Schroder, 1929.

SOLUBILITY OF SODIUM NITRATE IN AQUEOUS AMMONIA SOLUTIONS AT 15°.

(Fedotieff and Koltunoff, 1914.)

In Aqueous NH_3.

d_{15} of Sat. Sol.	Gms. per 100 Gms. H_2O. NH_3.	$NaNO_3$.
1.253	13.87	75.03
1.233	17.28	73.99
1.212	20.38	73.18

NO

In Aqueous $NH_3 + NH_4NO_3$.

d_{15} of Sat. Sol.	Gms. per 100 Gms. H_2O. NH_3.	NH_4NO_3.	$NaNO_3$.
1.324	12.91	83.51	74.10
1.330	16.97	128.9	69.40

SOLUBILITY OF SODIUM NITRATE IN AQUEOUS AMMONIA SOLUTIONS AT 0°.

(Guyer, Sieber and Schmid, 1934.)

The authors given their results only in the form of a diagram from which the following approximate values were read.

Gms. per 100 gms. sat. sol. NH_3	$NaNO_3$	Gms. per 100 gms. sat. sol. NH_3	$NaNO_3$
0	42.3	60	39.5
10	36	70	43
20	31.5	80	47
28	30	90	52
40	33	100	55
50	36.5		

SOLUBILITY OF SODIUM NITRATE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE AT 0°.

(Engel, 1891.)

Milligram Mols. per 10 cc. Solution. Na_2O.	$NaNO_3$.	Sp. Gr. of Solutions.	Grams per 100 cc. Solution. NaOH.	$NaNO_3$.
0.0	66.4	1.341	0.0	56.50
2.875	62.5	1.338	2.30	53.19
6.1	57.15	1.333	4.89	48.63
12.75	47.5	1.327	10.21	40.42
26.0	29.5	1.326	20.83	25.10
39.0	17.5	1.332	31.25	14.89
45.88	13.19	1.356	36.76	11.22
60.88	6.05	1.401	48.75	5.15

Results for equilibrium in the system Sodium Nitrate, Sodium Hydroxide and Water at 0°, 25° and 65° are given by Kurnakow and Nikolajew, 1927. The isotherms for 100° and 125° and the complete temperature concentration diagrams for the system are given by Jänecke, 1930.

EQUILIBRIUM IN THE SYSTEM SODIUM NITRATE, SODIUM SULFATE AND WATER.

(Chretien, 1929.)

t°	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	t°	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Solid Phase
		$NaNO_3$	Na_2SO_4				$NaNO_3$	Na_2SO_4.	
-17.8	—	37.7	0.12	Ice+N+S.10	25	1.405	45.2	3.04	1.1.2+N
-10.6	—	25.0	1.32	" +S.10	"	1.398	46.5	1.57	N
-10.6	—	39.2	0.56	N + S.10	30	1.327	8.51	29.9	S.10+S
- 4.0	—	8.99	2.82	Ice+S.10	"	1.351	29.9	11.20	1.1.2+S
- 4.0	—	40.7	0.82	N + S.10	"	1.411	46.6	2.80	" + N
- 1.0	—	41.3	1.09	" + "	35	1.315	13.3	21.6	S
0	1.128	14.6	1.76	S.10	"	1.328	25.5	13.8	"
"	1.222	27.7	1.17	"	"	1.352	32.4	9.77	"
"	1.298	35.3	1.15	"	"	1.357	33.9	8.97	" + 1.1.2
"	1.342	39.7	1.07	"	"	1.360	36.1	7.51	1.1.2
"	1.355	41.2	1.07	" + N	"	1.374	40.2	5.41	"
"	1.352	41.6	0.0	N	"	1.415	47.2	2.65	"
6.5	—	41.9	2.12	"+S.10	"	1.417	48.0	2.53	" + N
10.2	1.382	41.8	3.08	" "	50	1.219	12.9	20.7	S
15.0	1.381	39.2	5.11	D + "	"	1.302	23.6	13.3	"
"	1.394	42.0	4.09	N+ 1.1.2	"	1.330	33.2	8.27	"
17.5	1.367	36.3	6.66	S.10+ "	"	1.365	39.9	5.67	"
"	1.395	42.8	3.78	N + "	"	1.388	43.9	4.43	"+ 1.1.2
20	1.203	13.3	10.91	S.10	"	1.392	44.5	4.23	1.1.2"
"	1.270	21.8	9.20	"	"	1.407	46.8	3.35	"
"	1.335	30.5	8.9	"	"	1.422	49.5	2.61	"
"	1.356	33.1	8.62	"	"	1.440	51.6	2.13	" + N
"	—	34.1	8.09	1.1.2	"	1.432	52.2	1.21	N
"	1.366	36.3	6.73	"	75	1.256	13.9	18.4	S
"	—	41.2	4.56	"	"	1.281	27.8	10.02	"
"	—	42.7	3.85	"	"	1.346	41.2	4.73	"
"	1.397	43.6	3.46	" + N	"	1.416	50.7	2.62	"
"	—	44.8	2.27	N	"	1.464	55.8	1.95	"
24.3	1.348	26.3	13.9	1.1.2+S.10+S	"	1.478	57.2	1.86	" + N
25	1.256	12.6	16.5	S.10	"	1.475	57.6	1.25	N
"	1.315	21.2	14.8	"	83	1.491	59.0	1.70	" + S
"	1.346	24.9	14.6	" + S	91	1.505	60.8	1.64	" "
"	—	25.9	13.9	S	100	1.230	13.6	17.8	S
"	1.350	26.8	13.3	"+ 1.1.2	"	1.247	24.9	10.9	"
"	1.351	27.7	12.70	1.1.2	"	1.321	40.5	4.9	"
"	1.350	29.5	11.30	"	"	1.403	51.3	2.77	"
"	1.354	31.1	10.20	"	"	1.466	58.1	1.97	"
"	1.368	37.7	6.17	"	"	1.515	62.6	1.57	" + N
"	1.393	43.1	3.74	"	"	1.514	63.1	0.86	N
"	1.404	44.6	3.40	"	120.3 b.pt.	—	66.2	1.48	" + S

NO

S.10 = $Na_2SO_4.10H_2O$; S = Na_2SO_4; N = $NaNO_3$; 1.1.2 = $NaNO_3.Na_2SO_4.2H_2O$.

The author also gives results for the system $NaNO_3 + NaCl + Na_2SO_4 + H_2O$.

Less complete results differing in certain details from the above are given by Massink, 1918, Foote, 1925 and Hamid, 1926. Other results in general agreement with the above are given by Benrath, 1928, in connection with a study of the equilibrium in the reciprocal salt pair $Na_2(NO_3)_2 + MgSO_4 + H_2O$, at 15°, 25°, 50° and 97°.

A number of other determinations are given by Schroder, 1929a, b, 1929.

SOLUBILITY OF SODIUM NITRATE IN AQUEOUS SOLUTIONS OF SODIUM THIOSULFATE.

(Kremann and Rodemund, 1914.)

Results at 9°.

Gms. per 100 Gms. Sat. Sol. $NaNO_3$.	Gms. per 100 Gms. Sat. Sol. $Na_2S_2O_3$.	Solid Phase.
33.31	12.26	$NaNO_3$
22.57	23.41	" $+Na_2S_2O_3.5H_2O$
4.22	34.77	$Na_2S_2O_3.5H$

Results at 25°.

Gms. per 100 Gms. Sat. Sol. $NaNO_3$.	Gms. per 100 Gms. Sat. Sol. $Na_2S_2O_3$.	Solid Phase.
35.42	12.72	$NaNO_3$
25.40	24.25	"
19.90	31.81	" $+Na_2S_2O_3.5H_2O$
18.02	32.83	$Na_2S_2O_3.5H_2O$
4.33	40.50	"

SOLUBILITY OF SODIUM NITRATE IN ALCOHOLS.

100 gms. abs. methyl alcohol dissolve 0.41 gm. $NaNO_3$ at 25°.
100 gms. abs. ethyl alcohol dissolve 0.036 gm. $NaNO_3$ at 25°. (de Bruyn, 1892.)

SOLUBILITY OF SODIUM NITRATE IN AQUEOUS ETHYL ALCOHOL AT DIFFERENT TEMPERATURES.

(Bodländer, 1891; Taylor, 1897; Bathrick, 1896.)

Results at 13° (B.).

Sp. Gr. of Solutions.	Gms. per 100 cc. Solution. C_2H_5OH.	H_2O.	$NaNO_3$.
1.3700	0.0	75.34	61.66
1.3395	3.08	73.53	57.34
1.3120	6.01	71.81	53.39
1.2845	8.30	70.85	49.30
1.2580	10.91	69.47	45.42
1.2325	13.77	67.12	42.36
1.2010	16.46	66.16	37.48

Results at 16.5° (B.).

Sp. Gr. of Solutions.	Gms. per 100 cc. Solution. C_2H_5OH.	H_2O.	$NaNO_3$.
1.3745	0.0	75.25	62.20
1.3162	6.16	70.82	54.64
1.2576	11.60	68.10	46.06
1.2140	16.49	65.04	39.87
1.1615	22.17	61.67	32.31
1.0855	32.22	52.92	23.41
1.0558	37.23	48.50	19.85
1.0050	43.98	42.78	13.74
0.9420	52.60	32.13	9.47
0.9030	60.00	25.65	4.65
0.8610	63.16	21.31	1.63

Results at 30° (T.).

Wt. per cent Alcohol in Solvent.	Gms. $NaNO_3$ per 100 Gms. Solution.	Gms. $NaNO_3$ per 100 Gms. Water.
0	49.10	96.45
5	46.41	91.15
10	43.50	85.55
20	37.42	74.75
30	31.31	65.10
40	25.14	55.95
50	18.94	46.75
60	12.97	37.25
70	7.81	28.25
90	1.21	12.25

Results at 40° (Bathrick).

Wt. per cent Alcohol	Gms. $NaNO_3$ per 100 Gms. Aq. Alcohol.
0	104.5
8.22	90.8
17.4	73.3
26.0	61.6
36.0	48.4
42.8	40.6
55.3	27.1
65.1	18.1
77.0	9.4
87.2	4.2

SOLUBILITY OF SODIUM NITRATE IN AQUEOUS SOLUTIONS OF URANYL NITRATE AND VIÇE VERSA AT 25°.

(Colani, 1928.)

Gms. per 100 gms. sat. sol. $UO_2(NO_3)_2$	Gms. per 100 gms. sat. sol. $NaNO_3$	Solid Phase	Gms. per 100 gms. sat. sol. $UO_2(NO_3)_2$	Gms. per 100 gms. sat. sol. $NaNO_3$	Solid Phase
0.0	47.78	$NaNO_3$	45.37	14.39	$UO_2(NO_3)_2.6H_2O$
9.12	40.96	"	48.62	9.43	"
20.83	31.71	"	51.59	6.06	"
34.35	22.26	"	53.06	3.45	"
40.76	17.58	"	56.08	0.0	"
44.20	16.20	" + $UO_2(NO_3)_2.6H_2O$			

SOLUBILITY OF SODIUM NITRATE IN AQUEOUS SOLUTIONS OF METHYL ALCOHOL AT 25°.

(Akerlof and Turck, 1935.)

Wt. % CH_3OH in solvent	Gm. Mols. $NaNO_3$ per 1000 gms. solvent	Wt. % CH_3OH in solvent	Gm. Mols. $NaNO_3$ per 1000 gms. solvent
0.0	10.825	70.05	1.364
21.30	7.111	78.46	0.893
40.10	4.172	89.45	0.543
59.94	2.076	100.0	0.485

100 gms. aq. 50% Ethyl Alcohol dissolve 19.4 gms. $NaNO_3$ at 20°. (Wright, 1926.)

NO -

SOLUBILITY OF SODIUM NITRATE IN AQUEOUS ALCOHOL AT 25°.

(Armstrong and Eyre, 1910–11.)

Solvent. Mols. C_2H_5OH per 1000 Gms. H_2O.	=	Solvent. Gms. C_2H_5OH per 1000 Gms. H_2O.	Gms. $NaNO_3$ per 100 Gms. Sat. Sol.
0		0	47.93
0.25		11.51	47.32
0.50		23.03	46.73
1		46.06	45.43
2		92.12	43.04

SOLUBILITY OF SODIUM NITRATE IN AQUEOUS SOLUTIONS OF ACETONE.

Results at 30°. (Taylor, 1897.) Wt. per cent Acetone in Solvent.	Gms. NaNO₃ per 100 Gms. Solution.	Gms. NaNO₃ per 100 Gms. Water.	Results at 40°. (Bathrick, 1896.) Wt. per cent Acetone.	Gms. $NaNO_3$ per 100 Gms. Aq. Acetone.
0	49.10	96.45	0.0	105
5	46.96	93.20	8.47	91.2
9.09	45.11	90.40	16.8	78.3
20	40.10	83.70	25.2	66.4
30	35.08	77.20	34.3	57.9
40	29.80	70.75	44.1	46.2
50	24.34	64.40	53.9	32.8
60	18.55	59.95	64.8	23.0
70	13.15	50.50	76.0	10.8
80	7.10	38.20	87.6	3.2
90	1.98	20.20		

100 gms. hydroxylamine dissolve 13.1 gms. $NaNO_3$ at 17–18°. (de Bruyn, 1892.)

100 cc. anhydrous hydrazine dissolve 100 gms. $NaNO_3$ at room temp. (Welsh and Broderson, 1915.)

SOLUBILITY OF SODIUM NITRATE IN ANHYDROUS ACETIC ACID DETERMINED BY THE FREEZING-POINT METHOD.

(Davidson and Geer, 1933.)

t°	Mol. % $NaNO_3$ in sat. sol.	Solid Phase	t°	Mol. % $NaNO_3$ in sat. sol.	Solid Phase
16.60	0.0	CH_3COOH	46.5	0.202	$NaNO_3$
16.53	0.031	"	53.7	0.246	"
16.45	0.150	"	78.5	0.448	"
27.0	0.122	$NaNO_3$	88.3	0.573	"
31.5	0.150	"	93.4	0.641	"
36.0	0.166	"	95.7	0.677	"
40.0	0.173	"	103.0	0.854	"

SOLUBILITY OF SODIUM NITRATE IN UREA (CARBAMIDE) DETERMINED BY THE FREEZING-POINT METHOD.

(Howells, 1930.)

t°	Wt. % $NaNO_3$ in sat. sol.	Solid Phase	t°	Wt. % $NaNO_3$ in sat. sol.	Solid Phase
132.0	0.0	$CO(NH_2)_2$	88.4	30.5	$NaNO_3$
121.4	6.9	"	92.5	31.1	"
106.8	16.3	"	109.0	33.2	"
95.8	23.22	"	131.7	36.69	"
88.8	27.0	"	156.0	41.30	"
83.9	29.5	" + $NaNO_3$			

NO

The author also gives complete results for the ternary system $NaNO_3$ + NH_4NO_3 + $CO(NH_2)$.

EQUILIBRIUM IN THE SYSTEM SODIUM NITRATE, ISO PROPYL ALCOHOL AND WATER AT 25°.

(Ginnings and Chen, 1931.)

Points on the binodal curve of this system were determined by titrating mixtures of the salt and one of the liquids with the other liquid until clouding appeared or disappeared. Tie lines, *, were located by means of determinations of the salt in two layers in contact with each other. The plait point, PP, was found by plotting.

Gms. per 100 gms. of the homogeneous mixture			Gms. per 100 gms. of the homogeneous mixture	
$NaNO_3$	$CH_3CH(OH)CH_3$		$NaNO_3$	$CH_3CH(OH)CH_3$
10.90	49.50	*	29.25	11.54
14.5	39.50		32.65	8.20
17.17	33.80		37.70	4.90
18.20	31.50		40.56	4.04
21.5	26.0	PP	43.80	3.00
24.4	19.5			

The composition of the plait point, determined in a manner similar to the above, for the system Sodium Nitrate, Tertiary Butyl Alcohol and Water at 25° was found by Ginnings, Herring and Webb, 1933, to be

32.4 wt. percent $NaNO_3$ + 11.6 wt. percent $(CH_3)_3COH$

Ginnings and Dees, 1935, and Ginnings, Webb and Hinohara, 1933, have respectively determined the binodal curves for the systems Sodium Nitrate, Allyl Alcohol and Water at 25° and Sodium Nitrate Pyridine and Water at 25°, but the original results are not given but only the values of constants for the curves calculated by means of empirical equations.

SODIUM NITRATE

SOLUBILITY OF SODIUM NITRATE IN LIQUID AMMONIA.

t°	Gms. $NaNO_3$ per 100 cc sat. sol.	t°	Gms. $NaNO_3$ per 100 gms. NH_3
-50.5	47.3 (1)	-53.0	99.2 (2)
-49.0	50.3 (1)	-37	110.9 (2)
-48.0	52.3 (1)	0	126.4 (2)
-47.5	53.3 (1)	+0.1	127.5 (3)
-47.6	55.8 (1)	25	97.6 (4)
-48.0	58.5 (1)	30	137.4 (2)
-50.2	59.9 (1)	48	143.6 (2)
-48.6	61.2 (1)	60	148.5 (2)
-49.8	63.1 (1)		

NO

(1) Scherer, 1931; (2) Portnow and Rawdine (3) Linhard and Stephan, 1933, 1934; (4) Hunt, 1932.

Fusion-point data are given for:

$NaNO_3$ + KNO_3 + $SrNO_3$ (Harkins and Clark, 1915.)
" + NaOH (Retortillo and Moles, 1933.)
" + $Pb(NO_3)_2$ (Glass, Laybourn and Madgin, 1932.)
" + " + $Sr(NO_3)_2$ (Laybourn, Madgin and Freeman, 1934.)
" + $RbNO_3$ (Puschin and Radoicic, 1937.)
" + $TlNO_3$ (Van Eyk, 1905.)

SODIUM HYDROXIDE Na OH.

OH

FREEZING-POINTS OF DILUTE AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE

(Klein and Svanberg, 1920.)

t° of f. pt.	−0.35.	−0.867.	−1.72.
Normality of aq. NaOH	0.1	0.25	0.50

FREEZING-POINTS OF MIXTURES OF SODIUM HYDROXIDE AND WATER.

(Von Antropoff and Sommer, 1926.)

t° of beginning of crystallization.	t° of transition.	t°. of outer.	Gms. per 100 gms. of mixture.	
			Na OH.	H_2O.
322	303	–	100.0	0.9
319	305	48	98.7	1.3
298	–	53	96.7	3.3
265	–	56	91.7	8.4
205	–	56	85.5	14.5
–	–	58	76.2	23.8

The authors also give data for the system Na OH + Na Cl + H_2O.

SODIUM HYDROXIDE NaOH.

SOLUBILITY IN WATER.

(Pickering, 1893; Mylius and Funk (Dietz), 1900.)

t°.	Gms. NaOH per 100 Gms.		Solid Phase.
	Solution.	Water.	
− 7.8	8.0	8.7	Ice
−20	16.0	19.1	"
−28	19.0	23.5	Ice + $NaOH.7H_2O$
−24	22.2	28.5	$NaOH.7H_2O$ + $NaOH.5H_2O$
−17.7	24.5	32.5	$NaOH.5H_2O$ + $NaOH.4H_2O$ α
0	29.6	42.0	$NaOH.4H_2O$ α
+ 5	32.2	47.5	$NaOH.4H_2O$ α + $NaOH.3\frac{1}{2}H_2O$
10	34.0	51.5	$NaOH.3\frac{1}{2}H_2O$
15.5	38.9	63.53	" f. pt.
5	45.5	83.5	$NaOH.3\frac{1}{2}H_2O$ + $NaOH.2H_2O$
12	50.7	103.0	$NaOH.2H_2O$ + $NaOH.H_2O$
20	52.2	109	$NaOH.H_2O$
30	54.3	119	"
40	56.3	129	"
50	59.2	145	"
60	63.5	174	"
64.3	69.0	222 3	" f. pt.
61.8	74.2	288	$NaOH.H_2O$ + NaOH
80	75.8	313	NaOH (?)
110	78.5	365	"
192	83.9	521	"

Sp. Gr. of sat. solution at 18° = 1.539.

For determinations of the Sp. Gr. of sodium hydroxide solution, see Kohlrausch, 1879; Wegscheider and Walter, 1905.

100 gms. of the sat. solution in water contain 46.36 gms. NaOH at 15°.

(de Forcrand, 1909a.)

OH 100 gms. H_2O dissolve 2.83 gm. mols. NaOH at 25°. (Akerlof and Short, 1937.)

100 gms. sat. solution of sodium hydroxide in water contain 51.33 gms. NaOH at 25°, determined by E.M.F. measurements. (Shibata, 1932.)

SOLUBILITY OF SODIUM HYDROXIDE IN WATER AT HIGH TEMPERATURES.

(v. Antropoff and Sommer, 1928.)

t°	Gms. NaOH per 100 gms. sat. sol.
205	85.5
265	91.6
295	96.7
322(m. pt.)	100.0

1000 gms. liquid ammonia dissolve 0.0025 gm. NaOH at −40°.

(Shoszarewky and Tchitchinadze, 1916.)

Data for equilibrium in the system sodium hydroxide, resorcinol and water at 30° are given by van Meurs (1916).

EQUILIBRIUM IN THE SYSTEM SODIUM HYDROXIDE, SODIUM SULFITE AND WATER

(Hammick and Currie, 1925.)

The mixtures were constantly stirred for 24 to 48 hours. Silver vessels were used for the stronger sodium hydroxide solutions. Both the saturated solutions and the solid phases were analyzed. The temperatures were constant to within 0°.1. The results are probably accurate to ± 0.5 per cent.

Gms. per 100 gms. sat. sol. NaOH.	Gms. per 100 gms. sat. sol. Na_2SO_3.	Solid Phase.
	Results at 0.15°.	
29.5	0.0	$NaOH.4H_2O$
29.1	0.1	» $+Na_2SO_3$
27.9	0.1	Na_2SO_3
27.1	0.4	»
26.6	0.7	»
25.4	1.3	»
23.3	2.2	» $+Na_2SO_3.7H_2O$
21.9	2.21	$Na_2SO_3.7H_2O$
16.9	2.8	»
9.0	5.2	»
3.0	9.0	»
0.0	12.3	»
	Results at 20°.	
52.2	0.0	$NaOH.H_2O$
50.1	trace	Na_2SO_3
36.3	0.1	»
26.8	1.0	»
24.9	1.1	»
20.2	3.5	»
16.0	6.7	»
15.5	7.0	»
13.8	8.6	» $+Na_2SO_3.7H_2O$
14.0	9.0	» »
13.4	9.2	$Na_2SO_3.7H_2O$
12.7	9.4	»
12.2	9.6	»
11.6	9.9	»
9.9	11.0	»
8.3	12.0	»
4.4	15.4	»
1.6	18.7	»
0.0	21.3	»

Gms. per 100 gms. sat. sol. NaOH.	Gms. per 100 gms. sat. sol. Na_2SO_3.	Solid Phase.
	Results at 25°.	
53.3	0.0	$NaOH.H_2O$
43.9	trace	Na_2SO_3
42.7	0.1	»
29.4	0.3	»
28.7	0.5	»
25.2	1.0	»
20.7	2.5	»
20.7	2.9	»
17.2	5.8	»
14.2	8.2	«
12.6	10.1	»
12.2	10.2	»
9.6	13.8	» $+Na_2SO_3.7H_2O$
9.8	13.2	» »
9.7	13.0	$Na_2SO_3.7H_2O$
5.0	17.7	»
2.5	19.3	»
0.7	22.5	»
0.0	23.6	»
	Results at 32°.	
54.4	0.0	$NaOH.H_2O$
51.8	0.001	Na_2SO_3
36.2	0.1	»
27.2	0.6	»
20.1	2.9	«
16.5	5.4	»
11.1	11.2	»
7.6	15.7	»
5.1	19.1	»
2.3	23.1	»
0.6	26.4	»
0.0	26.5	»

SOLUBILITY OF SODIUM HYDROXIDE IN METHYL ALCOHOL AND IN ETHYL ALCOHOL AT ABOUT 28°.

(Murray, 1929.)

The mixtures were shaken occasionally at room temperature during about three weeks. Portions of the clear supernatant solutions were then removed, weighed and titrated with normal sulfuric acid.

Solvent	d. of sat. sol.	Normality of sat. sol.	Gms. NaOH per: 100 cc sat. sol.	Gms. NaOH per: 100 gms. sat. sol.
Methyl Alcohol	1.01	5.98	23.9	23.6
Ethyl Alcohol	0.93	3.40	13.6	14.7

EQUILIBRIUM IN THE SYSTEM SODIUM HYDROXIDE, ACETONE AND WATER AT 0°.

(Gibby, 1934.)

The binodal curve was determined by titration of acetone into aqueous sodium hydroxide solutions until a permantent separation into two layers was observed. Tie lines were located by preparing mixtures which yielded sufficient amounts of the two layers for titrating the alkali in each.

Gms. per 100 gms. homogeneous mixture		Gms. per 100 gms. homogeneous mixture		Gms. per 100 gms. homogeneous mixture	
KOH	$(CH_3)_2CO$	KOH	$(CH_3)_2CO$	KOH	$(CH_3)_2CO$
0.0	— •••	4.4	41.7	25.0	— •
0.4	80.1	8.2	26.6	27.2	2.0
0.6	70.1	15.1	11.1	28.4	1.3
0.7	70.5	17.9	7.8	29.8	— •
1.7	58.6	20.7	5.5	37.9	— •
2.2	55.1	21.3	5.2	43.8	0.4
3.0	50.4				

• Tie lines.

PO **SODIUM** Hydro **PHOSPHITE** $Na_2HPO_3.5^1/_2H_2O$.

SOLUBILITY OF SODIUM HYDROPHOSPHITE IN WATER. (Rosenheim and Reglin, 1921.)

t°.	Gms. Na_2HPO_3 per 100 gms. sat. sol.	t°.	Gms. Na_2HPO_3 per 100 gms. sat. sol.
0	80.72	30	84.96
20	81.06	38	91.94
25	82.21	43	92.70

SODIUM PHOSPHITES

SOLUBILITY OF SODIUM PHOSPHITES, ETC., IN WATER.

Salt.	Formula.	t°.	Gms. Salt per 100 Gms. H_2O.	Authority.
Hydrogen Phosphite	$(NaH)HPO_3.2\frac{1}{2}H_2O$	0	56	(Amat. — Compt. rend. 106, 1351, '88.)
"	"	10	66	
"	"	42	193	
Hypophosphate	$Na_4P_2O_6.10H_2O$	cold	3.3	(Salzer — Liebig's Ann. 211, 1, '82.)
Hydrogen Hypophosphate	$Na_3HP_2O_6.9H_2O$	?	4.5	
Tri Hydrogen "	$NaH_3P_2O_6 3H_2O$	cold	6.7	
Di Hydrogen "	$Na_2H_2P_2O_6.6H_2O$	cold	2.2	(Salzer — Liebig's Ann. 187, 331, '77)
Di Hydrogen "	$Na_2H_2P_2O_6.6H_2O$	b. pt.	20.0	
Hypophosphite	$(NaH)HPO_2.H_2O$	25	100.0	(U. S. P.)
Hypophosphite	$(NaH)HPO_2.H_2O$	b. pt.	830	"

100 gms. H_2O dissolve 108.7 gms. anhydrous sodium hypophosphite (NaH_2PO_2) at 15°, d_{15} of sat. sol. = 1.388. (Greenish and Smith, 1901.)

Tri SODIUM PHOSPHATE (Ortho) $Na_3PO_4.12H_2O$.

SOLUBILITY OF TRI SODIUM PHOSPHATE IN WATER. (Apfel, 1911.)

The saturated solutions were prepared by constant stirring in a thermostat. The author's determinations were calculated to the gram basis, plotted on cross section paper and the following values taken from the curve. The solid phases were identified only by estimation of their water of crystallization.

t°.	Gms. Na_3PO_4 per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. Na_3PO_4 per 100 gms. sat. sol.	Solid Phase.
0.....	4.3	$Na_3PO_4.12H_2O$	50.....	22.7	$Na_3PO_4.10H_2O$
10.....	7.6	»	55.....	26.2	»
20.....	10.8	»	60.....	28.5	»
25.....	12.3	»	65.....	30.2	»
30.....	14.0	»	70.....	32.7	$Na_3PO_4.8H_2O$
40.....	16.8	»	75.....	35.1	»

SODIUM (Hydrogen) PHOSPHATE

SOLUBILITY OF TRI SODIUM PHOSPHATE IN WATER AT TEMPERATURES UP TO 350°.

(Schroeder, Berk and Gabriel, 1937.)

The authors' determinations were plotted and the following values taken from the smoothed curve.

PO

t^0	Gms. Na_3PO_4 per 100 gms. H_2O	Solid Phase	t^0	Gms. Na_3PO_4 per 100 gms. H_2O	Solid Phase
75	57.0	$Na_3PO_4.10H_2O$ + $Na_3PO_4.8H_2O$(?)	180	67	$Na_3PO_4.H_2O$
			200	61	"
80	60.0	$Na_3PO_4.8H_2O$(?)	215	59	" + Na_3PO_4
90	68.0	"	216	46	Na_3PO_4
100	77.0	"	218	40	"
110	86.0	"	220	37	"
121	94.0	" + $Na_3PO_4.H_2O$	230	22	"
130	90.0	$Na_3PO_4.H_2O$	240	14	"
140	85.0	"	250	9.5	"
150	80.0	"	300	2.5	"
160	76.0	"	350	0.15	"

SOLUBILITY OF Na_3PO_4 IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE.

(Schroeder, Berk and Gabriel, 1937.)

t^0	Gms. per 100 gms. H_2O		t^0	Gms. per 100 gms. H_2O	
	NaOH	Na_3PO_4		NaOH	Na_3PO_4
150	0.0	82	250	20.6	5.5
"	8.2	49	"	29.5	5.7
"	20.0	20.6	350	0.0	0.15
250	0.0	8.6	"	8.0	0.44
"	8.2	7.0	"	21.9	2.0
			"	21.3	2.2

These determinations were made in connection with boiler feed-water studies.

Di SODIUM (Hydrogen) PHOSPHATE $Na_2HPO_4.12H_2O$.

SOLUBILITY OF DISODIUM HYDROGEN PHOSPHATE IN WATER.

(Hammick, Goadby and Booth, 1920.)

Constant agitation in a thermostat was employed. The authors desired to correct some of the points reported by others.

t°.	Gms. Na_2HPO_4 per 100 gms. sat. sol.	Solid Phase.
−0.47 eutec.	1.45	Ice + $Na_2HPO_4.12H_2O$
+6.0.....	2.73	$Na_2HPO_4.12H_2O$
19.95.....	7.26	"
22.77.....	8.93	"
24.15.....	9.53	"
25.75.....	10.90	"
27.80.....	14.16	"
28.65.....	15.87	"
29.65.....	16.04	"
29.5....	17.18	$Na_2HPO_4.12H_2O$ + β $Na_2HPO_4.12H_2O$
30.1....	19.45	$\beta Na_2HPO_4.12H_2O$
30.9....	20.08	"
32.50...	22.57	"
33.70...	24.63	"
34.70...	29.75	"
35.0....	–	" + $Na_2HPO_4.7H_2O$
36.5....	31.15	$Na_2HPO_4,7H_2O$
40.02...	35.56	"

Data showing the effect of sodium chloride upon the transition temperatures of disodium phosphate hydrate are given by Okazawa, 1920.

SOLUBILITY OF DISODIUM HYDROGEN PHOSPHATE IN WATER.

(Mensel and Gäbler, 1929.)

t°	Gms. Na_2HPO_4 per 100: cc sat. sol.	gms. sat. sol.	gms. H_2O	Solid Phase
-0.48	—	—	1.55	Ice + $Na_2HPO_4.12H_2O$*
0	1.637	1.605	1.631	$Na_2HPO_4.12H_2O$*
18	6.312	5.985	6.367	"
25	11.928	10.829	12.144	"
25	—	10.51 (1)	—	"

* The β modification according to Hammick, Goodby and Booth.
(1) Palitzsch, S, 1929.

SOLUBILITY OF DISODIUM HYDROGEN PHOSPHATE IN AQUEOUS SOLUTIONS OF HYDROGEN PEROXIDE AT 0°.

(Menzel and Gäbler, 1929.)

Gms. per 100 gms. sat. sol. H_2O_2	Na_2HPO_4	Gms. per 100 gms. sat. sol. H_2O_2	Na_2HPO_4
0.00	1.605	0.9349	1.789
0.2501	1.652	1.288	1.860
0.7132	1.742	1.633	1.923

SOLUBILITY OF DI SODIUM PHOSPHATE IN AQUEOUS SOLUTIONS OF URETHAN AT 25°.

(Palitzsch, 1928, 1929.)

Gm. Mols. per 1000 gms. H_2O Na_2HPO_4	$NH_2COOC_2H_5$	Solid Phase
0.54	1.152	$Na_2HPO_4.12H_2O$
0.374	3.62	"

SODIUM Hydrogen **PHOSPHATE** $Na_2HPO_4.12H_2O$.

Solubility in Water.

(Shiomi, 1908; Menzies and Humphrey, 1912.)

t°.	Gms. Na_2HPO_4 per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. Na_2HPO_4 per 100 Gms. H_2O.	Solid Phase.
− 0.43	1.42	Ice	45	67.3	$Na_2HPO_4 7H_2O$
− 0.24	0.70	"	47.23	76.58 (S)	"
− 0.5 Eutec.	...	" $+Na_2HPO_4.12H_2O$	48.3 tr. pt.	...	$Na_2HPO_4.7H_2O+$
+0.05	1.67	$Na_2HPO_4.12H_2O$	48 "	... (S)	$Na_2HPO_4.2H_2O$
10.26	3.55 (S)	"	50	80.2	$Na_2HPO_4.2H_2O$
15.11	5.23 (S)	"	55.17	81.4 (S)	"
20	7.66	"	60	82.9	"
25	12	"	70.26	88.11 (S)	"
30.21	20.81 (S)	"	80	92.4	"
30.76	23.41 (S)	"	89.74	102.87 (S)	"
32	25.7	"	90.2	101.1	"
33.04	30.88 (S)	"	95 tr. pt.	...	" $+ Na_2HPO_4$
34	33.8	"	95.2 "	... (S)	" "
35.2 tr. pt.	...	" $+Na_2HPO_4.7H_2O$	96.2	104.6	Na_2HPO_4
36.45 "	... (S)	" "	99.77	102.15 (S)	"
37.27	47.51 (S)	$Na_2HPO_4.7H_2O$	105	103.3	"
39.2	51.8	"	120	99.2	"

Results marked (S) by Shiomi, all others by Menzies and Humphrey.

100 gms. H_2O dissolve 12.2 gms. Na_2HPO_4 at 25°, determined by refractometer. (Osaka, 1903–8.)

100 gms. H_2O dissolve 5.23 gms. Na_2HPO_4 at 15°, $d_{15} = 1.049$. (Greenish and Smith, 1901.)

100 gms. alcohol of $d_{15} = 0.941$ dissolve 0.33 gm. Na_2HPO_4 at 15.5°.

Mono **SODIUM** (Dihydrogen) **PHOSPHATE** $NaH_2PO_4.2H_2O$.

Solubility of Mono Sodium Phosphate in Water. (Apfel. 1911.)

Constant stirring was employed. The solid phases were identified by determinations of their water of crystallization.

t°.	Mols. PO_4 per 1000 gms. sat. sol.	Gms. NaH_2PO_4 per 100 gms. sat. sol.	Solid Phase.
0	3.01	36.1	$NaH_2PO_4.2H_2O$
18	3.82	45.8	»
25	4.05	48.6	»
35.5	4.47	53.6	»
40	4.7	56.4	»
44	4.83	58.0	»
44	5.06	60.7	$NaH_2PO_4.H_2O$ (unstable)
50	5.15	61.8	$NaH_2PO_4.2H_2O$
55	5.32	63.8	$NaH_2PO_4.H_2O$
58	5.46	65.5	»
61	5.48	65.8	NaH_2PO_4
65	5.49	65.9	»
70	5.52	66.2	»
75	5.60	67.2	»
83	5.76	69.1	»

100 gms. sat. sol. of mono sodium phosphate in water contain 48.69 gms. NaH_2PO_4 at 25°. (Schnellbach and Rosin, 1931.)

Solubility of Mono Sodium Phosphate in Aqueous Solutions of Sodium Sulfate at 25°. (Apfel, 1911.)

Mols. per 1000 gms. sat. sol.		Gms. per 100 gms. sat. sol.		Solid Phase.
PO_4.	SO_4.	NaH_2PO_4.	Na_2SO_4.	
4.05	0.0	48.6	0.0	$NaH_2PO_4.2H_2O$
3.92	0.11	47.0	1.56	»
3.82	0.26	45.8	3.69	»
3.58	0.45	43.0	6.39	»
3.28	0.71	39.3	10.1	»

SODIUM Dihydrogen **PHOSPHATE** NaH_2PO_4.

SOLUBILITY IN WATER.

(Imadsu, 1911-12.)

t°.	Gms. NaH_2PO_4 per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. NaH_2PO_4 per 100 Gms. H_2O.	Solid Phase.
0.1	57.86	$NaH_2PO_4.2H_2O$	45	148.20	$NaH_2PO_4.H_2O$
5	63.82	"	50	158.61	"
10	69.87	"	55	170.85	"
15	76.72	"	57	175.81	"
20	85.21	"	57.4 tr. pt.	...	" $+NaH_2PO_4$
25	94.63	"	60	179.33	NaH_2PO_4
30	106.45	"	65	184.99	"
35	120.44	"	69	190.24	"
40	138.16	"	80	207.29	"
40.8 tr. pt.	...	" $+NaH_2PO_4.H_2O$	90	225.31	"
41	142.55	$NaH_2PO_4.H_2O$	99.1	246.56	"

SODIUM Acid **PHOSPHATE** $NaH_2PO_4.H_3PO_4$.

SOLUBILITY IN WATER AND IN ANHYDROUS PHOSPHORIC ACID, DETERMINED BY THE SYNTHETIC METHOD.

(Parravano and Mieli, 1908.)

PO

Solubility in Water.						Solubility in H_3PO_3.	
t°.	Gms. NaH_2PO_4.-H_3PO_4 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. NaH_2PO_4.-H_3PO_4 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. NaH_2PO_4.-H_3PO_4 per 100 Gms. Sat. Sol.
−5.7	20.77	Ice	79.7	87.48	NaH_2PO_4	98.5	52.72
−7.9	26.92	"	85	88.65	"	111	69.59
−11.4	34.15	"	101.7	91.47	"$+NaH_2PO_4.H_3PO_4$	119	77.55
−38	56.66	"	104.5	92.67	$NaH_2PO_4.H_3PO_4$	122	81.71
−34	80.46	NaH_2PO_4	110	95.79	"	123	87.20
41	81.82	"	119	97.99	"		
51.7	83.68	"	126.5	100	"		

m. pt. of the H_3PO_4 = 40.6°

Data are also given for the fusion points of $NaH_2PO_4 + H_3PO_4$.

Fusion-point data for mixtures of $NaPO_3 + Na_4P_2O_4$ are given by Parravano and Calcagni (1908, 1910.)

EQUILIBRIUM IN THE SYSTEM SODIUM HYDROXIDE, PHOSPHORIC ACID AND WATER AT 25°.

(D'Ans and Schreiner, 1910a.)

Mols. per 1000 Gms. Sol.		Solid Phase.	Mols. per 1000 Gms. Sol.		Solid Phase.
Na.	PO_4.		Na.	PO_4.	
13.32	...	$NaOH.H_2O$	6.76	4.88	$Na_2HPO_4.7H_2O$
4.28	0.040	$Na_3PO_4.12H_2O$	7.31	5.55	" unstable
3.24	0.183	"	6.76	4.88	" $+Na_2HPO_4.2H_2O$
2.24	0.752	"	6.19	4.68	$Na_2HPO_4.2H_2O$
2.73	1.08	"	6.01	4.67	"
3.48	1.33	$Na_3PO_4.12H_2O+Na_2HPO_4.12H_2O$	5.12	4.36	"
2.62	1.09	$Na_2HPO_4.12H_2O$	4.81	4.22	"
1.56	0.78	"	4.36	4.08	"
2.38	1.60	"	4.06	4.03	"
3.18	2.24	"	4.19	4.38	"
4.65	3.55	"	4.32	4.96	"
5.63	3.87	"	4.65	5.89	"
6.31	4.63	$Na_2HPO_4.7H_2O$	4.88	6.40	"

SODIUM Hypo **PHOSPHATES** $Na_4(PO_3)_2.10H_2O$, $Na_3H(PO_3)_2.9H_2O$, $Na_2H_2(PO_3)_2.6H_2O$.

EQUILIBRIUM IN THE SYSTEM SODIUM OXIDE, PHOSPHORUS TETROXIDE AND WATER AT 30°. (Müller, 1916.)

Saturation was secured by constant agitation in a thermostat. The author's determinations were plotted and the following results were read from the diagram.

Gms. per 100 gms. sat. sol.		Solid Phase.	Gmg. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase
Na_2O.	P_2O_5.		Na_2O.	P_2O_4.		Na_2O.	P_2O_4.	
0.83	0.84	Na_4	0.75	1.53	Na_2	0.75	1.53	Na_2
1.00	1.12	y	1.0	1.75	x	0.80	1.85	
1.2	1.40	y	1.2	1.97	x	0.90	2.55	
1.4	1.67	y	1.4	2.20	x	1.00	3.16	
1.6	1.97	y	1.6	2.44	x	1.10	3.85	
1.8	2.28	y	1.8	2.65	x	1.20	4.50	
2.0	2.56	y	2.0	2.90	x	1.30	5.25	
2.2	2.85	y	2.2	3.15	x	1.40	5.90	
2.35	3.07	Na_3	2.35	3.38	Na_3	1.47	6.57	

$Na_4 = Na_4(PO_3)_2.10H_2O$; $Na_3 = Na_3H(PO_3)_2.9H_2O$; $Na_2 = Na_2H_2(PO_3)_2.6H_2O$.

The author was unable to identify the solid phases corresponding to the three branches of the solubility diagram of this system.

SOLUBILITY OF SODIUM HYPOPHOSPHATE, SODIUM HYDROGEN HYPOPHOSPHATE AND OF SODIUM DIHYDROGEN HYPOPHOSPHATE, EACH SEPARATELY, IN WATER. (Müller, 1916.)

Sodium Hypophosphate $Na_2PO_3.5H_2O$.		Sodium Hydrogen Hypophosphate $Na_3H(PO_3)_2.9H_2O$.		Sodium Dihydrogen Hypophosphate $NaHPO_3.5H_2O$.	
t°.	Gms. Na_2PO_3 per 100 gms. sat. sol.	t°.	Gms. $Na_3H(PO_3)_2$ per 100 gms. sat. sol.	t°.	Gms. $NaHPO_3$ per 100 gms. sat. sol.
25.2	1.47	25	4.46	25	1.95
30	1.68	30.2	5.55	30	2.50
35	1.91	35.2	6.68	35	2.99
40.2	2.24	40	8.30	40	3.66
45	2.64	45	10.60	45	4.55
50	3.08	50	13.02	50	5.61

SODIUM Pyro**PHOSPHATE** $Na_4P_2O_7.10H_2O$.

SOLUBILITY IN WATER. (Mulder; Poggiale.)

t°.	Gms. per 100 Gms. H_2O.	t°.	Gms. per 100 Gms. H_2O.	t°.	Gms. per 100 Gms. H_2O.
0	3.16	25	8.14	60	21.83
10	3.95	30	9.95	80	30.04
20	6.23	40	13.50	100	40.26
		50	17.45		

SODIUM Pyro**PHOSPHATES**.

SOLUBILITY IN WATER. (Giran, 1903a.)

Salt.	Formula.	t°	Gms. Anhydrous Salt per 100 cc. Sat. Sol.
Monosodium Pyrophosphate	$NaH_3P_2O_7$	18	62.7
Disodium Pyrophosphate	$Na_2H_2P_2O_7.6H_2O$	18	14.95
Trisodium Pyrophosphate	$Na_3HP_2O_7.6H_2O$	18	28.17

SOLUBILITY OF SODIUM PYRO PHOSPHATE IN WATER.

(Menzel and Gäbler, 1929; Menzel and Sieg, 1932.)

t°	Gms. $Na_4P_2O_7$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Na_4P_2O_7$ per 100 gms. sat. sol.	Solid Phase
-0.43	2.132	Ice+$Na_4P_2O_7.10H_2O$	60	19.75	$Na_4P_2O_7.10H\,O$
0	2.236	$Na_4P_2O_7.10H_2O$	70	27.49	"
18	5.147	"	76	33.04	"
20	5.220	"	79.5 tr.pt.	—	" + $Na_4P_2O_7$
25	6.618	"	82	35.13	$Na_4P_2O_7$
30	7.04	"	89	32.65	"
45	11.61	"	96	31.15	"
50	13.98	"			

SOLUBILITY OF SODIUM PYRO PHOSPHATE IN AQUEOUS SOLUTIONS OF HYDROGEN PEROXIDE AT 0°.

(Menzel and Gäbler, 1929.)

PO

Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.	
H_2O_2	$Na_4P_2O_7$	H_2O_2	$Na_4P_2O_7$
0.5107	2.460	1.345	2.980
0.5795	2.506	2.082	3.475
0.9430	2.710	2.440	3.766

Di SODIUM Di Hydrogen Pyro PHOSPHATE $Na_2H_2P_2O_7.6H_2O$.

SOLUBILITY OF DISODIUM PYRO PHOSPHATE IN WATER.

(Selva, 1935.)

t°	d. of sat. sol.	Gms. $Na_2H_2P_2O_7$ per 100 gms. sat. sol.	Solid Phase	t°	d. of sat. sol.	Gms. $Na_2H_2P_2O_7$ per 100 gms. sat. sol.	Solid Phase
-0.7	—	4.08	Ice+$Na_2H_2P_2O_7.6H_2O$	30	1.1312	16.48	*$Na_2H_2P_2O_7.6H_2O$
0	—	4.28	$Na_2H_2P_2O_7.6H_2O$	27	1.1156	14.35	"+$Na_2H_2P_2O_7$
10	1.0509	6.50	"	30	—	14.58	$Na_2H_2P_2O_7$
20	1.0847	10.70	"	35	1.1171	15.04	"
25	1.1040	13.00	"	40	1.1180	15.52	"

* Metastable

EQUILIBRIUM IN THE SYSTEM TETRA SODIUM PYRO PHOSPHATE, DISODIUM PYRO PHOSPHATE AND WATER.

(Selva, 1935.)

Gms. per 100 gms. sat. sol.		Solid Phase
$Na_4P_2O_7$	$Na_2H_2P_2O_7$	
Results at 20°		
5.25	0.00	$Na_4.10$
7.18	3.01	"
9.43	6.80	"
11.66	10.31	"
15.45	16.22*	"
12.55	11.58	" + $Na_3.7$
11.90	12.67	$Na_3.7$
11.58	13.74	"
11.07	16.55	" + $Na_2.6$
8.26	14.51	$Na_2.6$
Results at 20° (con.)		
5.61	12.8	$Na_2.6$
0.0	10.70	"
Results at 30°		
7.35	0.0	$Na_4.10$
12.82	9.30	" + $Na_3.1$
11.47	10.37	$Na_3.1$
10.62	13.25	"
9.72	18.30	" + $Na_2H_2P_2O_7$
0.0	14.50	$Na_2H_2P_2O_7$

PO

* = Metastable

$Na_4.10 = Na_4P_2O_7.10H_2O$; $Na_3.7 = Na_3HP_2O_7.7H_2O$; $Na_2.6 = Na_2H_2P_2O_7.6H_2O$
$Na_3.1 = Na_2HP_2O_7.1H_2O$.

SODIUM Methyl **PHOSPHATE** (neutral) $Na_2CH_3PO_4.6H_2O$.

100 gms. sat. solution of neutral sodium methyl phosphate in water contain 30.79 gms. of the anhydrous salt at 12°.5. (Bailly, 1919.)

SODIUM β Glycero **PHOSPHATE** $Na_2C_3H_5(OH)_2PO_4.5H_2O$.

100 gms. sat. solution of sodium β glycerophosphate in water contain 27.16 gms. of the anhydrous compound at 17°. (Bailly, 1916.)

100 gms. H_2O dissolve 27.38 gms. sodium glycerophosphate at 18°. (H. Rogier, *These*, Paris, 1912.)

100 gms. 86.5 % Glycerol ($d = 1.2326$) dissolve 79.7 gms. of sodium glycerophosphate (?hydrated) at 20°.

100 gms. 98.5 % Glycerol ($d = 1.2645$) dissolve 82.4 gms. of sodium glycerophosphate (? hydrated) at 20°. (Holm, 1921, 1922.)

SODIUM Per **RHENATE** $NaReO_4$. ReO

A sat. solution of Sodium Per Rhenate in Water contains about 250 gms. $NaReO_4$ per liter at 20°(?). (Noddak and Noddak, 1929.)

SOLUBILITY OF SODIUM PER RHENATE IN ETHYL ALCOHOL.

(Tollert, 1932.)

Solvent	t°	Gms. $NaReO_4$ per liter sat. sol.
89.7 Wt. % C_2H_5OH	19.5	22.42
99.1 " "	18.0	11.14

SODIUM SULFIDE $Na_2S.9H_2O$.

SOLUBILITY IN WATER.

(Parravano and Fornaini, 1907.)

t°.	Gms. Na_2S per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. Na_2S per 100 Gms. Sat. Sol.	Solid Phase.
−10 Eutec.	9.34	$Na_2S.9H_2O$+Ice	60	29.92	$Na_2S.5\frac{1}{2}H_2O$
+10	13.36	$Na_2S.9H_2O$	70	31.38	"
15	14.36	"	80	33.95	"
18	15.30	"	90	37.20	"
22	16.20	"	48 tr. pt.	...	$Na_2S.9H_2O+Na_2S.6H_2O$
28	17.73	"	50	26.7	$Na_2S.6H_2O$
32	19.09	"	60	28.1	"
37	20.98	"	70	30.22	"
45	24.19	"	80	32.95	"
48.9 tr. pt.	...	" $+Na_2S.5\frac{1}{2}H_2O$	90	36.42	"
50	28.48	$Na_2S.5\frac{1}{2}H_2O$	91.5 tr. pt.	...	" $+Na_2S.5\frac{1}{2}H_2O$

SOLUBILITY OF SODIUM SULFIDE IN WATER, DETERMINED BY THE FREEZING-POINT METHOD.

(Sanfourche and Liebaul, 1922.)

The authors results were plotted and the following table constructed from the curves.

S

t°.	Gms. Na_2S per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. Na_2S per 100 gms. sat. sol.	Solid Phase.
−2.........	2.0	Ice	50 tr. pt.....	28.0	$Na_2S.9H_2O+Na_2S.5\frac{1}{2}H_2O$
−5.........	5.0	»	70..........	32.5	$Na_2S.5\frac{1}{2}H_2O$
−9 5 Eutec.	7.5	»$+Na_2S.9H_2O$	90..........	39.5	»
0.........	8.8	$Na_2S.9H_2O$	97.5 m. pt...	45.0	»
10.........	10.8	»	90..........	52 5	»
20.........	13.6	»	86 Eutec....	54.5	»$+Na_2S.H_2O$
30.........	17.0	»	90..........	57.8	$Na_2S.H_2O$
40.........	21.0	»	95..........	60.1	»

EQUILIBRIUM IN THE SYSTEM SODIUM SULFATE, SODIUM SULFIDE AND WATER.

(Hogg, 1926.)

The attainment of equilibrium was effected by (1) cooling homogeneous solutions from higher temperatures and, when necessary, innoculating with the appropriate solid phase (systems at 0°.1 and 18°, (2) heating hetereogeneous systems from lower temperatures (systems at 25° and 31°) (3) evaporating homogeneous solutions under reduced pressure at the temperature of the experiment (40°) untill sufficient solid appeared. When all phases were present the tubes were mechanically rotated in a thermostat for from 4 to 40 hours. The saturated solutions and moist solid phases were analyzed. M. C. with formula, indicates mixed crystals and the major constituent.

Results at 0°.1.

$d_{\frac{0.1}{4}}$ of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase.	$d_{\frac{0.1}{4}}$ of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase.
	Na_2SO_4.	Na_2S.			Na_2SO_4.	Na_2S.	
1.041	2.99	1.44	M.C.$Na_2SO_4.10H_2O$	1.129	1.23	11.18	M.C.$Na_2SO_4.10H_2O$ +M.C.$Na_2S.10H_2O$
1.052	2.11	3.16	»	1.129	1.16	11.16	» »
1.066	1.68	4.79	»	1.131	1.19	11.23	» »
1.081	1.54	6.16	»	1.130	1.25	11.14	» »
1.091	1.48	7.36	»	1.131	1.23	11.21	» »
1.099	1.28	8.32	»	1.137	1.16	11.94	M.C.$Na_2S.10H_2O$
1.110	1.27	9.49	»	—	0.93	11.22	»
1.124	1.24	10.77	»	1.125	0.63	11.34	»
1.129	1.19	11.11	»	1.122	0.0	11.33	»
1.132	1.18	11.23	M.C.$Na_2SO_4.10H_2O$ +M.C.$Na_2S.10H_2O$				

EQUILIBRIUM IN THE SYSTEM SODIUM SULFATE, SODIUM SULFIDE AND WATER (CON.)

(Hogg, 1926.)

d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase.	d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase.
	Na_2SO_4.	Na_2S.			Na_2SO_4.	Na_2S.	
	Results at 18°.				Results at 31°.		
1.126	13.31	0.62	$Na_2SO_4.10H_2O$	1.285	29.97	0.40	$Na_2SO_4.10H_2O$
1.126	11.91	1.51	»	1.294	29.15	1.47	»
1.131	10.67	2.84	»	1.291	28.72	2.43	»
1.130	9.30	4.54	»	1.290	28.65	2.31	» + Na_2SO_4
1.132	9.05	5.33	»	1.288	27.39	2.85	» »
1.143	8.09	6.82	»	1.264	23.06	4.81	Na_2SO_4
1.149	7.64	7.99	»	1.248	19.47	6.97	»
1.162	7.15	9.47	»		18 92	7.47	»
1.165	9.96	7.09	»	1.228	14.46	9.83	»
1.167	7.17	10.04	»	1.219	11.56	12.14	»
1.175	6.96	10.91	»	1.214	8.59	14.39	»
1.186	6.93	12.14	»		6.58	16.36	»
1.208	7.01	13.08	»	1.214	4.79	18.69	»
1.225	9.75	13.15	»	1.253	2.56	22.22	»
1.210	7.24	13.95	» +M.C.$Na_2S.9H_2O$	1.222	4.32	19.69	» +$Na_2S.9H_2O$
1.212	7.21	13.90	» »	1.229	4.04	19.33	» »
–	6.44	13.98	M.C.$Na_2S.9H_2O$	–	3.04	19.57	$Na_2S.9H_2O$
1.212	5.83	14.02	»	1.210	1.05	20.44	»
1.197	5.20	14.50	»	1.202	0.0	20.60	»
1.187	3.47	15.08	»		Results at 40°		
–	2.28	15.33	»	1.302	28.90	1.32	Na_2SO_4
–	0.53	15.65	»	-	24.43	3.56	»
1.169	–	15.95	$Na_2S.9H_2O$	1.260	20.25	6.18	»
	Results at 25°			–	15.23	9.49	»
--	19.71	1.63	$Na_2SO_4.10H_2O$	1.236	14.14	9.78	»
1.203	17.84	3.27	»	1.223	8.72	14.25	»
1.204	17.12	4.40	»	–	7.37	14.97	»
1.241	14.67	9.96	» + Na_2SO_4	1.223	6.53	15.45	»
1.241	14.70	9.96	» »	–	5.22	14.08	»
1.241	14.51	10.04	Na_2SO_4	1.233	3.41	20.36	»
1.237	12.50	11.21	»	1.239	2.79	21.27	»
1.222	10.80	12.68	»	1.223	1.91	23.04	»
1.228	8.06	14.68	»	1.253	1.84	23.57	»
1.221	6.32	16.07	» + $Na_2S.9H_2O$	1.248	1.90	23.72	» +$Na_2S.9H_2O$
1.224	6.87	15.87	» »	1.256	1.62	24.25	» »
1.229	7.18	15.84	» »	1.238	0.88	23.93	$Na_2S.9H_2O$
1.205	5.01	16.61	$Na_2S.9H_2O$	1.236	0.49	24.06	»
1.202	3.40	17.17	»	1.248	0.0	25.01	»
1.183	0.0	17.86	»	1.248	0.0	25.09	»

The following transition points were also determined.

	Transition.	t°.	$d\frac{t^\circ}{4}$ of sat. sol.	Gms. per 100 gms. sat. sol.	
				Na_4SO_4.	Na_2S.
Binary..	$Na_2S.10H_2O \rightleftharpoons Na_2S.9H_2O$.....	4.7..	1.128		12.46
Ternary.	The above in sat. Na_2SO_4.......	2.3..	1.135	1.40	11.49
»	$Na_2SO_4.10H_2O \rightleftharpoons Na_2SO_4$ in sat. Na_2S.	20.9..	–	9.48	13.41
»	?	–	1.331	4.48	19.97

In all cases the densities were measured at the temperature of the experiment.

SODIUM SULFIDE

SOLUBILITY OF SODIUM SULFIDE IN LIQUID AMMONIA CONTAINING INCREASING AMOUNTS OF AMMONIUM BROMIDE AT -33°.

(Johnson and Wheatley, 1934.)

Gm. Mols. per liter sat. sol.	
NH_4Br	Na_2S
0.0	0.002
0.15	0.036
0.3	0.06
0.6	0.18

This increase in solubility of Na_2S is considered to be due to the formation of ammonium sulfide.

Fusion-point data are given for:

$Na_2S + S$ (Friedrich, 1914; Thomas and Rule, 1917; Pearson and Robinson, 1930.)
$Na_2S + Na_2SO_4$ (Tammann and Olsen, 1930.)

SO SODIUM SULFITE $Na_2SO_3.7H_2O$.

SOLUBILITY OF SODIUM SULFITE IN WATER.

(Foerster, Brosch and Norberg-Schulz, 1924.)

The determinations were made with exceptional care. The solutions were kept in contact with an atmosphere of hydrogen to prevent oxidation.

t°.	Gms. Na_2SO_3 per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. Na_2SO_3 per 100 gms. sat. sol.	Solid Phase.
— 0.667	1.865	Ice	33.8	28.54 (unstable)	$Na_2SO_3.7H_2O$
— 1.27	3.73	»	34.7	28.86 »	»
— 2.23	6.69	»	35.9	29.89 »	»
— 2.70	8.12	»	34.5	28.20	Na_2SO_3
— 3.45 Eutec.	10.48	» + $Na_2SO_3.7H_2O$	35.6	27.80	»
— 1.30	11.25	$Na_2SO_3.7H_2O$	41.0	27.15	»
0.0	12.59	»	46.0	26.35	»
9.2	15.60	»	50.0	25.75	»
16.5	19.14	»	58.1	24.79	»
19.9	20.82	»	66.0	24.06	»
24.0	22.76	»	70.0	23.85	»
26.85	24.32	»	94.4	21.44	»
28.2	25.36	»	97.0	21.32	»
33.0	27.99	»	99.0	21.70	»
33.4 tr. pt.	–	» + Na_2SO_3			

The above results show that the transition temperature of 21°.6 for $Na_2SO_3.7H_2O \rightleftharpoons Na_2SO_3$ and the solubilities of Na_2SO_3, reported by Hartley and Barrett, 1909, are incorrect.

The density of the sat. sol. at 15° is 1.21. (Greenish and Smith, 1901.)

SODIUM SULFITE Na_2SO_3.

The following results for the solubility of sodium sulfite in water are by Arii, 1932.

t°	Gms. Na_2SO_3 per 100 gms. sat. sol.	Solid Phase
25	23.05	$Na_2SO_3.7H_2O$
35	26.57	Na_2SO_3

This author also gives results for the System $Na_2SO_3 + Na_2S_2O_5 + H_2O$ at 25° and at 35°.

SOLUBILITY OF SODIUM SULFITE IN WATER.

(Hartley and Barrett, 1909.)

t°.	Gms. Na_2SO_3 per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. Na_2SO_3 per 100 Gms. H_2O.	Solid Phase.
− 0.76	2.15	Ice	18.2	25.31	$Na_2SO_3.7H_2O$
− 1.37	4.21	"	23.5	29.92	" (unstable)
− 1.96	6.24	"	29	34.99	" "
− 2.77	9.44	"	37.2	44.08	" "
− 3.5*	12.48	" $+Na_2SO_3.7H_2O$	21.6†	...	" $+Na_2SO_3$
− 4.5	17.91	Ice (unstable)	37	28.04	Na_2SO_3
− 1.9	13.09	$Na_2SO_3.7H_2O$	47	28.13	"
+ 2	14.82	"	55.6	28.21	"
5.9	17.61	"	59.8	28.76	"
10.6	20.01	"	84	28.26	"

* Eutec. † tr. pt.

See the following discussion by Rivett and Lewis, 1923.

Equilibrium in the System Sodium Sulfite, Sodium Sulfate and Water.

(Rivett and Lewis, 1923.)

Constant agitation was employed for assuring saturation. The solutions and solid phases were analyzed and the compositions of the latter identified by the « rest method ». At 25° both a stable and a metastable system exists, and each was determined. The solid phases in contact with the solutions corresponding to the two branches of the stable system were respectively a series of mixed crystals of $Na_2SO_4.10H_2O + Na_2SO_3.10H_2O$ and $Na_2SO_4.7H_2O + Na_2SO_3.7H_2O$. The solid phases for the two branches of the metastable system were mixed crystals of anhydrous sulfite and sulfate.

Results at 25° for the Stable System.

$d_{\frac{25}{4}}$ of sat. sol.	Gms. per 100 gms. sat. sol. Na_2SO_4.	Gms. per 100 gms. sat. sol. Na_2SO_3.
1.211...	20.40	2.53
1.227...	19.66	4.11
1.239...	18.11	6.59
1.258...	17.31	9.22
1.269...	16.43	11.39
1.292...	15.25	14.61
1.311...	14.55	16.80
1.312...	14.49	16.81
– ...	11.05	18.27
1.274...	8.97	19.44
1.250...	4.14	21.61
– ...	0.00	23.75

Results at 25° for the Metastable System.

$d_{\frac{25}{4}}$ of sat. sol.	Gms. per 100 gms. sat. sol. Na_2SO_4.	Gms. per 100 gms. sat. sol. Na_2SO_3.
1.347...	20.51	14.39
1.347...	19.12	15.43
1.347...	17.82	16.94
1.347...	16.32	18.34
– ...	16.18	18.52
1.346...	13.82	20.35
– ...	12.34	21.88
1.346...	10.93	23.40
1.340...	7.47	26.32
1.322...	6.75	25.45
1.302...	3.99	26.57
1.285...	1.69	27.29

The authors also determined the isotherms for 0°.1, 17°.5 and 37°.5. At the latter temperature the solid phases were mixed crystals of the anhydrous salts. In subsequent papers by Lewis and Rivett, 1924, data are given for many other isotherms. By extrapolation of these results to zero content of sodium sulfate solubility results for pure sodium sulfite hepta hydrate were obtained. These when plotted together with the determinations of Hartley and Barrett, 1909 (see preceeding page) agreed satisfactorily and give confidence in the extrapolation method of estimating the solubility of sodium sulfite heptahydrate. When, however, the extrapolated values obtained by use of commercial anhydrous sodium sulfite (already containing sulfate), were compared with the results of Hartley and Barrett, determined upon perfectly pure sulfite, a considerable difference was found. Thus, the transition temperature was 31°.5 at 27.2 per cent concentration of Na_2SO_3 instead of 22° at 22.0 per cent Na_2SO_3, as found by Hartley and Barrett. The other estimated values for the solubility of anhydrous sodium sulfite were :

t°........................	33.0.	37.5.	42.5.	47.5.	52.5.	57.5.	62.5.	67.5.
Wt. % Na_2SO_3.....	26.8	26.3	25.7	25.25	24.7	24.1	23.6	23.2

The authors surmised « that the marked discrepancy is due to the mixed crystals of sulfite and sulfate corresponding, in the limiting case of zero sulfate, with a form of sodium sulfite which is metastable to that obtained as a pure salt by Hartley and Barrett's method ». A complete examination of the whole ternary system, at temperatures where only the anhydrous solids appeared, was then made. The results showed that these two salts are capable of mixing in quite a number of distinct series of mixed crystals of varying stabilities. More than 80 solutions were prepared at 40°, 45° and 60° by more or less complicated methods, involving evaporation of unsaturated solutions of suitable concentrations to yield the solid phases in desired quantity at the temperature of the experiment. The analytical results, when plotted, show that there are no fewer than five solution curves and five corresponding series of mixed crystals. The precise limits of these are uncertain « but the error is not sufficient to affect the general conclusions ».

SODIUM Hydro**SULFITE** $Na_2S_2O_4$.

SOLUBILITY IN WATER. (Jellinck, 1911.)

t°.	Gms. $Na_2S_2O_4$ per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. $Na_2S_2O_4$ per 100 Gms. H_2O.	Solid Phase.
−0.107	0.394	Ice	− 4.58 Eutec.	19	Ice + $Na_2S_2O_4.2H_2O$
−1.10	4	"	+20	22 (±5% error)	$Na_2S_2O_4.2H_2O$
−2.21	9	"	52 tr. pt.	27.8	" + $Na_2S_2O_4$
−3.15	13	"	20	24.1	$Na_2S_2O_4$ (unstable)
−4.17	17	"			

The pure sample was prepared by salting out the commercial product with NaCl. It is very easily oxidized to $Na_2S_2O_5$ and must be kept in an indifferent atmosphere or a vacuum. A special apparatus was required for the freezing-point determinations (ice curve) and for the solubility determinations. Great difficulty was experienced in obtaining concordant results with a given sample of $Na_2S_2O_4$.

SODIUM Pyro **SULFITE** $Na_2S_2O_5.7H_2O$, $Na_2S_2O_5.6H_2O$ (métastable)

SOLUBILITY OF SODIUM PYROSULFITE IN WATER.

(Foerster, Brosch and Norberg-Schulz, 1924.)

SO

The determinations were made with exceptional care. Equilibrium was approached from above and below. A new preparation of the salt was used for each determination and the composition of the solid phase was determined by analysis in each case. In order to reduce the free sulfur dioxide present, the volume of air space above the saturated solution was kept at a minimum. The two hydrates give solubility curves which are almost parallel. The metastable hexahydrate is very easy to obtain and its equilibrium with the solutions can be readily followed.

t°.	Gms. $Na_2S_2O_5$ per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. $Na_2S_2O_5$ per 100 gms. sat. sol.	Solid Phase.
−0.56.....	1.435	Ice	− 7.5.....	24.50	$Na_2S_2O_5.7H_2O$
−2.28.....	6.40	»	− 5.0.....	26.15	»
−3.19.....	9.00	»	0.0.....	31.10	»
−5.24.....	14.64	»	+ 1.2.....	32.45	»
−7.84.....	20.92	»	5.5 tr. pt..	–	» + $Na_2S_2O_5$
−9.74 Eutec..	24.20	» + $Na_2S_2O_5.6H_2O$	0.0.....	37.47 (unst.)	$Na_2S_2O_5$
−8.5......	24.75	$Na_2S_2O_5.6H_2O$	8.6.....	38.65	»
−4.2......	28.10	»	15.0.....	39.20	»
−2.2......	30.25	»	22.8.....	39.77	»
0.0......	32.90	»	31.4.....	40.79	»
+1.8......	35.40	»	40.2.....	41.60	»
3.0......	37.10	»	59.0.....	44.27	»
3.8 tr. pt...	–	» + $Na_2S_2O_5$	71.4.....	45.62	»
−9.05 Eutec..	23.50	Ice + $Na_2S_2O_5.7H_2O$	85.0.....	47.89	»
−9.0......	23.77	$Na_2S_2O_5.7H_2O$	97.2.....	49.06	»

SODIUM SULFITE

EQUILIBRIUM IN THE SYSTEM SODIUM SULFITE, SODIUM PYRO SULFITE AND WATER AT 25° AND AT 35°.

(Arii, 1927.)

Results at 25°

Gms. per 100 gms. sat. sol.		Solid Phase
Na_2SO_3	$Na_2S_2O_5$	
23.05	0.0	$Na_2SO_3.7H_2O$
20.98	3.66	"
17.70	10.39	"
17.01	12.49	"
15.67	16.70	"
15.06	18.65	"
13.89	21.91	"
11.83	26.73	"
11.28	29.10	" + $Na_2S_2O_5$
10.87	29.45	$Na_2S_2O_4$
9.63	30.70	"
8.33	31.77	"
7.22	32.70	"
4.46	35.34	"
1.78	37.93	"
0.0	39.75	"

Results at 35°

Gms. per 100 gms. sat. sol.		Solid Phase
Na_2SO_3	$Na_2S_2O_5$	
26.57	0.0	Na_2SO_3
25.00	2.13	"
24.17	3.27	"
21.04	8.00	"
19.22	11.54	"
16.60	16.33	"
14.80	20.40	"
11.86	25.80	"
8.86	30.84	"
6.77	43.03	"
5.99	34.91	" + $Na_2S_2O_6$
4.12	36.48	$Na_2S_2O_6$
3.11	37.42	"
1.74	38.69	"
0.0	40.55	"

SO

100 gms. Liquid Sulfur Dioxide (SO_2) dissolve 0.023 gm. Na_2SO_3 at 0°.
(Jander and Ruppolt, 1937.)

SODIUM SULFATE $Na_2SO_4.10H_2O$.

FREEZING-POINTS OF DILUTE AQUEOUS SOLUTIONS OF SODIUM SULFATE.

(Klein and Svanberg, 1920.)

t° of f. pt......	-0.470.	-1.037.	-1.865.
Normality of Aq. Na_2SO_4......	0.1	0.25	0.50

SOLUBILITY OF SODIUM SULFATE IN WATER.

(Richards and Yngve, 1918.)

The determinations were made with the highest possible degree of accuracy. The solid phase was $Na_2SO_4.10H_2O$ in all cases. The temperatures refer to the Paris hydrogen scale.

t°.	Gms. Na_2SO_4 per 100 gms. H_2O.	t°.	Gms. Na_2SO_4 per 100 gms. H_2O.	t°.	Gms. Na_2SO_4 per 100 gms. H_2O.
15.000...	13.181	19.000...	17.698	23.000...	23.888
16.000...	14.185	20.000...	19.064	24.000...	25.762
17.000...	15.268	21.000...	20.549	25.000...	27.795
18.000..	16.437	22.000...	22.155		

The following determinations are given by Nishizawa, 1920.

t°.	Gm. mols. Na_2SO_4 per 1000 gms. mols. H_2O.	Gms. Na_2SO_4 per 100 gms. H_2O.	Solid Phase.
15...............	16.61	13.10	$Na_2SO_4.10H_2O$
30...............	52.01	41.02	»
40...............	61.01	48.10	Na_2SO_4

Data for the effect of various salts upon the transition temperature of $Na_2SO_4.10H_2O$ are given by Norton and Johnston, 1926.

SODIUM SULFATE Na_2SO_4.

SOLUBILITY IN WATER.

(Mulder; Löwel, 1851; Tilden and Shenstone, 1883; Etard, 1894; Funk, 1900a; Berkeley, 1904.)

t°.	Gms. Na_2SO_4 per 100 Gms.		Mols. Na_2SO_4 per Liter (B.).	Solid Phase.	t°.	Gms. Na_2SO_4 per 100 Gms.		Mols. Na_2SO_4 per Liter (B.).	Solid Phase.
	Solution.	Water.				Solution.	Water.		
0	4.76	5.0	0.31	$Na_2SO_4.10H_2O$	50	31.8	46.7	2.92	Na_2SO_4
5	6.0	6.4	...	"	60	31.2	45.3	2.83	"
10	8.3	9.0	0.631	"	80	30.4	43.7	2.69	"
15	11.8	13.4	...	"	100	29.8	42.5	2.60	"
20	16.3	19.4	1.32	"	120	29.5	41.95	...	"
25	21.9	28.0	...	"	140	29.6	42	...	"
27.5	25.6	34.0	...	"	160	30.7	44.25	...	"
30	29.0	40.8	2.63	"	230	31.7	46.4	...	"
31	30.6	44.0	...	"	0	16.3	19.5	...	$Na_2SO_4.7H_2O$
32	32.3	47.8	...	"	5	19.4	24	...	"
32.75	33.6	50.65	3.11	"	10	23.1	30	...	"
33	33.6	50.6	...	Na_2SO_4	15	27.0	37	...	"
35	33.4	50.2	...	"	20	30.6	44	...	"
40	32.8	48.8	3.01	"	25	34.6	53	...	"

SO

The very carefully determined values of Berkeley are as follows:

t°.	d_t of Sat. Sol.	Gms. Na_2SO_4 per 100 Gms. H_2O.	Solid Phase.	t°.	d_t of Sat. Sol.	Gms. Na_2SO_4 per 100 Gms. H_2O.	Solid Phase.
9.70	1.0432	4.71	$Na_2SO_4.10H_2O$	32.5 tr. pt.		...	$Na_2SO_4.10H_2O+Na_2SO_4$
10.25	1.0802	9.21	"	33.5	1.3307	49.39	Na_2SO_4
15.65	1.1150	14.07	"	38.15	1.3229	48.47	"
20.35	1.1546	...	"	44.85	1.3136	47.49	"
24.90	1.2067	27.67	"	60.10	1.2918	45.22	"
27.65	1.2459	34.05	"	75.05	1.2728	43.59	"
30.20	1.2894	41.78	"	89.85	1.2571	42.67	"
31.95	1.3230	47.98	"	101.9*	1.2450	42.18	"

* B. pt.

Later determinations of the Solubility of Sodium Sulfate in Water at one or more temperatures by the following investigators, are in good agreement among themselves and with the earlier results:
Küpper, 1927; Benrath, et. al., 1928; Flöttmann, 1928; Caven and Johnson, 1928; Schröder, 1929; Matsin, Oguri, Noda and Kumagi, 1929; Makarow and Wachberg, 1930; Rakowski and Nikitina, 1931; Belopolski, 1933.

The following additional data at high temperatures, determined by the sealed tube method, are given by Wuite (1913–14).

t°.	Mol. Per cent Na_2SO_4.	Gms. Na_2SO_4 per 100 Gms. H_2O.	Solid Phase.	t°.	Mol. Per cent Na_2SO_4.	Gms. Na_2SO_4 per 100 Gms. H_2O.	Solid Phase.
62	5.39	44.92	Na_2SO_4 (rhombic)	208	5.39	44.92	Na_2SO_4 (rhombic)
70	5.27	43.87	" "	235 tr. pt.		...	" " +monoclinic
80	5.18	43.07	" "	241	5.39	44.92	Na_2SO_4 (monoclinic)
120	5.04	41.84	" "	250	5.04	41.84	" "
190	5.255	43.74	" "	279	4.12	33.84	" "
192	5.27	43.87	" "	319	2.56	20.71	" "

Supersolubility curves for the ice phase, $Na_2SO_4.7H_2O$ phase and Na_2SO_4 phase were determined by Hartley, Jones and Hutchinson (1908) by agitating mixtures of sodium sulfate and water contained in sealed tubes, and noting the points at which spontaneous crystallization occurred while the tubes were gradually cooled. The effect of mechanical friction, produced by bits of glass, garnet, etc., was also studied.

SOLUBILITY OF SODIUM SULFATE IN WATER AT TEMPERATURES BETWEEN 140° AND 350°.

(Schroeder, Gabriel and Partridge, 1935.)

SO The authors used a steel bomb in which the mixtures were rotated at constant temperatures maintained in an air bath. The results confirm in general those of previous workers. The following values were taken from the smoothed curve drawn from the original results.

t°	Gms. Na_2SO per 100 gms. H_2O	t°	Gms. Na_2SO_4 per 100 gms. H_2O	t°	Gms. Na_2SO_4 per 100 gms. H_2O	t°	Gms. Na_2SO_4 per 100 gms. H_2O
140	42.1	200	44.1	250	44.0	310	18.5
150	42.2	210	44.2	260	41.8	320	13.1
160	42.5	220	44.8	270	38.8	330	7.3
170	43.1	230	45.6	280	35.2	340	4.2
180	43.4	235	46.0	290	30.8	350	2.4
190	43.8	241 tr.pt.	46.8	300	24.8		

A discussion of the several forms of anhydrous sodium sulfate is given.

EQUILIBRIUM IN THE SYSTEM SODIUM SULFATE SULFURIC ACID AND WATER AT 12.5°.

(Montemartini and Losana, 1928.)

d. of sat. sol.	Gms. per 100 gms. sat. sol. Na_2SO_4	Gms. per 100 gms. sat. sol. H_2SO_4	Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol. Na_2SO_4	Gms. per 100 gms. sat. sol. H_2SO_4	Solid Phase
1.0865	9.46	0	Na. 10	1.4080	10.86	36.91	NaH.1
1.2746	19.26	11.86	" + NaH.5 (1)	1.4752	3.68	51.62	" (3)
1.2608	30.40	18.73	Na + " (2)	1.5720	3.71	59.42	NaH
1.4801	31.56	20.58	" + "	1.6562	4.75	70.62	" + NaH.H
1.4868	30.15	22.06	" + "	1.7780	5.65	81.74	NaH.H
1.4876	25.06	27.96	" + " + NaH.1	1.9254	9.98	89.06	"

(1) Traces of Na_2SO_4 (?); (2) Traces of Na.10(?); (3) Traces of NaH
Na.10 = $Na_2SO_4.10H_2O$; NaH.5 = $NaHSO_4.5H_2O$; NaH.1 = $NaHSO_4.H_2O$; NaH = $NaHSO_4$; NaH.H = $NaHSO_4.H_2SO_4$.

SOLUBILITY OF SODIUM SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°.

(D'Ans, 1906; 1909c; 1913.)

Mols. per 1000 Gms. Sat. Sol.		Solid Phase.	Mols. per 1000 Gms. Sat. Sol.		Solid Phase.
H_2SO_4.	Na_2SO_4.		SO_3.	Na_2SO_4.	
0	1.541	$Na_2SO_4.10H_2O$	8.70	0.076	$NaH_3(SO_4)_2.H_2O$
0.286	1.671	"	8.86	0.156	"
0.338	1.742	"	8.93	0.273	"
0.60	1.85	"	8.84	0.527	" (unstable)
0.763	2	"	8.70	0.808	" "
0.884	2.256	" $+Na_2SO_4$	8.62	0.844	" "
0.423	0.77	$NaHSO_4.H_2O$	8.61	0.899	"
0.496	0.47	"	8.87	0.445	" $+Na_2SO_4.4\frac{1}{2}H_2SO_4$
1.666	2.437	$Na_2SO_4+Na_3H(SO_4)_2$	8.93	0.437	$Na_2SO_4.4\frac{1}{2}H_2SO_4$
1.576	2.363	" $+Na_3H(SO_4)_2.H_2O$	9.08	0.394	"
2.611	2.091	$Na_3H(SO_4)_2+$ "	9.36	0.425	" $+NaHS_2O_7$
5.91*	0.409	$NaHSO_4$	9.18	0.567	$NaHS_2O_7$
6.30	0.332	"	9.42	0.728	"
6.64	0.297	" $+NaH_3(SO_4)_2.H_2O$	9.48	0.76	"
6.90	0.173	$NaH_3(SO_4)_2.H_2O$	9.48	0.953	" +?
7.36	0.071	"	9.85	0.787	?
7.74	0.047	"	9.98	0.908	?
8.12	0.037	"	9.77	1.03	unstable
8.40	0.046	"	10.16	0.797	
			10.78	0.302	

* From this point on the figures in this column are Mols.SO_3 = H_2SO_4 + SO_3.

SO

100 cc. sat. solution of Na_2SO_4 in absolute H_2SO_4 contain 29.99 gms. Na_2SO_4 and the molecular compound which is formed contains 8 mols. H_2SO_4 per 1 mol. Na_2SO_4 and melts at about 40°. (Bergius, 1910.)

Aqueous H_2SO_4 containing 0.51 mol. per liter dissolve 2.238 mols. Na_2SO_4 per liter at 25°; Aq. H_2SO_4 of 0.779 mol. per liter dissolves 2.465 mols. Na_2SO_4 at the same temperature. (Herz, 1911–12.)

100 gms. H_2O dissolve 30 gms. $NaHSO_4$ at 16°. (Aschan, 1913.)
100 gms. H_2O dissolve 28.6 gms. $NaHSO_4$ at 25° and 50 gms. at 100°. (U.S.P. VIII.)
100 gms. 95 per cent alcohol dissolve about 1.4 gms. $NaHSO_4$ at 25°. (U.S.P. VIII.)
100 gms. 95% formic acid dissolve 30 gms. $NaHSO_4$ at 19.3°. (Aschan, 1913.)

EQUILIBRIUM IN THE SYSTEM SODIUM SULFATE, SULFURIC ACID AND WATER.

(Pascal and Ero, 1919; Faust and Esselmann, 1926; Foote, 1919).

Results by Pascal and Ero.

t°.	Gms. per 100 gms. sat. sol.		Solid Phase.
	Na_2SO_4.	H_2SO_4.	
−45...	1.6	42.8	$Na_3H(SO_4)_2$ + $Na_2SO_4.10H_2O$
−30...	1.6	42.8	$Na_3H(SO_4)_2$
−30...	2.30	37.10	»
−30...	3.10	26.80*	»
−24...	3.0	30.0	Ice
−24...	7.5	35.0	Ice + $Na_3H(SO_4)_2$ + $Na_2SO_4.10H_2O$
−21...	7.5	40.0	$NaHSO_4.H_2O$
− 1...	7.5	40.0*	»
−17...	3.0	24.25	Ice
−11...	10.0	30.0	$Na_2SO_4.10H_2O$
−10...	5.0	15.0	» + Ice
− 9...	3.0	12.5	Ice
− 7...	10.0	22.5	$Na_2SO_4.10H_2O$
− 6...	4.0	45.0	$Na_3H(SO_4)_2$
− 3...	9.1	32.1*	$NaHSO_4.H_2O$
− 3...	10.25	10.9	$Na_2SO_4.10H_2O$
− 3...	16.0	27.1	$Na_2H(SO_4)_2$
− 3...	20.1	22.4	»

Results by Faust and Esselmann at 0°.

Na_2SO_4.	H_2SO_4.	Solid Phase.
5.98	6.74	
7.9	14.75	
11.5	20.5	
14.44	21.64	$Na_2SO_4.10H_2O$
20.01	21.69	»
23.01	21.52	»
28.3	22.07	»
27.85	22.66	$Na_3H(SO_4)_2$
26.25	23.81	
25.70	24.13	
22.95	26.08	$Na_3H(SO_4)_2.H_2O$
18.67	29.35	»
16.45	30.74	$NaHSO_4.H_2O$
13.88	32.73	»
13.01	33.13	
9.62	34.59	
7.66	37.21	
3.98	43.31	$NaHSO_4.H_2O$
2.11	57.5	
2.38	58.46	$NaHSO_4.H_2O$
2.79	60.00	
3.05	61.30	
3.44	62.60	$NaHSO_4$
3.36	62.87	
0.0	69.90	

* = Metastable.

Results by Pascal and Ero at 5°.0.

Gms. per 100 gms. sat. sol.		Solid Phase.
Na_2SO_4.	H_2SO_4.	
13.94	8.75	$Na_2SO_4.10H_2O$
25.55	14.96	»
33.30	16.70	» + Na_2SO_4
25.74	25.05	$Na_3H(SO_4)_2$
16.23	33.60	»
4.95	45.90	» + $NaHSO_4.H_2O$
4.19	48.60	$NaHSO_4.H_2O$
3.96	58.78	$NaHSO_4$
0.95	70.80	»
0.19	81.70	$NaH_3(SO_4)_2.1\frac{1}{2}H_2O$
3.02	88.70	»

Results by Foote at 12°.0.

Na_2SO_4.	H_2SO_4.	Solid Phase.
9.53	0.0	$Na_2SO_4.10H_2O$
32.93	16.51	» + $Na_3H(SO_4)_2$
25.41	27.96	$NaHSO_4.H_2O$ + $Na_3H(SO_4)_2$
4.33	58.79	$NaH(SO_4)_2.H_2O$ (divariant)

Results by Pascal and Ero at 14°.0.

Na_2SO_4.	H_2SO_4.	Solid Phase.
25.9	0.0	$Na_2SO_4.7H_2O$
34.15	9.5	»
19.81	7.13	$Na_2SO_4.10H_2O$
28.50	13.40	»
33.35	20.19	Na_2SO_4
28.58	24.54	$Na_3H(SO_4)_2$
22.77	29.97	»
17.74	33.88	»
5.63	48.12	$NaHSO_4.H_2O$
4.54	58.68	$NaHSO_4$
8.68	58.68*	$NaHSO_4.H_2O$
2.09	63.78	$NaHSO_4$
1.20	70.76	»
0.35	81.66	$NaH_3(SO_4)_2.1\frac{1}{2}H_2O$
0.32	81.68	»
3.44	87.92	$NaH_3(SO_4)_2$
3.64	88.30	»
5.95	91.69*	$NaH_3(SO_4)_2.1\frac{1}{2}H_2O$
15.05	85.00	$NaH_3(SO_4)_2$
33.70	23.30 (15°)	$Na_3H(SO_4)_2$

Results by Pascal and Ero at 23°.

Na_2SO_4.	H_2SO_4.	Solid Phase.
29.29	10.11	$Na_2SO_4.10H_2O$
35.52	13.37	»
34.05	13.56	» + Na_2SO_4
34.65	19.38	Na_2SO_4
30.08	26.61	$Na_2H(SO_4)_2$
9.42	43.76	»
6.23	56.09	$NaHSO_4.H_2O$ + $NaHSO_4$
2.78	63.93	$NaHSO_4$
7.54	64.06*	$NaHSO_4.H_2O$
1.84	79.40	$NaH_3(SO_4)_2.1\frac{1}{2}H_2O$
14.74	83.89	$NaH_3(SO_4)_2$
3.95	87.29	» + $NaH_3(SO_4)_2.1\frac{1}{2}H_2O$

EQUILIBRIUM IN THE SYSTEM SODIUM SULFATE, SULFURIC ACID AND WATER (CON.). (Pascal and Ero, 1919; Faust and Esselmann, 1926; Foote, 1919.)

Gms. per 100 gms. sat. sol.		
Na_2SO_4.	H_2SO_4.	Solid Phase.
Results by Foote at 25°.		
21.90	0.0	$Na_2SO_4.10H_2O$
33.48	8.62	» + Na_2SO_4
35.36	16.27	$Na_3H(SO_4)_2$ + »
27.02	30.58	» + $NaHSO_4.H_2O$
6.54	56.25	$NaHSO_4.H_2O$ (divariant)
Results by Faust and Esselmann at 29°.5.		
32.22	3.06	$Na_2SO_4.10H_2O$
32.89	3.99	Na_2SO_4
32.84	5.18	»
32.60	6.99	»
32.42	8.94	»
32.51	10.05	»
33.34	13.83	»
33.75	14.38	»
34.02	15.60	»
34.37	17.31	»
33.49	19.10	$Na_3H(SO)_2$
33.19	19.49	»
32.69	21.45	»
32.38	22.35	»
30.86	24.98	»
29.79	27.35	»
28.72	29.89	»
28.32	30.60	»
27.81	32.53	
26.87	32.64	
26.54	32.79	$NaHSO_4.H_2O$
19.62	36.65	»
19.00	37.22	»
10.51	45.50	»
8.96	48.15	»
8.35	49.49	»
7.85	55.13	» + $NaHSO_4$
5.70	59.96	$NaHSO_4$
4.59	62.55	
4.31	65.55	
12.7	82.91	
9.3	84.25	
Results by Pascal and Ero at 36°.0.		
35.54	19.31	Na_2SO_4
32.98	26.46	$Na_3H(SO_4)_2$
37.89	26.98*	Na_2SO_4
17.61	42.34	$NaHSO_4.H_2O$
12.53	53.07	»
6.05	65.41	$NaHSO_4$
18.09	86.96	$NaH_3(SO_4)_2$
6.69	86.20	»

* = Metastable.

Gms. per 100 gms. sat. sol.		
Na_2SO_4.	H_2SO_4	Solid Phase.
Results by Faust and Esselmann at 46°.0.		
32.4	3.47	Na_2SO_4
32.54	6.27	»
32.52	6.8	»
33.01	10.8	»
34.08	14.4	»
34.17	14.9	»
34.14	14.87	»
34.57	15.86	»
34.60	16.17	»
36.00	18.08	»
35.94	18.12	»
35.63	19.18	
35.45	20.16	
34.97	21.32	
34.73	22.93	
34.52	23.04	
34.40	24.60	$Na_3H(SO_4)_2$
33.59	27.2	»
33.25	28.48	»
33.15	29.3	»
33.07	30.18	»
33.01	33.16	»
33.27	33.44	»
33.22	33.08	»
33.25	35.36	$NaHSO_4.H_2O$
32.65	35.70	»
30.95	36.5	»
21.2	43.9	»
20.5	44.52	»
19.85	45.17	»
17.71	48.5	»
17.76	48.32	»
17.13	49.6	»
14.21	51.31	$NaHSO_4$
12.41	52.65	»
10.2	55.5	»
9.93	56.0	»
6.82	61.79	»
6.4	62.46	»
6.16	64.8	»
6.04	65.59	
4.51	67.76	
2.3	74.83	(?)
7.5	72.16	
1.92	78.58	
13.22	80.44	(?)

EQUILIBRIUM IN THE SYSTEM SODIUM SULFATE, SULFURIC ACID AND WATER (CON.).

(Pascal and Ero, 1919; Faust and Esselmann, 1926.)

Results by Pascal and Ero at 56°.

Gms. per 100 gms. sat. sol.		
Na_2SO_4.	H_2SO_4.	Solid Phase.
34.63	8.47	Na_2SO_4
34.99	12.81	»
36.65	18.69	»
36.88	25.10	$Na_3H(SO_4)_2$
40.51	33.21*	$NaHSO_4.H_2O$
19.86	51.15	»
33.00	41.35	»
11.57	60.45	$NaHSO_4$
8.44	62.72	»
5.24	74.63	$NaHSO_4.H_2O$
5.68	76.54	$NaH_3(SO_4)_2.1\,{}^1/_2H_2O$
4.49	78.30	»
21.54	78.46	$NaH_3(SO_4)_2$
15.20	81.15	»
9.30	83.25	»

Result by Faust and Esselmann at 60°.

Gms. per 100 gms. sat. sol.		
Na_2SO_4.	H_2SO_4.	Solid Phase.
32.27	4.66	Na_2SO_4
33.70	13.13	»
34.26	14.71	»
37.03	19.00	»
36.86	22.1	$Na_3H(SO_4)_2$
36.48	25.6	»
37.0	29.87	»
38.22	34.26	»
33.04	41.77	»
31.24	42.53	$NaHSO_4$
17.72	51.25	»
13.27	55.36	»
8.22	63.75	»
8.21	67.79	»
11.33	73.65	
16.60	77.78	
15.93	78.6	
3.2	78.69	(?)
3.3	79.32	
13.59	80.8	
5.14	81.01	$NaHSO_4$

Results of Pascal and Ero at 75°.

Gms. per 100 gms. sat. sol.		
Na_2SO_4.	H_2SO_4.	Solid Phase.
41.80	23.10	$Na_2SO_4 + Na_3H(SO_4)_2$
42.40	31.80	$Na_3H(SO_4)_2$
20.10	55.20	$NaHSO_4 + NaHSO_4.H_2O$
11.10	63.40	$NaHSO_4$
12.30	69.80	»
13.40	77.40	$NaH_3(SO_4)_2$
24.90	75.30	»

* = Métastable.

Results of Faust and Esselmann at 82°.5.

Gms. per 100 gms. sat. sol.		
Na_2SO_4.	H_2SO_4.	Solid Phase.
31.72	6.49	Na_2SO_4
32.83	10.48	»
36.44	16.88	»
38.63	19.73	»
38.85	20.20	»
39.20	25.0	$Na_3H(SO_4)_2$
40.63	28.86	»
41.24	30.17	»
42.25	32.15	»
44.20	35.15	»
45.37	36.14	»
46.20	36.55	»
39.02	41.04	$NaHSO_4$
34.80	44.00	»
28.78	47.55	»
23.62	50.64	»
25.5	49.78	»
20.84	53.9	»
19.42	54.35	»
16.45	56.99	»
10.97	65.07	»
11.9	65.5	»
24.67	71.38	(?)
10.56	71.44	(?)
10.06	72.26	
21.43	73.00	
19.37	73.12	
11.47	75.44	
11.20	75.73	

Results by Pascal and Ero at 97°.

Gms. per 100 gms. sat. sol.		
Na_2SO_4.	H_2SO_4.	Solid Phase.
34.89	8.53	Na_2SO_4
44.34	15.03	»
44.22	20.22	»
44.37	24.02	$Na_3H(SO_4)_2$
44.13	31.91	»
44.10	33.10	»
48.29	34.20	»
51.89	35.53	$NaHSO_4.H_2O$
37.78	42.97	$NaHSO_4$
21.02	56.60	»
15.88	61.92	»
15.60	65.00	»
20.43	68.09	»
21.71	70.98	$NaH_3(SO_4)_2$
29.43	71.16	»
27.60	72.50	$2NaHSO_4.H_2SO_4$
18.0	73.20*	$NaHSO_4$

EQUILIBRIUM IN THE SYSTEM SODIUM SULFATE, SULFURIC ACID AND WATER (CON.).

(Pascal and Ero, 1919.)

t°.	Gms. per 100 gms. sat. sol. Na_2SO_4.	H_2SO_4.	Solid Phase.	t°.	Gms. per 100 gms. sat. sol. Na_2SO_4.	H_2SO_4.	Solid Phase.
120...	49.00	32.67	$Na_3H(SO_4)_2$	169.5.	50.20	44.75	$NaHSO_4$
120...	50.10	34.50	»	159.5.	47.23	48.67	»
120...	53.20	36.50	$NaHSO_4$	160.5.	45.00	49.20	»
120...	32.26	51.20	»	149.5.	40.41	52.09	»
120...	26.80	57.70	»	91.5.	45.00	38.50	$NaHSO_4.H_2O$
120. .	27.50	64.55	»	>145...	45.00	33.00	Na_2SO_4
120...	35.61	64.58	»	>170...	57.20	29.05	»

Freezing-point data for mixtures of sodium sulfate and sulfuric acid are given by Kendall and Landon, 1920, and Cambi and Bozza, 1923. Results for mixtures of sodium pyrosulfate and sodium bisulfate are given by Cambi and Bozza, 1923

EQUILIBRIUM IN THE SYSTEM SODIUM SULFATE, SULFURIC ACID AND ETHYL ALCOHOL.

(Dunnicliff and Hoon, 1926.)

The authors studied the action of alcohol upon sodium hydrogen sulfate and found that the maximum concentration of acid obtained in the liquid phase was 17.75 per cent. With quantities of salt necessary to yield higher concentrations it was impossible to separate the liquid phase and the « Rest ». Hence the system could not be further investigated by this method. They then studied the action of alcoholic sulfuric acid solutions upon sodium sulfate and sodium hydrogen sulfate. The experimental results are not presented in a manner which can be easily understood.

SOLUBILITY OF SODIUM SULFATE IN PURE HYDROGEN PEROXIDE.

(Maass and Hatcher, 1922.)

The temperatures were determined at which the last trace of solid dissapeared from mixtures of accurately weighed amounts of the two compounds.

t°.	Gms. Na_2SO_4 per 100 gms. mixture.	t°.	Gms. Na_2SO_4 per 100 gms. mixture.	t°.	Gms. Na_2SO_4 per 100 gms. mixture.
—2.17.....	1.19	— 5.52.....	10.23	+19.6....	22.64
—2.87.....	2.56	— 6.77.....	13.51	29.1.....	23.59
—3.12.....	4.47	— 9.02.....	16.77	39.1.....	25.62
—4.27.....	6.92	—10.57.....	19.47		

SOLUBILITY OF SODIUM SULFATE IN AQUEOUS SOLUTIONS OF AMMONIA AT 35°

(Fedotieff and Kolosoff, 1923.)

d of sat. sol.	Gms. per 100 cc. sat. sol. Na_2SO_4.	NH_3.	Gms. per 100 gms. H_2O. Na_2SO_4.	NH_3.
1.202...........	28.76	4.84	33.23	5.65
1.169...........	25.39	6.08	29.71	6.49
1.137...........	21.98	6.59	25.83	7.75

SOLUBILITY OF SODIUM SULFATE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE AT 25°.

(D'Ans and Schreiner, 1910.)

Mols. per 1000 Gms. Sat. Sol. $(NaOH)_2$.	Na_2SO_4.	Solid Phase.	Mols. per 1000 Gms. Sat. Sol. $(NaOH)_2$.	Na_2SO_4.	Solid Phase.
0.074	1.41	$Na_2SO_4.10H_2O$	2.82	0.24	Na_2SO_4
0.70	1.08	"	3.52	0.126	"
1.47	0.90	" +Na_2SO_4	5.83	0.013	"
2.02	0.59	Na_2SO_4	6.62	0	$NaOH.H_2O$

Data for the equilibrium in the following systems at temperatures between 150° and 350° are given by Schroeder, Gabriel and Partridge, 1935, and Schroeder, Berk and Gabriel, 1937.

Na_2SO_4 + NaOH + H_2O
" + NaCl + "
" + NaOH + NaCl + H_2O
" + Na_3PO_4 + H_2O
" + " + NaOH + H_2O

The determinations were made in connection with boiler feed-water studies.

EQUILIBRIUM IN THE SYSTEM SODIUM SULFATE, SODIUM THIOSULFATE AND WATER.

(Garran, 1926.)

Saturation was obtained by constant agitation in a thermostat for from 3 to 24 hours. M. C. indicates mixed crystals and the formula following shows the major constituent. * indicates metastable equilibrium.

Results at 0°.8.

d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase.
	Na_2SO_4.	$Na_2S_2O_3$.	
1.040	4.60	0.0	$Na_2SO_4.10H_2O$
1.065	3.13	4.48	M.C.$Na_2SO_4.10H_2O$
1.105	2.31	9.63	»
1.159	1.88	16.03	»
1.190	1.87	19.62	»
1.247	1.56	25.63	»
—	1.34	30.07	»
1.312	1.27	32.26	»
1.324	1.58	33.91*	»
1.314	1.22	32.72	»+M.C.$Na_2S_2O_3.5H_2O$
1.317	1.15	32.72	
1.317	1.44	32.72	M.C.$Na_2S_2O_3.5H_2O$
1.315	—	33.57	$Na_2S_2O_3.5H_2O$

Results at 18°.

d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase.
	Na_2SO_4.	$Na_2S_2O_3$.	
1.130	14.11	0.0	$Na_2SO_4.10H_2O$
1.150	12.31	4.01	M.C.$Na_2SO_4.10H_2O$
1.180	10.71	9.36	»
1.194	9.83	11.34	»
1.225	8.45	15.86	»
1.248	7.65	19.16	»
1.276	7.14	22.46	»
1.301	6.01	25.53	»
1.314	5.97	27.00	»
1.338	6.04	29.57	»
1.356	6.32	32.31	»
1.374	5.94	33.66	»
1.390	6.14	35.07	»
1.399	6.26	35.42	»+M.C.$Na_2S_2O_3.5H_2O$
1.394	6.31	35.46	M.C.$Na_2S_2O_3.5H_2O$
1.395	4.87	36.61	»
1.384	1.65	39.12	»
1.378	0.0	40.36	$Na_2S_2O_3.5H_2O$

Results at 25°.

d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase.
	Na_2SO_4.	$Na_2S_2O_3$.	
1.204	21.60	0.0	$Na_2SO_4.10H_2O$
1.215	19.74	3.48	M.C.$Na_2SO_4.10H_2O$
1.236	18.44	7.30	»
1.253	17.12	10.14	»
1.271	16.13	13.22	»
1.288	14.86	16.16	»
1.311	13.97	19.35	»
—	13.62	22.02	»
1.359	12.97	24.96	»

Results at 25°.

d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase.
	Na_2SO_4.	$Na_2S_2O_3$.	
—	12.72	26.86	M.C.$Na_2SO_4.10H_2O$ +M.C.Na_2SO_4
—	12.72	26.85	
—	13.27	26.12*	M.C.Na_2SO_4
1.379	12.15	28.00	»
—	10.28	30.31	»
1.401	7.73	34.72	»
—	6.06	38.07	»
—	4.53	41.86*	»
1.453	4.87	43.32*	»
—	5.59	38.83	M.C.Na_2SO_4 +M.C.$Na_2S_2O_3.5H_2O$
—	5.66	38.67	
1.426	5.64	38.97	
1.420	5.42	38.85	
—	5.20	38.96	
1.418	4.69	39.45	M.C.$Na_2S_2O_3.5H_2O$
1.412	3.13	40.92	»
1.411	2.01	41.53	»
1.410	0.23	43.52	»
—	0.0	43.50	$Na_2S_2O_3.5H_2O$

Results at 40°.

d of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase.
	Na_2SO_4.	$Na_2S_2O_3$.	
—	32.37	0.0	Na_2SO_4
—	29.35	3.79	M.C.Na_2SO_4
1.326	24.79	9.06	»
1.334	18.58	16.73	»
—	14.76	22.95	»
1.367	11.14	28.06	»
—	10.40	30.44	»
1.383	8.13	34.35	»
—	5.90	39.74	»
1.444	4.28	43.06	»
1.484	2.46	48.78	»
	1.79	51.04*	»
	2.03	52.10*	»
1.496	2.27	49.38	M.C.Na_2SO_4 +M.C.$Na_2S_2O_3.5H_2O$
1.496	2.08	49.72	
1.494	2.24	49.73	
	2.09	49.97	
	3.61	49.60*	M.C.$Na_2S_2O_3.5H_2O$
1.493	2.14	49.88	»
	2.15	49.98	»
—	1.58	50.15	»
1.492	0.67	50.49	»
1.488	0.0	51.23	$Na_2S_2O_3.5H_2O$

SOLUBILITY OF SODIUM SULFATE IN AQUEOUS SOLUTIONS OF SODIUM ACETATE AT 25°.

(Fox, 1909.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
CH_3COONa.	Na_2SO_4.		CH_3COONa.	Na_2SO_4.	
0	21.9	$Na_2SO_4.10H_2O$	12.58	13.50	$Na_2SO_4.10H_2O$
4.10	17.72	"	16.26	11.50	"
7.71	16.48	"	20.68	8.10	"

SOLUBILITY OF MIXTURES OF NICKEL SULPHATE AND SODIUM SULPHATE, ETC.

(Koppel; Wetzel — Z. physik. Chem. 52, 401, '05.)

t°.	Gms. per 100 Gms. Solution.		Gms. per 100 Gms. H_2O.		Mols. per 100 Mols. H_2O.		Solid Phase.
	$NiSO_4$.	Na_2SO_4.	$NiSO_4$.	Na_2SO_4.	$NiSO_4$.	Na_2SO_4.	
0	16.94	7.61	22.46	10.09	2.61	1.28	$NiSO_4.7H_2O$ + $Na_2SO_4.10H_2O$
5	17.99	10.85	25.28	15.24	2.94	1.93	
10	18.97	13.85	28.26	20.64	3.29	2.61	
20	18.76	17.21	29.31	26.87	3.410	3.404	$NiNa_2(SO_4)_2.4H_2O$
25	17.85	16.54	27.33	25.33	3.181	3.208	"
30	16.74	15.34	24.64	22.58	2.868	2.861	"
35	16.28	14.91	23.66	21.67	2.753	2.744	"
40	15.35	14.49	21.88	20.65	2.546	2.616	"
18.5	19.61	16.49	30.70	25.80	3.56	3.27	$NiNa_2(SO_4)_2.4H_2O$ + $NiSO_4.7H_2O$
20	20.13	16.15	31.59	25.35	3.67	3.21	
25	21.20	14.77	33.11	23.06	3.85	2.92	
30	22.60	12.80	34.98	19.82	4.07	2.59	
35	23.62	10.78	36.01	16.43	4.19	2.08	
40	24.92	9.39	37.93	14.29	4.41	1.81	
18.5	16.80	18.93	26.14	29.45	3.04	3.72	$NiNa_2(SO_4)_2.4H_2O$ + $Na_2SO_4.10H_2O$
20	15.48	20.18	24.06	31.37	2.80	3.97	
25	10.92	24.12	16.81	37.13	1.96	4.70	
30	6.40	28.71	9.87	44.25	1.15	5.60	
35	4.54	31.65	7.13	49.59	0.838	6.28	$NiNa_2(SO_4)_2.4H_2O$ + Na_2SO_4
40	4.63	31.37	7.24	49.03	0.843	6.21	

EQUILIBRIUM IN THE SYSTEM SODIUM SULFATE, NICKEL SULFATE AND WATER AT VARIOUS TEMPERATURES.

(Benrath and Benrath, 1929; Benrath, 1931.)

Gms. per 100 gms. sat. sol. Ns_2SO_4	Gms. per 100 gms. sat. sol. $NiSO_4$	Solid Phase
Results at 60°		
29.51	4.37	Na_2SO_4 + 1.1.4
17.51	13.29	1.1.4
11.66	20.92	"
7.50	28.84	"
4.52	34.40	" + $NiSO_4.6H_2O$
0.0	36.20	$Ni_2SO_4.6H_2O$
Results at 64.5°		
4.29	36.10	1.1.4 + $NiSO_4.6H_2O$
Results at 75°		
28.75	5.44	Na_2SO_4 + 1.1.4
19.0	13.62	1.1.4
15.03	17.51	"
7.64	28.75	"
7.28	30.31	"
4.63	37.0	" + $NiSO_4.6H_2O$
3.55	37.75	$NiSO_4.6H_2O$
0.0	38.85	"

d. of sat. sol.	Gms. per 100 gms. sat. sol. Na_2SO_4	Gms. per 100 gms. sat. sol. $NiSO_4$	Solid Phase
	Results at 97°		
1.237	30.50	0.0	Na_2SO_4
1.264	29.12	2.30	"
1.304	28.08	5.16	"
1.331	27.62	6.49	" + 1.1.4
1.304	22.71	9.54	1.1.4
1.310	21.13	10.94	"
1.331	16.45	16.33	"
1.403	10.25	26.00	"
—	7.32	31.37	"
1.506	6.49	33.73	"
1.600	3.48	41.00	"
—	3.43	41.90	" + $NiSO_4.6H_2O$
1.638	3.14	43.18	$NiSO_4.6H_2O$
1.633	2.96	42.78	"
1.619	1.61	43.40	"
1.617	0.0	45.57	"

SO

1.1.4 = $Na_2SO_4.NiSO_4.4H_2O$.

EQUILIBRIUM IN THE SYSTEM SODIUM SULFATE, PRASEODYMIUM SULFATE AND WATER AT 25°.

(Zambonini and Restanio, 1931.)

Gms. per 100 gms. sat. sol. $Pr_2(SO_4)_3$	Gms. per 100 gms. sat. sol. Na_2SO_4	Solid Phase	Gms. per 100 gms. sat. sol. $Pr_2(SO_4)_3$	Gms. per 100 gms. sat. sol. Na_2SO_4	Solid Phase
—	9.45	$5.4.8H_2O$	—	3.64	$1.1.2H_2O$
—	6.61	"	—	1.44	"
—	5.24	"	2.36	0.01	"

$5.4.8H_2O = 5Na_2SO_4.4Pr_2(SO_4)_3.8H_2O$; $1.1.2H_2O = Na_2SO_4.Pr_2(SO_4)_3.2H_2O$.

EQUILIBRIUM IN THE SYSTEM SODIUM SULFATE, SAMARIUM SULFATE AND WATER AT 25°.

(Restanio, 1934.)

Gms. per 100 gms. sat. sol. $Sm_2(SO_4)_3$	Gms. per 100 gms. sat. sol. Na_2SO_4	Solid Phase	Gms. per 100 gms. sat. sol. $Sm_2(SO_4)_3$	Gms. per 100 gms. sat. sol. Na_2SO_4	Solid Phase
—	18.63	—	—	2.08	1.1.2
—	12.95	4.5.8	0.26	0.50	"
—	10.65	"	1.39	0.29	—
—	8.40	1.1.2	1.41	0.28	—

4.5.8 = $4Sm_2(SO_4)_3.5Na_2SO_4.8H_2O$; 1.1.2 = $Sm_2(SO_4)_3.Na_2SO_4.2H_2O$.

EQUILIBRIUM IN THE SYSTEM SODIUM SULFATE, ZINC SULFATE AND WATER.

(Caven and Johnston, 1928.)

Results at 0°

Gm. Mols. per 1000 gms. H_2O		Solid Phase
$ZnSO_4$	Na_2SO_4	
0.0	0.331	$Na_2SO_4.10H_2O$
0.128	0.347	"
0.414	0.366	"
0.600	0.381	"
0.914	0.388	"
1.886	0.463	"
2.494	0.485	"
2.521	0.492	" + $ZnSO_4.7H_2O$
2.568	0.122	$ZnSO_4.7H_2O$
2.580	0.00	"

Results at 25°

Gm. Mols. per 1000 gms. H_2O		Solid Phase
$ZnSO_4$	Na_2SO_4	
0.0	1.072	$Na_2SO_4.10H_2O$
0.583	2.023	"
1.226	2.087	" + 1.1.4
1.987	1.322	1.1.4
2.669	0.871	"
2.922	0.745	"
3.157	0.641	"
3.463	0.551	" + $ZnSO_4.7H_2O$
3.504	0.255	$ZnSO_4.7H_2O$
3.518	0.0	"

1.1.4 = $Na_2SO_4.ZnSO_4.4H_2O$

SOLUBILITY OF ZINC SULFATE SODIUM SULFATE MIXTURES IN WATER.

(Koppel, Gumpery, 1905.)

t°	Gms per 100 Gms. Solution.		Gms per 100 Gms H_2O.		Mol. per 100 Mols H_2O.		Solid Phase.
	$ZnSO_4$	Na_2SO_4.	$ZnSO_4$.	Na_2SO_4	$ZnSO_4$.	Na_2SO_4.	
0	27.10	5.33	40.30	7.90	4.50	1.01	$ZnSO_4.7H_2O$ + $Na_2SO_4.10H_2O$
5	27.85	6.27	42.28	9.52	4.71	1.21	
25	17.58	15.63	26.32	23.40	2.94	2.96	$ZnNa_2(SO_4)_2.4H_2O$
30	17.66	15.58	26.47	23.44	2.95	2.97	"
35	17.50	15.70	26.30	23.52	2.94	2.98	"
40	17.75	15.72	26.68	23.63	2.98	2.99	"
10	29.16	7.16	45.79	11.24	5.11	1.42	$ZnNa_2(SO_4)_2.4H_2O$ + $ZnSO_4.7H_2O$
15	30.70	6.40	48.81	10.17	5.45	1.29	
20	32.51	5.36	52.34	8.62	5.84	1.09	
25	34.36	4.41	56.15	7.22	6.27	0.91	
30	36.28	3.80	60.55	6.34	6.76	0.81	
35	38.18	3.30	65.25	5.64	7.28	0.71	
38	38.83	2.90	66.64	4.98	7.44	0.63	$ZnNa_2(SO_4)_2.4H_2O$ + $ZnSO_4.6H_2O$
40	38.26	2.78	64.89	4.71	7.24	0.60	
10	27.91	7.92	43.50	12.34	4.85	1.565	$ZnNa_2(SO_4)_2.4H_2O$ + $Na_2SO_4.10H_2O$
15	24.28	10.90	36.92	16.71	4.12	2.12	
20	19.14	14.58	28.77	21.95	3.21	2.79	
25	13.31	19.94	19.93	29.87	2.22	3.785	
30	6.96	27.75	10.67	42.51	1.19	5.39	
35	5.61	30.03	8.72	46.61	0.971	5.91	$ZnNa_2(SO_4)_2.4H_2O$ + Na_2SO_4
40	5.96	28.65	9.16	43.83	1.02	5.555	

SODIUM SULFATE

EQUILIBRIUM IN THE SYSTEM SODIUM SULFATE, ZINC SULFATE AND WATER.

(Benrath and Benrath, 1929; Benrath, 1930.)

Gms. per 100 gms. sat. sol. $ZnSO_4$	Gms. per 100 gms. sat. sol. Na_2SO_4	Solid Phase
Results at 50°		
6.48	28.19	Na_2SO_4 + 1.1.4
41.47	2.72	Zn6 + "
Results at 68°		
39.82	4.05	Zn.1 + 1.1.4
Results at 75°		
38.30	4.71	Zn.1 + 1.1.4
10.54	24.52	3.1 + "
6.54	27.75	" + Na_2SO_4
Results at 80°		
1.73	29.67	Na_2SO_4
6.45	27.55	3.1
8.19	26.19	"
11.38	23.80	" + 1.1.4
12.78	22.78	1.1.4
18.49	16.88	"
28.05	9.27	"
36.53	5.77	" + Zn.1
37.14	5.29	Zn.1
39.06	2.02	"
40.56	0.0	"

d. of sat. sol.	Gms. per 100 gms. sat. sol. $ZnSO_4$	Gms. per 100 gms. sat. sol. Na_2SO_4	Solid Phase
Results at 97°			
1.237	0.0	30.50	Na_2SO_4
1.279	3.36	29.27	"
1.301	5.67	28.45	"
1.315	6.17	28.43	" + 3.1
—	8.68	26.24	3.1
1.352	12.16	24.24	"
—	15.77	22.00	"
1.398	18.12	20.60	" + 1.1.4
1.421	21.37	17.84	1.1.4
1.435	25.04	14.76	"
1.506	30.92	11.40	"
1.561	35.70	9.18	"
1.532	34.50	9.30	" + Zn.1
1.509	35.93	5.14	Zn.1
1.510	36.05	4.45	"
1.532	41.23	0.0	"
Results at 100°			
—	32.55	10.31	Zn.1 + 1.1.4
—	17.66	20.71	3.1 + "
—	6.12	27.96	" + Na_2SO_4

1.1.4 = $Na_2SO_4.ZnSO_4\ 4H_2O$
3.1 = $3Na_2SO_4.ZnSO_4$
Zn.6 = $ZnSO_4.6H_2O$; Zn.1 = $ZnSO_4.H_2O$

SOLUBILITY OF SODIUM SULFATE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 25°.

(Flatt and Jordan, 1933.)

Wt. % C_2H_5OH in solvent	Wt. % C_2H_5OH in solvent after saturation	Gms. Na_2SO_4 per 100 cc sat. sol.	Gms. Na_2SO_4 per 100 gms. solvent	Gms. Na_2SO_4 per 100 gms. sat. sol.	Solid Phase
0.0	0.0	27.77	27.85	21.78	$Na_2SO_4.10H_2O$
20.4	18.6	6.795	7.017	6.557	"
37.3	36.7	1.177	1.254	1.239	"
—	52.9	0.352	0.390	0.388	"

SOLUBILITY OF SODIUM SULFATE IN AQUEOUS ETHYL ALCOHOL.

(de Bruyn, 1900.)

t°.	Concentration of Alcohol in Wt. %.	Gms. Na_2SO_4 per 100 Gms. Aq. Alcohol.	Gms. per 100 Gms. Solution.			Solid Phase.
			H_2O.	C_2H_5OH.	Na_2SO_4.	
15	0	12.7	88.7	0	11.3	$Na_2SO_4.10H_2O$
“	9.2	6.7	85.1	8.6	6.3	“
“	19.4	2.6	78.6	18.9	2.5	“
“	39.7	0.5	60	39.5	0.5	“
“	58.9	0.1	41.1	58.8	0.1	“
“	72	0	28	72	0	“
“	0	37.4	72.8	0	27.2	$Na_2SO_4.7H_2O$
“	11.2	16.3	76.5	9.5	14	“
“	20.6	7	74.3	19.2	6.5	“
“	30.2	2	68.4	29.6	2	“
25	0	28.2	78.1	0	21.9	$Na_2SO_4.10H_2O$
“	10.6	13.9	78.5	9.3	12.2	“
“	24	4.5	72.8	22.9	4.3	“
“	54	0.4	45.6	54	0.4	“ $+Na_2SO_4$
36	0	49.3	67	0	33	Na_2SO_4
“	8.8	29.2	70.6	6.8	22.6	“
“	12.8	22.4	71.2	10.5	18.3	“
“	17.9	15.4	71.1	15.5	13.4	“
“	18.1	15.3	71	15.7	13.3	“
“	28.9	5.4	66.5	28.4	5.1	“
“	48.7	0.8	50.9	48.3	0.8	“
45	0	47.9	67.6	0	32.4	“
“	9	27.5	71.3	7.1	21.6	“
“	14.5	19.2	71.8	12.1	16.1	“
“	20.6	12.3	70.6	18.4	10	“
“	31	5.1	65.6	29.5	4.9	“

The following additional determinations at 25° are given by Schreinemakers and de Baat (1909):

25	...	...	63.41	34.84	1.75	$Na_2SO_4.10H_2O$
“	...	...	49	50.5	0.5	
“	...	...	46.6	53	0.4	“ $+Na_2SO_4$
“	...	...	34.9	64.95	0.15	Na_2SO_4

Between certain concentrations of the aqueous alcohol the liquid separates into two layers. The following results were obtained at 25°, 36° and 45°:

t°.	Upper Layer.			Lower Layer		
	Gms. H_2O.	Gms. C_2H_5OH.	Gms. Na_2SO_4.	Gms. H_2O.	Gms. C_2H_5OH.	Gms. Na_2SO_4
25	66.5	27.3	6.2	67.4	5.1	27.5
“	68.1	23.9	8.0	68.5	6.0	25.5
“	68.3	23.1	8.6	68.3	6.7	25.0
36	...	...	...	66.6	4.1	29.3
“	57.7	38.4	3.9	...	...	...
“	65.0	28.3	6.7	68.8	5.9	25.3
“	68.1	21.2	10.7	68.9	9.4	21.7
45	61.8	32.9	5.3	...	...	...
“	65.8	25.3	8.9	68.4	8.8	22.8
“	66.0	24.0	10.0	68.6	10.1	21.3

Data for equilibrium in the system $Na_2SO_4 + NaCl + C_2H_5OH + H_2O$ at 15°, 25° and 35° are given by Schreinemakers and de Baat (1909), and Schreinemakers (1910).

SOLUBILITY OF SODIUM SULFATE IN SEVERAL ALCOHOLS.

(Kirn and Dunlap, 1931.)

Alcohol	Formula	Gm. Mols. Na_2SO_4 per 100 gm. Mols. Alcohol at: 20°	30°	40°	50°
Methanol	CH_3OH	0.00555	0.00544	0.00523	0.00415
Ethanol	C_2H_5OH	0.00143	0.00154	0.00156	0.00114
Iso Propanol	$CH_3CHOHCH_3$	0.000886	0.000939	0.000928	0.000739

Insoluble in Propanol, Butanol and Iso Butanol.

SOLUBILITY OF SODIUM SULFATE IN AQUEOUS PROPYL ALCOHOL AT 20°.

(Linebarger, 1892.)

Gms. C_3H_7OH per 100 Gms. Alcohol-Water Mixture.	Gms. Na_2SO_4 per 100 Gms. Sat. Solution.	Gms. C_3H_7OH per 100 Gms. Alcohol-Water Mixture.	Gms. Na_2SO_4 per 100 Gms. Sat. Solution.
42.20	1.99	56.57	0.55
49.77	1.15	60.64	0.44
55.65	0.72	62.81	0.38

100 gms. H_2O dissolve 183.7 gms. sugar + 30.5 gms. Na_2SO_4 at 31.25°, or 100 gms. sat. solution contain 52.2 gms. sugar + 9.6 gms. Na_2SO_4. (Köhler, 1897.)

100 gms. 95% formic acid dissolve 16.5 gms. Na_2SO_4 at 19°. (Aschan, 1913.)

100 gms. of a saturated solution of $Na_2SO_4.10H_2O$ in glycerol of 95 percent purity (d_{25} = 1.246) contain 7.52 gms. $Na_2SO_4.10H_2O$ at 25°. (Schnellbach and Rosin, 1929.)

SO

EQUILIBRIUM IN THE SYSTEM SODIUM SULFATE, TERTIARY BUTYL ALCOHOL AND WATER AT 30°

(Ginnings and Robbins, 1930.)

The points on the binodal curve of this system were determined by observing the appearance or disappearance of clouding in mixtures of weighed amounts of Na_2SO_4 and one of the liquids, upon addition of weighed amounts of the other. Tie lines, *, were located by determining the Na_2SO_4 in two layers in contact with each other and from these the plait point, PP., was found by plotting.

Gms. per 100 gms. homogeneous liquid		Gms. per 100 gms. homogeneous liquid		Gms. per 100 gms. homogeneous liquid		Gms. per 100 gms. homogeneous liquid	
$(CH_3)_3COH$	Na_2SO_4	$(CH_3)_3COH$	Na_2SO_4	$(CH_3)_3COH$	Na_2SO_4	$(CH_3)_3COH$	Na_2SO_4
93.0	— *	37.0	2.5 PP	20.8	4.9	8.1	11.4
68.0	— *	33.7	2.6	19.5	5.3	—	11.5 *
66.0	— *	31.1	2.9	17.5	5.8	6.7	13.3
58.6	0.3	28.8	3.4	16.4	6.2	6.1	14.2
50.0	— *	26.3	3.6	14.3	6.9	5.5	15.2
47.0	1.2	24.9	3.9	12.4	7.8	4.8	16.5
42.2	1.6	22.9	4.2	10.2	9.5	3.9	17.9
37.2	2.2	21.5	4.6 *	—	10.5 *	3.0	19.8
						1.8	24.5 *

The plait point of this system at 25° was found by Ginnings, Herring and Webb, 1933, to have the composition 2.8 percent Na_2SO_4 + 31.4 percent $(CH_3)_3COH$ + 65.8 percent H_2O.

The plait point of the System Sodium Thiosulfate, Tertiary Butyl Alcohol and Water at 25° was found by Ginnings, Herring and Webb, 1933 to have the composition, 3.2 percent $Na_2S_2O_3$ + 33.6 percent $(CH_3)_3COH$ + 63.2 percent H_2O. The original results for the other points on the binodal curve are not given but only the values of constants calculated by means of an empirical equation. Similar results for the plait point of the system Sodium Alum, Tertiary Butyl Alcohol and water at 25° are 5.4 percent $NaAl(SO_4)_2$ + 26.9 percent $(CH_3)_3COH$ + 67.7 percent H_2O.

The binodal curves and plait points of the systems

Na_2SO_4 + Pyridine + H_2O

and $Na_2S_2O_4$ + " + " are given by Ginnings, Webb and Hinohara, 1933, but the authors do not give their experimental results but only the values of arbitrary constants calculated by means of empirical equations.

SOLUBILITY OF SODIUM SULFATE IN AQUEOUS SOLUTIONS OF URETHAN AT 25°.

(Palitzsch, 1928, 1929.)

Gms Mols. per 1000 gms. H_2O		Solid Phase
Na_2SO_4	$NH_2COOC_2H_5$	
1.936	0.0	$Na_2SO_4.10H_2O$
1.542	0.8273	"
0.184	16.17	Upper liquid layer
1.214	1.897	Lower liquid layer

SO

SOLUBILITY OF SODIUM SULFATE IN AN AQUEOUS SOLUTION OF UREA.

(Löwenherz, 1895.)

Solvent.	t°.	Gms. Na_2SO_4 per 100 Gms. Sat. Sol.	The Corresponding Figure for the Solubility of Na_2SO_4 in Pure Water Was Found to be:
100 gms. H_2O+12 gms. urea	20.86	22.36	...
" "	24.83	21.21	21.62
" "	28.32	26.50	26.48
" "	29.83	28.23	...
" "	31.90	...	32.34
" "	34.85	27.73	33.09
" "	39.92	27.19	32.58

Fusion-point data for Na_2SO_4 + KCl are given by Sackur (1911–12). Results for Na_2SO_4 + $SrSO_4$ are given by Calcagni (1912–1912a). Results for Na_2SO_4 + Na_2WO_4 are given by Bocke (1907).

SODIUM Phenyl **SULFATE** $C_6H_5O_4SNa.3H_2O$.

100 gms. sat. solution in water contain 31.0 gms. of the compound at 17°.
» » alcohol » 7.0 » »

(Burkhardt and Lapworth, 1926.)

SODIUM N-Phenyl β Aminoethyl Hydrogen **SULFATE**
$C_6H_5NH.C_2H_4O\,SO_3Na.H_2O$.

100 cc. sat. solution in water contain approx. 60 gms. of the compound at 15°.

(Saunders, 1922.)

SODIUM THIOSULFATE $Na_2S_2O_3.5H_2O$(I).

Solubility in Water. (Young and Burke, 1904, 1906.)

t°.	Gms. $Na_2S_2O_3$ per 100 Gms.		Solid Phase.	t°.	Gms. $Na_2S_2O_3$ per 100 Gms.		Solid Phase.
	Sat. Sol.	Water.			Sat. Sol.	Water.	
0	33.40	50.15	$Na_2S_2O_3.5H_2O$(I)	0	60.47	153	$Na_2S_2O_3.H_2O$(II)
10	37.37	59.66	“	10	61.04	156.7	“
20	41.20	70.07	“	20	62.11	163.9	“
25	43.15	75.90	“	25	62.73	168.3	“
35	47.71	91.24	“	30	63.56	174.4	“
45	55.33	123.87	“	40	65.22	187.6	“
48.17*	...	...	“+$Na_2S_2O_3.2H_2O$(I)	50	66.82	201.4	“
0	52.73	111.60	$Na_2S_2O_3.2H_2O$(I)	56.5*	...	...	“ +$Na_2S_2O_3$
10	53.94	117.10	“	0	46.14	85.67	$Na_2S_2O_3.6H_2O$(III and IV)
20	55.15	122.68	“	10	51.66	106.8	“
25	56.03	127.43	“	13	54.96	122	“
30	57.13	138.84	“	14.35*	...	...	“ +$Na_2S_2O_3.\frac{4}{3}H_2O$.(IV)
40	59.38	146.20	“	14.3*	...	...	“ +$Na_2S_2O_3.7H_2O$(III)
50	62.28	165.11	“	0	57.42	134.8	$Na_2S_2O_3.7H_2O$(III)
60	65.68	191.30	“	10	58.28	139.7	“
66.5*	...	...	“+$Na_2S_2O_3$	20	59.28	145.6	“
0	41.96	72.30	$Na_2S_2O_3.5H_2O$(II)	25	60.18	151.1	“
10	45.25	82.65	“	30	60.78	155	“
20	49.38	97.55	“	40	62.60	167.4	“
25	52.15	108.98	“	47.5	64.68	183.1	“
30	56.57	130.26	“	48.5*	...	...	“ +$Na_2S_2O_3.H_2O$(III)
30.22*	...	...	“+$Na_2S_2O_3.4H_2O$(II)	47.5	64.78	183.9	$Na_2S_2O_3.H_2O$(III)
33.5	58.59	141.48	$Na_2S_2O_3.4H_2O$(II)	50	65.3	188.2	“
36.2	60.51	153.23	“	55	66.45	198.1	“
36.6	62.80	168.82	“	60	68.07	213.1	“
40.65*	...	..	“+$Na_2S_2O_3.H_2O$(II)	61*	...	...	“+ $Na_2S_2O_3$

S0

* tr. pt.

t°.	Gms. $Na_2S_2O_3$ per 100 Gms.		Solid Phase.	t°.	Gms. $Na_2S_2O_3$ per 100 Gms.		Solid Phase.
	Sat. Sol.	Water.			Sat. Sol.	Water.	
0	57.63	136	$Na_2S_2O_3.\frac{4}{3}H_2O$ (IV)	30	63.34	172.80	$Na_2S_2O_3.H_2O$ (V)
10	58.49	140.9	“	40	64.75	183.70	“
20	59.57	147.3	“	50	66.58	199.2	“
25	60.35	152.2	“	55	67.59	208.5	“
30	61.03	156.6	“	43*	...	...	“+$Na_2S_2O_3.\frac{1}{2}H_2O$(V)
40	62.95	169.9	“	25	64.21	179.4	$Na_2S_2O_3.\frac{1}{2}H_2O$ (V)
50	65.45	189.5	“	40	64.99	185.6	“
55	67.07	203.7	“	50	66.02	194.3	“
58*	...	...	“ +$Na_2S_2O_3$	60	67.4	206.7	“
0	57.63	136	$Na_2S_2O_3.2H_2O$ (V)	70	69.06	223.2	“
10	59.05	144.2	“	70*	...	...	“ +$Na_2S_2O_3$
20	61.02	156.5	“	40	67.4	206.7	$Na_2S_2O_3$
25	62.30	165.3	“	50	67.76	210.2	“
30	63.56	174.4	“	60	68.48	217.3	“
35	65.27	188	“	70	69.05	223.1	“
27.5*	...	...	“ +$Na_2S_2O_3.H_2O$ (V)	80	69.86	231.8	“

* tr. pt.

The authors adopted a new system of naming the hydrates, based upon their mutual transition relations. These transitions occur in such a way that the members of one group undergo transition into members of the same group and not into members of another group. Those hydrates belonging to group (I) are called primary hydrates, those belonging to group (II) are called secondary and those belonging to the (III), (IV) and (V) groups are called tertiary, quaternary and quintary respectively.

Commercial sodium thiosulfate is the primary pentahydrate, $Na_2S_2O_3.5H_2O$ (I).

SODIUM THIOSULFATE $Na_2S_2O_3.5H_2O$ (I).

SOLUBILITY OF SODIUM THIOSULFATE IN WATER. (Picon, 1924.)

This entire system has been reinvestigated by a method of determination involving the reheating of previously crystallized mixtures of accurately weighed amounts of the constituents, and observing the temperature of dissapearance of the last crystal. The results are, with few exceptions, in very good agreement with the determinations of Young and Burke, 1904, 1906 (« Solubilities », page 674-675) made by the direct analysis of saturated solutions. The present results are given in terms of gram molecules of $Na_2S_2O_3$ per 100 gram. molecules of the mixture.

t°.	Mol. °/₀ $Na_2S_2O_3$.
Ice Curve.	
—1.8...	0.85
—4.3...	2.09
—6.8...	3.40
—8.6...	4.14
—10.0...	4.50
—10.6...	4.71
—14.0...	5.70
—17.5...	6.56
—22.5...	7.25
$Na_2S_2O_3.12H_2O$ (II) Curve.	
—16.5...	7.49
—16.3...	8.02
$Na_2S_2O_3.10H_2O$ (I) Curve.	
—13.9...	6.01
—11.5...	6.34

t°.	Mol. °/₀ $Na_2S_2O_3$.
$Na_2S_2O_3.10H_2O$ (I) Curve.	
—10.5...	6.56
—9.5...	7.0
—9.0...	7.25
—8.6...	7.49
—8.2...	8.02
—7.9...	8.45
$Na_2S_2O_3.6H_2O$ (II) Curve.	
—16.0...	6.24
—13.0...	6.56
—9.5...	7.00
—3.0...	8.02
—0.5...	8.45
+3.4...	9.00
8.0...	10.00
12.9...	11.92

t°.	Mol. °/₀ $Na_2S_2O_3$.
$Na_2S_2O_3.5H_2O$ (II) Curve.	
—14.0...	6.34
—9.0...	6.56
—2.0...	7.03
+2.5...	7.56
5.4...	7.98
14.5...	8.98
20.8...	10.00
25.5...	10.98
28.1...	11.92
30.1...	13.01
$Na_2S_2O_3.5H_2O$ (I) Curve.	
—4.8...	4.92
—3.4...	4.94
—1.0...	5.21
+3.6...	5.66
4.5...	5.73
8.5...	6.02

t°.	Mol. °/₀ $Na_2S_2O_3$.
$Na_2S_2O_3.5H_2O$ (I) Curve.	
9.75...	6.23
12.7....	6.43
15.7....	6.87
18.4....	7.01
23.1....	7.64
25.8....	8.02
31.0....	8.59
37.6....	9.68
41.5....	10.97
45.5....	12.50
46.9....	13.46
47.8....	14.28
48.0....	15.02
48.2....	15.72
48.3....	16.55
48.6....	17.35
48.0....	17.80
48.0....	18.15

t°.	Mol. °/₀ $Na_2S_2O_3$.
$Na_2S_2O_3.4H_2O$ (II) Curve.	
34.9...	14.23
37.9...	15.00
39.0...	16.05
40.0...	16.74
40.1...	17.23
$Na_2S_2O_3.2H_2O$ (I) Curve.	
49.6...	15.57
56.7...	16.81
59.0...	17.40
61.3...	18.23
62.3...	18.30
64.9...	19.20
65.0...	19.20
65.5...	19.40
66.0...	19.51
66.5...	19.68
66.8...	19.71
$Na_2S_2O_3.H_2O$ (II) Curve.	
46.2...	17.06
51.9...	18.08

t°.	Mol. °/₀ $Na_2S_2O_3$.
$Na_2S_2O_3.H_2O$ (II) Curve.	
52.5...	18.10
59.0...	19.20
59.5...	19.34
61.4...	19.75
62.4...	19.84
63.5...	20.19
65.4...	20.48
66.5...	20.79
66.8...	20.86
67.5...	21.17
69.1...	21.39
69.5...	21.64
$Na_2S_2O_3.H_2O$ (I) Curve.	
45.6...	17.92
49.5...	18.49
51.5...	18.62
53.5...	19.05
55.5...	19.33
57.5...	19.61
59.0...	19.84

t°.	Mol. °/₀ $Na_2S_2O_3$.
$Na_2S_2O_3.H_2O$ (I) Curve.	
60.5...	20.06
61.7...	20.22
63.75..	20.64
65.0...	20.84
70.0...	21.86
71.5...	22.17
72.0...	22.26
72.5...	22.45
$Na_2S_2O_3.\frac{1}{2}H_2O$ (I) Curve.	
59.5...	18.77
63.5...	19.06
65.0...	19.32
66.5...	19.40
67.2...	19.44
69.5...	19.75
70.0...	19.80
72.0...	20.07
75.0...	20.44
76.0...	20.72
88.0...	22.26

t°.	Mol. °/₀ $Na_2S_2O_3$.
$Na_2S_2O_3$ Curve.	
61.0...	19.69
61.7...	19.72
67.0...	19.90
68.0...	19.94
68.5...	19.96
69.5...	19.98
69.8...	20.08
74.0...	20.22
74.6...	20.29
76.5...	20.42
79.75..	20.48
83.0...	20.80
88.0...	20.97
91.0...	21.19
93.5...	21.30
97.0...	21.58
107.0...	22.32
112.0...	22.60
112.5...	22.69
114.5...	22.91

100 gms. alcohol dissolve 0.0025 gm. $Na_2S_2O_3$ and 0.0034 gm. $Na_2S_2O_3.5H_2O$ at room temperature. (Bödtker, 1897.)

100 gms. alcohol of 0.941 Sp. Gr. dissolve 33.3 gms. sodium thiosulfate at 15.5°.

Data for the lowering of the freezing-point of $Na_2S_2O_3.5H_2O$ by each of the following compounds: urea, glucose, cane sugar, NaCl, $NaClO_3$, $NaNO_3$ and Na_2SO_4 are given by Boutaric (1911).

EQUILIBRIUM IN THE SYSTEM SODIUM THIOSULFATE, ETHYL ALCOHOL AND WATER AT 20°.

(Dolique, 1934.)

Results determined by analysis of saturated solutions prepared by shaking together $Na_2S_2O_3.5H_2O$, and aqueous ethyl alcohol solutions containing various concentrations of C_2H_5OH by volume.

SO

Vol. percent C_2H_5OH in solvent used		Volume of liquid layers	d. of liquid layers	Gms. per 100 gms. liquid layer $Na_2S_2O_3$	Gms. per 100 gms. liquid layer C_2H_5OH
10	(no separation)		1.344	36.70	4.0
20	Upper layer	7.9 cc	0.876	1.2	50.31
	Lower layer	92.1 "	1.338	36.9	5.2
30	Upper layer	21.6 "	0.899	1.128	51.6
	Lower layer	78.4 "	1.338	36.90	4.8
40	Upper layer	34.8 "	0.901	1.15	53.17
	Lower layer	65.2 "	1.337	36.85	4.3
50	Upper layer	52.8 "	0.898	1.10	56.7
	Lower layer	47.2 "	1.342	36.85	4.3
60	Upper layer	73.8 "	0.898	1.02	56.9
	Lower layer	26.2 "	1.341	36.85	4.3
70	(no separation)		0.895	0.967	62.0
80	"	"	0.864	0.230	73.5
90	"	"	0.834	0.0146	85.7

Results determined by the systhetic method; that is by titrating known aqueous solutions of thiosulfate with known amounts of alcohol to appearance of clouding.

Gms. per 100 gms. homogeneous mixture $Na_2S_2O_3$	H_2O	C_2H_5OH
28.31	62.85	8.83
24.82	63.0	11.87
16.77	61.64	21.59
7.73	57.23	35.04
6.72	55.96	37.18
6.10	55.44	38.46
5.84	54.76	39.40

Gms. per 100 gms. homogeneous mixture Na_2SO_4	H_2O	C_2H_5OH
4.85	53.37	41.76
3.90	51.10	45.00
3.18	40.22	47.60
1.93	43.81	54.26
0.93	36.56	62.51
0.92	31.94	67.12
0.41	29.00	70.58

The binodal curves and plait points of the systems:
Sodium Thiosulfate + Allyl Alcohol + Water at 25°
and Sodium Thiosulfate + Pyridine + Water at 25° have been determined respectively by Ginnings and Dees, 1935, and Ginnings, Webb and Hinohara, 1933, but the experimental results are not given but only the values of a series of constants calculated by empirical equations.

An aqueous solution simultaneously saturated with Sodium Thiosulfate and Urethan, contains 4.79 gm. mols. $Na_2S_2O_3$ + 0.132 gm. mols. $NH_2COOC_2H_5$ per 1000 gms. H_2O at 25°. (Palitzsch, 1928, 1929.)

SODIUM Di THIONATE $Na_2S_2O_6.2H_2O$.

SOLUBILITY OF SODIUM DI THIONATE IN WATER.

(Ishikawa and Oku, 1927.)

t°	d. of sat. sol.	Gms. $Na_2S_2O_6$ per 100 gms. H_2O	Solid Phase	t°	d. of sat. sol.	Gms. $Na_2S_2O_6$ per 100 gms. H_2O	Solid Phase
-1.36	—	5.72	$Na_2S_2O_6.8H_2O$	5	—	9.34*	$Na_2S_2O_6.2H_2O$
-0.73	—	5.94	"	10	1.0773	11.12	"
-0.49	—	6.04	"	20	1.0984	15.12	"
0.0	—	6.27	"+$Na_2S_2O_6.6H_2O$	30	1.1216	19.63	"
+1.0	—	6.62	$Na_2S_2O_6.6H_2O$	40	1.1460	24.69	"
3.0	1.054	7.49	" "	50	1.1705	30.17	"
5.0	1.056	8.47	"	60	1.1920	36.07	"
7.5	1.068	9.82	"	70	1.2191	42.48	"
9.1	—	10.80	"+$Na_2S_2O_6.2H_2O$	80	1.2425	49.26	"
10.0	—	11.34*	"	90	1.2711	56.29	"
0	1.0565	7.83*	$Na_2S_2O_6.2H_2O$	100	1.2981	64.74	"

* Metastable.

100 gms. sat. solution of sodium dithionate in water contain 6.05 gms. $Na_2S_2O_6$ at 0°, 10.63 gms. at 12°, 13.39 gms at 20° and 17.32 gms. at 30°. (de Baat, 1926.)

SOLUBILITY OF SODIUM DITHIONATE IN AQUEOUS SOLUTIONS OF STRONTIUM DITHIONATE AT 30° AND VICE VERSA. (de Baat, 1926.)

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
$Na_2S_2O_6$.	SrS_2O_6.	Solid Phase.	$Na_2S_2O_6$.	SrS_2O_6.	Solid Phase.
17.32	0.0	$Na_2S_2O_6.2H_2O$	6.91	12.24	$SrS_2O_6.4H_2O$
14.52	5.55	»	0.0	14.90	»
13.06	10.09	» +$SrS_2O_6.4H_2O$			

SO

SODIUM Poly THIONATE Tri ($Na_2S_3O_6.3H_2O$; Tetra ($Na_2S_4O_4.2H_2O$) Penta ($Na_2S_5O_6.2H_2O$.

EQUILIBRIUM IN THE SYSTEM SODIUM TRI THIONATE, SODIUM TETRA THIONATE AND WATER.

(Kurtenacker and Laszlo, 1938.)

Results at 0°

Gms. per 100 gms. sat. sol.		Solid Phase
$Na_2S_3O_6$	$Na_2S_4O_6$	
37.8	0.0	S_3
37.6	0.4	"
36.6	3.9	"
36.7	5.6	"
34.4	16.2	"
32.8	20.8	" + S_4
30.9	21.0	S_4
28.6	22.4	"
20.6	26.9	"
16.6	28.2	"
11.9	33.7	"
2.9	39.8	"
0.6	41.3	"
59.0 (30°)	0.0	S_3

Results at 20°

Gms. per 100 gms. sat. sol.			Solid Phase
$Na_2S_3O_6$	$Na_2S_4O_6$	$Na_2S_5O_6$	
52.9	0.0	0.0	S_3
52.2	0.6	0.0	"
46.7	6.4	0.4	"
43.1	12.7	0.7	"
40.0	17.8	1.1	"
38.8	19.3	1.6	" +S_4
34.0	21.6	2.8	S_4
25.3	27.3	2.2	"
21.3	30.5	3.4	"
12.1	37.9	2.3	"
9.8	40.4	3.2	"
5.1	45.8	2.0	"
1.4	49.7	0.5	"
0.0	50.4	—	"
0.0	55.0 (30°)	—	"

S_3 = $Na_2S_3O_6.3H_2O$; S_4 = $Na_2S_4O_6.2H_2O$.

SODIUM Poly THIONATES

EQUILIBRIUM IN THE SYSTEM SODIUM TETRA THIONATE, SODIUM PENTA THIONATE AND WATER.

(Kurtenacker and Laszlo, 1938.)

SO

Results at 0°

Gms. per 100 gms. sat. sol. $Na_2S_4O_6$	$Na_2S_5O_6$	Solid Phase
27.8	12.5	$Na_2S_4O_6 \cdot 2H_2O$
23.5	17.9	"
22.5	19.8	" + $Na_2S_6O_6 \cdot 2H_2O$
17.5	21.2	$Na_2S_5O_6 \cdot 2H_2O$
14.8	22.1	"
6.5	27.2	"
4.5	29.2	"
0.0	32.9	"

Results at 20°

Gms. per 100 gms. sat. sol. $Na_2S_4O_6$	$Na_2S_5O_6$	Solid Phase
44.0	8.8	$Na_2S_4O_6 \cdot 2H_2O$
34.6	10.9	"
33.0	13.3	"
28.0	19.6	"
25.2	23.3	" + $Na_2S_5O_6 \cdot 2H_2O$
21.4	23.2	$Na_2S_5O_6 \cdot 2H_2O$
15.3	29.8	"
1.9	49.2	"
0.0	52.0	"

SODIUM Dihydro Pyro ANTIMONATE $Na_2H_2Sb_2O_7$.

100 gms. sat. solution of Sodium Dihydro Pyro Antimonate in Water contain 0.0564 gms. $Na_2H_2Sb_2O_7$ at 18°, 0.0738 gm. at 25° and 0.1018 gm. at 33.5°. (Tomula, 1921.)

SODIUM SulfoANTIMONATE $Na_3SbS_4.9H_2O$.

SbS

SOLUBILITY IN WATER.

(Donk, 1908.)

t°.	Gms. Na_3SbS_4 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. Na_3SbS_4 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. Na_3SbS_4 per 100 Gms. Sat. Sol.	Solid Phase.
−0.1	0.5	Ice	−1.75	11.2	Ice	49.6	38.9	$Na_3SbS_4.9H_2O$
−0.65	4	"	0	11.8	$Na_3SbS_4.9H_2O$	59.6	45	"
−0.9	5.7	"	15	19.3	"	69.6	50.7	"
−1.26	7.8	"	30	27.1	"	79.5	57.1	"
−1.45	9.2	"	38	32	"			

SOLUBILITY OF SODIUM SULFOANTIMONATE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE AT 30°.

(Donk, 1908.)

Gms. per 100 Gms. Sat. Sol. Na_3SbS_4.	NaOH.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. Na_3SbS_4.	NaOH.	Solid Phase.
27.1	0	$Na_3SbS_4.9H_2O$	16.4	42.6	$Na_3SbS_4.9H_2O$
13	9.9	"	17.7	47.2	"+$NaOH.H_2O$
5.9	24.8	"	9.1	49.5	$NaOH.H_2O$
10.5	32.9	"	0	54.3	

Solubility of Sodium Sulfoantimonate in Aqueous Solutions of Sodium Thiosulfate.

(Donk, 1908.)

Results at 0°.

Gms. per 100 Gms. Sat. Sol. Na_3SbS_4.	Gms. per 100 Gms. Sat. Sol. $Na_2S_2O_3$.	Solid Phase.
11.8	0	$Na_3SbS_4.9H_2O$
4.4	4.9	"
0.8	14.6	"
0.1	27.3	"
0	33.6	" $+Na_2S_2O_3.5H_2O$
0	33.6	$Na_2S_2O_3.5H_2O$

Results at 30°.

Gms. per 100 Gms. Sat. Sol. Na_3SbS_4.	Gms. per 100 Gms. Sat. Sol. $Na_2S_2O_3$.	Solid Phase.
19.9	7.7	$Na_3SbS_4.9H_2O$
12.5	16.4	"
4.2	37.7	"
1	43.8	"
1	47	"
1	47.8	" $+Na_2S_2O_3.5H_2O$
0	45.8	$Na_2S_2O_3.5H_2O$

Solubility of Sodium Sulfoantimonate in Aqueous Ethyl Alcohol.

(Donk, 1908.)

Results at 0°. Gms. per 100 Gms. Sat. Sol. Na_3SbS_4.	C_2H_5OH.	Results at 30°. Gms. per 100 Gms. Sat. Sol. Na_3SbS_4.	C_2H_5OH.	Results at 65°. Gms. per 100 Gms. Sat. Sol. Na_3SbS_4.	C_2H_5OH.
11.8	0	19.3	5	47.9	0
8.2	3.7	14.6	10.3	39.3	4.7
3.2	12.7	6.4	24.8	36.5	8*
0.9	29	1.2	46	4.1	54.1*
0	60.8	0	76.2	0	81

* Two liquid layers separate between these concentrations of alcohol. The composition of several of these conjoined layers is as follows:

Gms. per 100 Gms. Alcoholic Layer. Na_3SbS_4.	C_2H_5OH.	Gms. per 100 Gms. Aqueous Layer. Na_3SbS_4.	C_2H_5OH.
4.1	54.1	36.5	8
10.2	40.4	27.8	14.3
14.1	33.5	24.1	18.8
...	0	18	27.2

The solid phase in contact with each of the above solutions is $Na_3SbS_4.9H_2O$.

Solubility of Sodium Sulfoantimonate in Aqueous Methyl Alcohol.

(Donk, 1908.)

Results at 0°.

Gms. per 100 Gms. Sat. Sol. Na_3SbS_4.	Gms. per 100 Gms. Sat. Sol. CH_3OH.	Solid Phase.
8.6	3.4	$Na_3SbS_4.9H_2O$
2.8	15.5	"
2.1	23.1	"
0.3	50.3	"
0.1	57	"
0.05	81.7	"
0.2	92	"
2	95.9	"

Results at 30°.

Gms. per 100 Gms. Sat. Sol. Na_3SbS_4.	Gms. per 100 Gms. Sat. Sol. CH_3OH.	Solid Phase.
27.1	0	$Na_3SbS_4.9H_2O$
12.8	18.1	"
5.8	33.1	"
0.1	65.7	"
0.1	84.2	"
1.2	91.2	"
3.9	94	"

SODIUM SELENITE $Na_2SeO_3.5H_2O$.

SOLUBILITY OF SODIUM SELENITE IN WATER.

(Janitski, 1932.)

t°	Gms. Na_2SeO_3 per 100 gms. sat. sol.	Solid Phase	t°	Gms. Na_2SeO_3 per 100 gms. sat. sol.	Solid Phase
-20.5	38.8	Ice + $Na_2SeO_3.8H_2O$	+16.3	45.48	$Na_2SeO_3.5H_2O$
-15	40.0	$Na_2SeO_3.8H_2O$	19.5	46.12	"
-10	41.58	"	24.4	47.28	"
- 8.7	—	" + $Na_2SeO_3.5H_2O$	30.4	48.27	"
- 8.0	42.9*	"	34.7	49.40	"
-28.1	41.6*	Ice + $Na_2SeO_3.5H_2O$	40.5	50.90*	"
-20.6	41.88*	$Na_2SeO_3.5H_2O$	35.9	—	" + Na_2SeO_3
-15	42.11*	"	46.8	48.76	Na_2SeO_3
-10.5	42.13*	"	54.4	48.14	"
- 6.8	42.4	"	67.6	47.15	"
- 0.5	43.9	"	89.1	45.93	"
			103.3	45.30	"

In a later paper Janickis and Gutmanite, 1936, give results for the freezing-points of aqueous solutions of $Na_2SeO_3.8H_2O$.

SODIUM Acid SELENITES Bi($NaHSeO_3 \cdot 3H_2O$), Pyro ($Na_2Se_2O_5$).

SOLUBILITY OF SODIUM ACID SELENITES IN WATER.

(Janitski, 1932.)

SeO

t°	Gms. $Na_2Se_2O_5$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Na_2Se_2O_5$ per 100 gms. sat. sol.	Solid Phase
-9.3	31.66 (33.66)	Ice + $NaHSeO_3.3H_2O$	40.1	64.27	$NaHSeO_3$
0	38.45	$NaHSeO_3 \cdot 3H_2O$	50.0	65.98	"
+8.1	43.97	"	59.9	67.40	"
14.6	49.19	"	79.2	72.26	"
20.0	54.02	"	89.0	74.76	"
25.4	60.32	"	93.0	75.8	" + $Na_2Se_2O_5$
27.1	62.52	" + $NaHSeO_3$	96	76.05	$Na_2Se_2O_5$
28.8	62.88	$NaHSeO_3$	101.4	76.61	"
32.0	63.14	"	109.5	77.57	"

The freezing-points of aqueous solutions of $NaHSeO_3 \cdot 3H_2O$ are given by Janickis and Gutmanaite, 1936.

SODIUM Tetra SELENITE $NaH_3(SeO_3)_2$.

SOLUBILITY OF SODIUM TETRA SELENITE IN WATER.

(Janitski, 1932.)

t°	Gms. $NaH_3(SeO_3)_2$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. NaH_3SeO_3 per 100 gms. sat. sol.	Solid Phase
-7.5	36.5	Ice + NaH_3SeO_3	32.0	58.17	NaH_3SeO_3
-6.9	37.12	NaH_3SeO_3	51.3	67.42	"
-0.7	41.50	"	69.6	75.88	"
13.5	48.83	"	79.2	80.93	"
22.8	53.42	"	83.0	83.95	"

The freezing-points of aqueous solutions of $NaH_3(SeO_3)_2$ are given by Janickis and Gutmanaite, 1936.

SODIUM SELENATE $Na_2SeO_4.10H_2O$.

SOLUBILITY IN WATER. (Funk, 1900a.)

t°.	Gms. Na_2SeO_4 per 100 Gms. Solution.	Mols. Na_2SeO_4 per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. Na_2SeO_4 per 100 Gms. Solution.	Mols. Na_2SeO_4 per 100 Mols. H_2O.	Solid Phase.
0	11.74	1.26	$Na_2SeO_4.10H_2O$	35.2	45.47	7.94	Na_2SeO_4
15	25.01	3.18	"	39.5	45.26	7.87	"
18	29.00	3.90	"	50	44.49	7.63	"
25.2	36.91	5.57	"	75	42.83	7.14	"
27	39.18	6.13	"	100	42.14	6.93	"
30	44.05	7.50	"				

Sp. Gr. of saturated solution at 18° = 1.315.

The above results were confirmed by Meyer and Aulich, 1928, and the transition point of $Na_2SeO_4.10H_2O \rightarrow Na_2SeO_4$ found to be at 31.8°.

The following results for the solubility of Na_2SeO_4 in water at temperatures above 75° are given by Smits and Mazee, 1928.) SeO

t^0	Gms. Na_2SeO_4 per 100 gms. sat. sol.	Gm. Mols. percent Na_2SeO_4 in sat. sol.	t^0	Gms. Na_2SeO_4 per 100 gms. sat. sol.	Gm. Mols. percent Na_2SeO_4 in sat. sol.
76	43.0	6.7	269	42.6	6.6
86	42.2	6.5	274	43.0	6.7
107	41.8	6.4	333	46.1	7.6
232	41.8	6.4	372	48.7	8.3
262	42.2	6.5	777 m.pt.	100.0	100

SODIUM Neodymium SELENATE $NaNd(SeO_4)_2.2H_2O$.

100 gms. H_2O dissolve about 7 gms. of the salt (? anhydrous) at 0° and 7 gms. at 20°. (Meyer, Julius and Kittlemann, 1931.)

SODIUM SILICATE $Na_2SiO_3.9H_2O$. SiO

SOLUBILITY IN AQUEOUS SODIUM HYDROXIDE AND SODIUM CHLORIDE SOLUTIONS. (Vesterberg, 1912.)

Solvent.	t°.	d_{17} of Sat. Sol.	Gms. per 100 cc. Sat. Solution.			
			Na_2O.	SiO_2 =	$Na_2SiO_3.9H_2O$.	NaCl.
Approx. 0.5 *n* NaOH	17.5	1.129	6.942	5.419 =	25.56	...
" " NaCl	17.5	1.150	7.347	7.172	33.83	2.207
Saturated NaCl Solution	19	1.258	4.563	4.376	20.64	27.91

Solid phase $Na_2SiO_3.9H_2O$ in each case.

EQUILIBRIUM IN THE SYSTEM SODIUM OXIDE, SILICA AND WATER AT 25°.

(Harman, 1927.)

The mixtures composed of Na_2SiO_3, $Na_2O.2SiO_2$, $Na_2O.3SiO_2$, silicate solutions, caustic soda and water, were stirred in hard glass vessels while protected from the CO_2 of the atmosphere, for periods of 8-14 days. In the cases of the saturated solutions too viscous to be filtered the clearest portions were centrifuged for a couple of days and the almost but still slightly cloudy supernatant solution used for analysis. Solutions having a composition of $Na_2O:SiO_2$ in excess of the ration 1:3 set to gels which could be moulded into elastic balls.

Gms. per 100 gms. sat. sol. Na_2O	Gms. per 100 gms. sat. sol. SiO_2	Solid Phase	Gms. per 100 gms. sat. sol. Na_2O	Gms. per 100 gms. sat. sol. SiO_2	Solid Phase
53.45	—	$NaOH.H_2O$	13.70	1.19	$Na_2SiO_3.9H_2O$
44.78	0.85	Na_2SiO_3	9.45	2.22	"
36.39	0.44	"	9.37	8.74	"
35.54	2.94	$Na_2SiO_3.2\frac{1}{2}H_2O$	14.11	19.65	"
33.02	2.92	$Na_2SiO_3.6H_2O$	19.32	31.33	"
29.58	1.90	"	18	33	$Na_2.2SiO_2.9H_2O$
27.54	1.84	"	10.52	28.8	"
24.48	1.34	$Na_2SiO_3.9H_2O$	11.0	38	"

Due to experimental difficulties the results for $Na_2O.2SiO_2.9H_2O$ are of uncertain accuracy.

Fusion-point data for Na_2SiO_3 + $SrSiO_3$ are given by Wallace, 1909
Results for Na_2SiO_3 + Na_2WO_4 are given by van Klooster, 1910-11.

SODIUM STANNATE $Na_2Sn(OH)_6$.

SnO

SOLUBILITY OF SODIUM STANNATE IN WATER.

(Zocher, 1920.)

t°	Gms. $Na_2Sn(OH)_6$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $NaSn(OH)_6$ per 100 gms. sat. sol.	Solid Phase
- 5	31.8	$Na_2Sn(OH)_6$	- 5	32.4	$Na_2Sn(OH)_6.H_2O$
0	31.5	"	0	33.2	"
+21	30.4	"	+21	35.4	"
25	30.3	"	25	36.5	"
35	29.4	"	35	37.5	"
45	26.6	"	45	39.2	"
			50	41.1	"

SOLUBILITY OF SODIUM STANNATE IN WATER.

(Reiff and Toussaint, 1939.)

t°	Gms. per 100 cc sat. sol. $Na_2[Sn(OH)_6]$	Gms. per 100 cc sat. sol. free NaOH	Solid Phase	t°	Gms. per 100 cc sat. sol. $Na[Sn(OH)_6]$	Gms. per 100 cc sat. sol. free NaOH	Solid Phase
0	52.0	0.0	$Na_2Sn(OH)_2$	60	37.0	2.5	$Na_2[Sn(OH)_6]$+ $Sn(OH)_4$
20	46.0	0.2	"				
25	43.5	1.0	"	80	33.0	5.0	" + "
40	41.5	1.5	"	100	30.0	7.0	" + "
				120	27.0	10.0	" + "

SOLUBILITY OF SODIUM STANNATE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE AND OF SODIUM CARBONATE.

(Reiff and Toussaint, 1939.)

The following approximate results were taken from the authors diagram

t°	Gms. $Na_2[Sn(OH)_6]$ per 100 cc sat. solution in Aqueous : 5 Percent NaOH	10 Percent NaOH	20 Percent NaOH	30 Percent NaOH	10 Percent Na_2CO_3
0	35	22.5	7	0.5	40
20	31	19	5.5	0.6	35.5
40	26	16	4.5	0.7	31
60	23	13.5	4.0	1.0	29
80	21	11.5	3.5	1.2	26.5
100	19.5	11.0	4.0	1.5	24.5
120	18.5	11.5	5.5	2.0	23.0

SOLUBILITY OF SODIUM STANNATE IN AQUEOUS 1.97 NORMAL SOLUTION OF VARIOUS SODIUM SALTS AT 18°.

SnO

(Reiff and Toussaint, 1939.)

Aqueous 1.97 Normal Solution of:	Gms. $Na_2[Sn(OH)_6]$ per 100 cc sat. sol.	Aqueous 1.97 Normal Solution of:	Gms. $Na_2[Sn(OH)_6]$ per 100 cc sat. sol.
CH_3COONa	20.7	Na_2SO_3	35.0
NaOH	25.0	Na_2WO_4	35.0
NaF	28.8	$NaNO_3$	35.3
$NaClO_4$	30.1	NaBr	37.0
NaCl	31.5	Na_2CrO_4	37.5
NaI	33.0	Na_2SO_4	38.0
Na_2CO_3	34.8		

SODIUM TELLURIDE Na_2Te.

Fusion-point data for the system Na_2Te + Te are given by Kraus and Glass, 1929.

SODIUM TELLURATE $Na_2TeO_4.2H_2O$.

100 gms. H_2O dissolve 0.77 gm. Na_2TeO_4 at 18°, and 2 gms. at 100°. Solid phase $Na_2TeO_4.2H_2O$.

100 gms. H_2O dissolve 1.43 gms. Na_2TeO_4 at 18°, and 2.5 gms. at 50°. Solid phase $Na_2TeO_4.4H_2O$.

(Mylius, 1901.)

VO

SODIUM MetaVANADATE $NaVO_3$.

SOLUBILITY IN WATER.

(MacAdam and Pierle, 1912.)

t°.	Gms. $NaVO_3$ per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. $NaVO_3$ per 100 Gms. H_2O.	Solid Phase.
25	21.10	$NaVO_3$	25	15.3	$NaVO_3.2H_2O$
40	26.23	"	40	30.2	"
60	32.97	"	60	68.4	"
75	38.83	"	75	38.8	$NaVO_3$

Considerable time was required for attainment of equilibrium. The two solid phases appear to exist for the whole rage of temperature and the conditions for the transformation of one into the other were not ascertained.

SODIUM Meta VANADATE $NaVO_3$.

EQUILIBRIUM IN THE SYSTEM SODIUM OXIDE, VANADIUM PENTOXIDE AND WATER AT 30°.

(Kiehl and Manfredo, 1937.)

VO

d. of sat. sol.	Gm. Mols. per 100 gm. mols. sat. sol. V_2O_5	Gm. Mols. per 100 gm. mols. sat. sol. Na_2O	Solid Phase
0.996	0.010	—	$V_2O_5.xH_2O$
0.9955	0.004	0.002	$V_2O_5.xH_2O.xyH_2O$
0.9979	0.03	0.026	" "
1.039	0.46	0.24	" "
1.163	1.73	1.30	" "
1.236	2.54	1.55	$V_2O_5+Na_4V_6O_{17}.12H_2O$
1.219	2.34	1.58	$Na_4V_6O_{17}.13H_2O$
1.208	2.22	1.68	" $+NaVO_3.2H_2O$
1.187	1.95	1.53	$NaVO_3.2H_2O$
1.148	1.57	1.37	"
1.110	1.21	1.23	"
1.151	1.50	1.69	"
1.265	2.36	3.19	"
1.418	3.60	5.50	"
1.536	4.57	7.55	" $+Na_4V_2O_7.18H_2O$
1.460	3.76	6.47	$Na_4V_2O_7.18H_2O$
1.363	2.56	4.93	"
1.352	2.32	4.46	"
1.367	2.31	5.08	$Na_4V_2O_7.18H_2O$
1.379	2.42	5.60	" $+Na_3VO_4.12H_2O$
1.278	1.55	4.19	$Na_3VO_4.12H_2O$
1.228	1.12	3.54	"
1.172	0.67	2.97	"
1.151	0.40	2.87	"
1.151	0.22	3.19	"
1.153	0.21	3.26	"
1.165	0.14	3.66	"
1.183	0.11	4.04	"
1.208	0.08	4.76	"
1.312	0.06	7.55	" $+Na_3VO_4.7H_2O$
1.337	0.04	8.39	$Na_3VO_4.7H_2O$
1.411	0.03	10.94	"
1.478	0.06	13.39	"
1.472	0.08	13.99	" $+Na_3VO_4.2H_2O$
1.519	0.08	15.23	$Na_3VO_4.2H_2O$
1.557	0.08	16.96	"
1.549	0.00	16.81	"

Fusion-point data for mixtures of $Na_2O + V_2O_5$ are given by Canneri, 1928.

SODIUM TUNGSTATE $Na_2WO_4.2H_2O$.

SOLUBILITY IN WATER.

(Funk, 1900a.)

WO

t°.	Gms. Na_2WO_4 per 100 Gms. Solution.	Mols. Na_2WO_4 per 100 Mols. H_2O.	Solid Phase.
−5	30.60	2.70	$Na_2WO_4.10H_2O$
−4	31.87	2.86	"
−3.5	32.98	3.01	"
−2	34.52	3.23	"
0	36.54	3.52	"
+3	39.20	3.95	"
5	41.02	4.26	"
−3.5	41.67	4.37	$Na_2WO_4.2H_2O$
+0.5	41.73	4.39	"
18	42.0	4.40	"
21	42.27	4.48	"
43.5	43.98	4.81	"
80.5	47.65	5.57	"
100	49.31	5.95	"

Sp. Gr. of sat. solution at 18° = 1.573. For Sp. Gr. determinations of aqueous solutions at 20°, see Pawlewski, 1900.

Fusion-point data for $Na_2WO_4 + WO_3$ are given by Parravano (1909); by Van Liempt, 1925; and by Hoermann, 1929.

SODIUM Para TUNGSTATE $5Na_2O.12WO_3.28H_2O$.

SOLUBILITY OF SODIUM PARA TUNGSTATE IN WATER.

(Vallance, 1931; Rosenheim and Wolff, 1930.)

The original results in each case were plotted and the following figures taken from the curves. The solid phase was $5Na_2O.12WO_3.28H_2O$ in each case.

t°	Gms. $5Na_2O.12WO_3$ per 100 gms. sat. sol.		t°	Gms. $5Na_2O.12WO_3$ per 100 gms. sat. sol.	
	(V)	(R & W)		(V)	(R & W)
0	2.1	2.10	50	26.5	21.0
10	4.2	4.2	60	35.0	28.0
20	7.5	7.5	70	43.0	35.0
25	9.0	9.0	80	52.0	—
30	11.4	10.7	90	61.0	—
40	18.0	15.0	100	70.0	—

WO

SODIUM ZINCATE $Na_2O.ZnO.4H_2O$.

EQUILIBRIUM IN THE SYSTEM SODIUM OXIDE, ZINC OXIDE AND WATER AT 30°

(Goudriaan, 1919, 1920.)

Especially carefully purified materials were used. The solid phases were determined by the rest method of Schreinemakers. At the zinc hydroxide end of the curve crystallized Zn $(OH)_2$ was used as solid phase and about two weeks allowed for the attainment of final equilibrium.

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
Na_2O.	ZnO.		Na_2O.	ZnO.	
11.8	2.6	ZnO	39.4	9.0	$Na_2O.3H_2O$
17.4	5.0	»	39.6	7.2	»
23.7	11.3	»	40.7	2.0	»
27.3	16.0	»	40.5	1.6	»
27.8	16:5	» + $Na_2O.ZnO.4H_2O$	40.9	1.1	»
28.0	14.9	$Na_2O.ZnO.4H_2O$	41.9	0.0	»
30.1	13.2	»	24.6	12.5	ZnO
31.8	11.7	»	19.9	15.2	$Zn(OH)_2$
33.2	11.2	»	13.7	7.2	»
34.7	10.4	»	10.1	4.7	»
36.1	10.2	»	4.6	1.0	»
39.2	9.7	» + $Na_2O.3H_2O$	4.5	0.4	ZnO

ZnO

More recent determinations of the equilibrium in this system, differing more or less from the above, are given by Müller, Müller and Fauvel, 1927, and by Scholder and Hendrich, 1939. These latter investigators found that at 20° the solid phase at concentrations of NaOH between 1 and 13.4 normality, was ZnO. At concentrations between 13.5 and 19.6 normality it was $Na[Zn(OH)_3]$ and at concentrations be- 19.6 and 20.1 it was $Na_2[Zn(OH)_4]$. Above 20.1 normality the solid phase consisted of mixtures of $Na_2[Zn(OH)_4]$ and $NaOH.H_2O$. At concentration of NaOH between 7.3 and 13.3 normality there are also present rhombic $Zn(OH)_2$ and $Na_3[Zn(OH)_3].3H_2O$ as metastable solid phases. Less complete results at 30°, 40° and 100° are also given.

SODIUM FluoZIRCONATE $5NaF.ZrF_4$.

100 gms. H_2O dissolve 0.387 gm. at 18°, and 1.67 gms. at 100°. (Marignac, 1861.)

NEODYMIUM BROMATE $Nd(BrO_3)_3.9H_2O$.

SOLUBILITY OF NEODYMIUM BROMATE IN WATER
(James, Fogg, McIntire, Evans and Donovan, 1927.)

Br

t°	Gms. $Nd(BrO_3)_3$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Nd(BrO_3)_3$ per 100 gms. sat. sol.	Solid Phase
0	30.52	$Nd(BrO_3)_3.9H_2O$	25	46.06	$Nd(BrO_3)_3.9H_2O$
5	34.01	"	30	48.77	"
10	37.19	"	35	51.48	"
15	40.30	"	40	53.70	"
20	43.04	"	45	56.90	

NEODYMIUM ACETATE, $Nd(CH_3COO)_3.H_2O$.

100 gms. sat. sol. of neodymium acetate in water contain 20.76 gms. $Nd(CH_3COO)_3$ at 25°. Constant agitation was employed for obtaining saturation.

(Meyer and Müller, 1920.)

NEODYMIUM GLYCOLATE $Nd(C_2H_3O_3)_3$.

One liter H_2O dissolves 4.609 gms. salt at 20°. (Jantsch & Grünkraut, 1912–13.)

CH

NEODYMIUM LACTATE, $Nd(C_3H_5O_3).2\,^1/_2\,H_2O$:

One liter of sat. solution of neodymium lactate in water contains 24.775 gms. $Nd(C_3H_5O_3)_3\,2\,^1/_2\,H_2O$ at 20°. Saturation was secured by constant agitation.

(Jantsch, 1926.)

NEODYMIUM SULFONATES.

SOLUBILITY IN WATER.

Sulfonate.	Formula.	t°.	Gms. Anhydrous Salt per 100 Gms. H_2O.	Authority.
Neodymium:				
m Nitrobenzene	$Nd[C_6H_4(NO_2)SO_3]_3\,6H_2O$	15	46.1	(Holmberg, 1907.)
Bromo Sulfonate	$Nd[C_6H_3Br(1)NO_2(4)SO_3(3)]_3.8H_2O$	25	7.25	(Katz & James, 1913.)

NEODYMIUM COBALTICYANIDE $Nd_2(CoC_6N_6)_2.9H_2O$.

1000 gms. aq. 10% HCl ($d_{15} = 1.05$) dissolve 4.19 gms. salt at 25°. (James & Willand, '16.)

NEODYMIUM Campho CARBONATE $Nd(C_{11}H_{15}O_3)_3$.

CO

SOLUBILITY OF NEODYMIUM CAMPHO CARBONATE IN SEVERAL SOLVENTS AT 15°.
(Picon, 1931.)

Solvent	Gms. $Nd(C_{11}H_{15}O_3)_3$ per 100 cc sat. sol.	Solvent	Gms. $Nd(C_{11}H_{15}O_3)_3$ per 100 cc sat. sol.
Water	0.7	Acetone	6.3
Methyl Alcohol	16.7	Benzene	50.+
Ethyl Alcohol	15.3	Chloroform	50.+
Ethyl Ether	4.9	CCl_4	50.+
Ethyl Acetate	5.9	Carbon DiSulfide	100
		Olive Oil	2.6

NEODYMIUM OXALATE $Nd_2(C_2O_4)_3.10H_2O$.

SOLUBILITY IN WATER AT 25° BY ELECTROLYTIC DETERMINATION.

(Rimbach and Schubert, 1909.)

One liter sat. solution contains 0.0053 mg. equivalents of anhydrous salt = 0.49 milligram.

One liter sat. aqueous solution contains 0.00148 gm. $Nd_2(C_2O_4)_3$ at 25°, determined gravimetrically and 0.00198 determined by electrolytic conductivity. (Sarver and Brinton, 1927.)

SOLUBILITY IN AQUEOUS 20% SOLUTIONS OF METHYL, ETHYL AND TRIETHYL AMINE OXALATES, ROUGHLY DETERMINED. (Grant and James, 1917.)

100 cc. aq. 20% methyl amine oxalate dissolve 0.027 gm. neodymium oxalate.
" " ethyl " " " 0.107 " " "
" " triethyl " " " 0.065 " "

SOLUBILITY OF NEODYMIUM OXALATE IN AQUEOUS SOLUTIONS OF ACIDS AT 25°.

(Sarver and Brinton, 1927.)

Concentration of Aq. Solvent in Normality	Gms. $Nd_2(C_2O_4)_3$ per 100 gms. sat. sol.	Concentration of Aq. Solvent in Normality	Gms. $Nd_2(C_2O_4)_3$ per 100 gms. sat. sol.
0.1008 HCl	0.0076	0.2482 HNO_3	0.0338
0.2576 "	0.0217	1.992 "	0.4287
0.5004 "	0.0442	4.054 "	1.353
1.018 "	0.1260	2.000 " + 0.1 $(COOH)_2$	0.1138
1.484 "	0.2222	3.03 " + 0.1 "	0.4606
2.000 "	0.3318	2.00 " + 0.5 "	0.0195
5.208 "	1.5330	3.03 " + 0.5 "	0.0811
0.978 " + 0.1 $(COOH)_2$	0.0082	4.00 " + 0.5 "	0.2528
2.000 " + 0.1 "	0.0747	4.00 " + sat. "	0.0972
2.865 " + 0.1 "	0.2167	6.00 " + sat. "	0.3413
3.965 " + 0.1 "	0.5570	0.086 H_2SO_4	0.0091
0.978 " + 0.5 "	0.0020	0.419 "	0.0415
2.000 " + 0.5 "	0.0112	0.958 "	0.1037
2.865 " + 0.5 "	0.0352	1.846 "	0.2237
3.965 " + 0.5 "	0.1047	2.612 "	0.3702
1.484 " + sat. "	0.0033		
4.000 " + " "	0.0775		
6.000 " + " "	0.1814		
6.200 " + " "	0.1785		

The determinations were made with very great care. The mixture was constantly rotated for several days.

COO

SOLUBILITY OF NEODYMIUM OXALATE IN AQUEOUS SOLUTIONS OF ACIDS AT 90°.

(Neckers and Kremers, 1928.)

The mixtures were shaken frequently during thirty-six hours.

Concentration of Aq. Solvent		Gms. Nd_2O_3 per 100 cc sat. sol.
Normality HNO_3 +	Percent $(COOH)_2.2H_2O$	
1.25	—	0.8707
2.50	—	1.9571
5.00	—	6.7788
1.25	5.0	0.0915
2.50	5.0	0.6760
5.00	5.0	5.1263

SOLUBILITY OF NEODYMIUM OXALATE IN AQUEOUS SOLUTIONS OF NEODYMIUM NITRATE AT 25°. (James and Robinson, 1913.)

(The mixtures were constantly agitated at constant temperature for twelve weeks.)

Gms. per 100 Gms. Sat. Sol. $Nd_2(C_2O_4)_3$.	Gms. per 100 Gms. Sat. Sol. $Nd_2(NO_3)_6$.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. $Nd_2(C_2O_4)_3$.	Gms. per 100 Gms. Sat. Sol. $Nd_2(NO_3)_6$.	Solid Phase.
0.18	6.46	$Nd_2(C_2O_4)_3.11H_2O$	2.07	47.64	$Nd_2(C_2O_4)_3.11H_2O$
0.54	12.23	"	2.54	50.52	"
0.76	17.78	"	2.89	52.82	"
0.85	22.67	"	3.17	54.67	"
0.96	27.43	"	2.21	56.48 probably	$1.2\frac{1}{2}.24$
1.28	31.36	"	1.44	59.68	$Nd_2(NO_3)_6(?H_2O)$
1.38	35.26	"	1.33	59.67	"
1.66	38.70	"	1.21	59.70	"
1.88	42.13	"	0.96	59.75	"
1.96	44.82	"	...	60.46	"

$1.2\frac{1}{2}.24^* = Nd_2(C_2O_4)_3.2\frac{1}{2}Nd_2(NO_3)_6.24H_2O$.

NEODYMIUM TriCHLORIDE, $NdCl_3.6H_2O$.

SOLUBILITY OF NEODYMIUM TRICHLORIDE IN WATER AND IN HYDROCHLORIC ACID. (Williams, Fogg and James, 1926)

Constant agitation was employed and equilibrium was approached from above and from below.

t°.	Gms. $NdCl_3$ per 100 gms. sat. sol. in Water.	Gms. $NdCl_3$ per 100 gms. sat. sol. in aq. HCl of $d = 1.105$.	Solid Phase in each case.
10	49.16	26.16	$NdCl_3.6H_2O$
20	49.49	26.57	"
30	49.91	27.92	"
40	50.41	29.83	"
55	51.11	31.94	"

SOLUBILITY OF NEODYMIUM TRICHLORIDE AND OF NEODYMIUM OXIDE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE AT 15°, 30°, 50° AND 100°. (Prandtl and Rauchenberger, 1920.)

NOTE — The results are given only in the form of small scale diagrams and it is stated that the numerical data will be published in full in the dissertation of Johanna Rauchenberger, University of München, 1920. The equilibrium $Nd(OH)_3 + 3NH_4Cl \rightleftharpoons NdCl_3 + 3NH_3 + 3H_2O$ was approached by the authors from both sides. The composition of the basic chlorides obtained by shaking the oxide with 1.0*n* NH_4Cl at different temperatures, and drying over soda lime, was approximately as follows:

$\overset{\text{At 15°.}}{Nd_4Cl_2O_5.9H_2O}$; $\overset{\text{At 30°.}}{Nd_8Cl_3O_{11}H.20H_2O - Nd_{13}Cl_2O_{19}H.30H_2O}$; $\overset{\text{At 50°.}}{Nd_9Cl_3O_{12}.22H_2O}$.

SOLUBILITY OF NEODYMIUM CHLORIDE IN WATER. (Matignon, 1906, 1909.)

Method of obtaining saturation not stated.

t°.	d_{13} of Sat. Sol.	Gms. $NdCl_3$ per 100 Gms. Sat. Sol.	Gms. $NdCl_3$ per 100 Gms. Water.	Gms. $NdCl_3.6H_2O$ per 100 Gms. Sat. Sol.	Gms. $NdCl_3.6H_2O$ per 100 Gms. Water.
13	1.74	49.67	98.68	71.12	246.2
100	...	...	140	...	...

100 gms. abs. alcohol dissolve 44.5 gms. (anhydrous) $NdCl_3$ at 20°. Saturation was obtained by spontaneous evaporation of the solution over H_2SO_4. (Matignon, 1906.)

100 gms. anhydrous pyridine dissolve 1.8 gms. anhydrous $NdCl_3$ at about 15°. Saturation obtained by daily agitation of the solution for some weeks. (Matignon, '06.)

NEODYMIUM Hexa Antipyrine Per **CHLORATE** $[Nd(COC_{10}H_{12}O_2)_6](ClO_4)_3$

100 cc sat. solution of Neodymium Hexa antipyrine Per chlorate in water contain 0.98 gm. $[Nd(COC_{10}H_{12}O_2)_6](ClO_4)_3$ at 20°. (Wilke-Dörfurt and Schliephake, 1925.)

NEODYMIUM CHROMATE $Nd_2(CrO_4)_3.8H_2O$.

100 gms. sat. solution of Neodymium Chromate in Water contain 0.027 gm. $Nd_2(CrO_4)_3$ at 25°. (Britton, 1924.)

NEODYMIUM MOLYBDATE $Nd_2(MoO_4)_3$.

One liter H_2O dissolves 0.0186 gm. salt at 28° and 0.0308 gm. at 75°. The mixtures were frequently stirred at constant temperature during only two hours. (Hitchcock, 1895.)

NEODYMIUM NITRATE $Nd(NO_3)_3.6H_2O$ α and β

SOLUBILITY OF α AND β NEODYMIUM NITRATES IN WATER.
(Friend, 1935.)

t°	Gms. $Nd(NO_3)_3$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Nd(NO_3)_3$ per 100 gms. sat. sol.	Solid Phase
0	55.97	$Nd(NO_3)_3.6H_2O$α	27.2	59.17	$Nd(NO_3)_3.6H_2O$β
13.2	57.37	"	29.4	59.18	"
18.2	58.03	"	37.2	60.95	"
23.0	59.59	"	42.4	61.91	"
25. (1)	60.46	"	50.0	64.86	"
26.2	60.69	"	57.2	67.00	"
			66.2	73.13	"
			67.5(m.pt.)	75.34	"

(1) James and Robinson, 1913.

NO

NEODYMIUM NITRATE

SOLUBILITY OF NEODYMIUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID.
(Quill and Robey, 1937.)

Results at 25°				Results at 50°			
d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	HNO_3	$Nd(NO_3)_2$			HNO_3	$Nd(NO_3)_2$	
—	0.0	59.0	Nd.6	1.963	0.0	66.26	Nd.6
1.741	6.20	53.31	"	1.948	2.14	64.62	"
—	6.36	52.15	"	1.901	6.92	60.34	"
—	18.28	40.79	"	1.885	10.41	57.74	"
—	43.95	23.64	"	1.997	11.93	59.47	" + Nd4
—	44.63	24.08	"	—	22.67	51.24	Nd.4
1.595	49.20	23.47	Nd.4	1.819	26.83	47.36	"
1.572	56.65	19.11	"	—	46.55	32.49	"
				—	45.46	34.97	"

Nd.6 = $Nd(NO_3)_3.6H_2O$; Nd.4 = $Nd(NO_3)_3.4H_2O$.

100 cc of a sat. solution of $Nd(NO_3)_3$ in Ethyl Ether, prepared by frequent agitation and allowing to stand over night at about 20°, contain 0.20 gm. Nd_2O_3. A saturated ethereal solution prepared as above but using neodymium nitrate which had been dehydrated at 150°, contain 2.67 gm. Nd_2O_3 per 100 cc of solution. (Wells, 1930.)

NEODYMIUM Cobalt **NITRATE**, $2Nd(NO_3)_3.3Co(NO_3)_2.24H_2O$.

SOLUBILITY OF NEODYMIUM COBALT NITRATE IN WATER
(Prandtl and Ducru, 1926.)

t°.	d. of sat. sol.	Gms. per 1000 gms. sat. sol. Nd_2O_3.	 CoO.	 Double salt.
15....	1.65	14.0	9.28	68.3
30....	1.68	14.84	9.84	72.4
45....	1.72	15.71	10.43	76.6
60....	1.77	16.63	11.16	81.1

SOLUBILITY OF NEODYMIUM DOUBLE NITRATES IN WATER. (Prandtl and Ducru, 1926.)

The saturated solutions were prepared by constant shaking in a thermostat.

Double salt of	t°.	d of sat. sol.	Gms. per 100 gms. sat. sol. Nd_2O_3.	 Other metal oxide.	 Double salt.
Neodymium magnesium nitrate $2Nd(NO_3)_3.3Mg(NO_3)_2.24H_2O$	15	1.52	14.45	5.17 (MgO)	66.0
	30	1.55	15.20	5.49 »	69.5
	50	1.59	16.34	5.78 »	74.4
	70	1.64	17.47	6.29 »	79.8
Neodymium manganese nitrate $2Nd(NO_3)_3.3Mn(NO_3)_2.24H_2O$	15	1.66	15.24	9.50 (MnO)	73.8
	30	1.70	15.99	10.15 »	77.4
	45	1.75	17.05	10.68 »	82.6
	60	1.82	18.37	11.48 »	89.0
Neodymium nickel nitrate $2Nd(NO_3)_3.3Ni(NO_3)_2.24H_2O$	15	1.63	14.01	9.13 (NiO)	68.4
	30	1.66	14.66	9.73 »	71.5
	45	1.69	15.41	10.12 »	75.1
	60	1.74	16.36	10.89 »	79.8
Neodymium zinc nitrate $2Nd(NO_3)_3.3Zn(NO_3)_2.24H_2O$	15	1.65	14.00	10.15 (ZnO)	69.1
	30	1.69	14.88	10.79 »	73.5
	50	1.75	15.86	11.53 »	78.3
	70	1.81	17.15	12.33 »	84.6

NO

NEODYMIUM Double **NITRATES**.

SOLUBILITY IN AQ. HNO_3 OF $d_{15} = 1.325$ (= 51.59 GMS. HNO_3 PER 100 CC.) AT 16°. (Jantsch, 1912.)

Double Salt.	Formula.	Gms. Hydrated Double Salt per 100 Gms. Sat. Sol.
Neodymium Magnesium Nitrate	$[Nd(NO_3)_6]_2Mg_3.24H_2O$	97.7
" Nickel "	" Ni_3 "	116.6
" Cobalt "	" Co_3 "	151.6
" Zinc "	" Zn_3 "	177
" Manganese "	" Mn_3 "	296

NEODYMIUM OXIDE Nd_2O_3.

O One liter sat. solution of Neodymium Oxide in Water contain 0.00000575 gm. mol. Nd_2O_3 at 29°. (Bush, 1927.)

NEODYMIUM Dimethyl **PHOSPHATE** $Nd_2[(CH_3)_2PO_4]_6$.

100 gms. H_2O dissolve 56.1 gms. $Nd_2[(CH_3)_2PO_4]_6$ at 25° and about 22.3 gms. at 95°. (Morgan and James, 1914.)

EODYMIUM SULFATE $Nd_2(SO_4)_3.8H_2O$ α.

SOLUBILITY OF NEODYMIUM SULFATE IN WATER.

The results of Friend, 1930; Meyer, R. J. (private communication to
ndoldt & Bornstein Tabellen) and Jackson and Reinacker, 1930, were
lotted and the following values taken from the average curve.

t°	Gms. $Nd_2(SO_4)_3$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Nd_2(SO_4)_3$ per 100 gms. sat. sol.	Solid Phase
0	11.5	$Nd_2(SO_4)_3.15H_2O$	50	3.2	$Nd_2(SO_4)_3.8H_2O$ α
10	8.8	$Nd_2(SO_4)_3.8H_2O$ α	60	2.7	"
20	6.6	"	70	2.4	"
25	5.8	"	85	2.0	"
30	5.0	"	87	1.2	$Nd_2(SO_4)_3.8H_2O$ β
40	3.9	"	95	1.15	"
		"	100	1.2	"

The previous results of Muthmann and Rohg, 1898, are not in good
reement with the later determinations.

SOLUBILITY OF NEODYMIUM SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID.

(Friend, 1930.)

SO

Results for Aqueous :

0.33 normal H_2SO_4		1.0 normal H_2SO_4		4.0 normal H_2SO_4		8.0 normal H_2SO_4	
t°	Gms. $Nd_2(SO_4)_3$ per 100 gms. sat. sol.	t°	Gms. $Nd_2(SO_4)_3$ per 100 gms. sat. sol.	t°	Gms. $Nd_2(SO_4)_3$ per 100 gms. sat. sol.	t°	Gms. $Nd_2(SO_4)_3$ per 100 gms. sat. sol.
D	10.04	0.2	9.89	0.2	4.56	11.0	1.62
0.4	5.71	15.4	7.0	14.8	3.93	30.4	2.04
6.4	4.79	30.4	6.10	30.4	3.61	46.4	2.19
1.0	3.54	79.2	4.41	46.4	3.78		
9.6	2.15	90.0	3.41	59.0	3.62		
		96.8	2.69				

EODYMIUM Potassium SULFATES.

EQUILIBRIUM IN THE SYSTEM NEODYMIUM SULFATE, POTASSIUM SULFATE AND WATER AT 25°. (Zambonini and V. Cagliotti, 1924.)

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
$Nd_2(SO_4)_3$.	K_2SO_4.	Solid Phase.	$Nd_2(SO_4)_3$.	K_2SO_4.	Solid Phase.
2.76	0.00	1.1.2	0.18	3.01	1.3.2
2.02	0.15	»	0.17	3.40	»+1.4.1
1.69	0.30	»	0.08	4.06	1.4.1
1.62	0.47	»+2.3.8	0.08	4.94	»
1.13	0.54	2.3.8	0.07	6.20	1.4.2
0.26	1.75	»	0.04	8.52	»
0.17	2.61	»	0.04	10.01	»
0.17	2.80	»+1.3.2	0.04	10.85	1.5.2
0.18	2.98	» »	0.00	11.18	»+K_2SO_4

1.1.2 = $Nd_2(SO_4)_3.K_2SO_4.2H_2O$; 2.3.8 = $2Nd_2(SO_4)_3.3K_2SO_4.8H_2O$; 1.3.2 = $Nd_2(SO_4)_3.3K_2SO_4.2H_2O$;
1.4.1 = $Nd_2(SO_4)_3.4K_2SO_4.H_2O$; 1.4.2 = $Nd_2(SO_4)_3.4K_2SO_4.2H_2O$; 1.5.2 = $Nd_2(SO_4)_3.5K_2SO_4.2H_2O$.

NEODYMIUM Sodium SULFATES.

EQUILIBRIUM IN THE SYSTEM NEODYMIUM SULFATE, SODIUM SULFATE AND WATER AT 25°. (Zambonini and Carobbi, 1925 *a*.)

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
$Nd_2(SO_4)_3$.	Na_2SO_4.	Solid Phase.	$Nd_2(SO_4)_3$.	Na_2SO_4.	Solid Phase.
2.37	0.57	$Nd_2(SO_4)_3.8H_2O$	–	9.11	4.5.8
1.11	0.14	»+1.1.2	–	8.97	»+3.4.6
0.28	0.49	1.1.2	–	10.98	3.4.6
0.14	1.24	»	–	13.16	»
–	3.11	»	–	14.54	»+2.3.5
–	5.02	»	–	16.92	2.3.5
–	6.00	4.5.8	–	17.61	»
–	7.72	»	–	17.95	»+Na_2SO_4

1.1.2 = $Nd_2(SO_4)_3.Na_2SO_4.2H_2O$; 4.5.8 = $4Nd_2(SO_4)_3.5Na_2SO_4.8H_2O$; 3.4.6 = $3Nd_2(SO_4)_3.4Na_2SO_4.6H_2O$
2.3.5 = $2Nd_2(SO_4)_3.3Na_2SO_4.5H_2O$.

NEODYMIUM Ammonium SULFATE $Nd_2(SO_4)_3.(NH_4)_2SO_4.8H_2O$.

EQUILIBRIUM IN THE SYSTEM NEODYMIUM SULFATE, AMMONIUM SULFATE AND WATER AT 25°.

(Zambonini, and Stolfi, 1927.)

80

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol		Solid Phase
$Nd_2(SO_4)_3$	$(NH_4)_2SO_4$		$Nd_2(SO_4)_3$	$(NH_4)_2SO_4$	
4.50	0.77	$Nd_2(SO_4)_3.8H_2O$+1.1.8	0.58	26.98	1.1.8
3.17	0.77	" "	0.58	29.18	"
2.58	1.00	1.1.8	0.58	35.18	"
1.16	2.78	"	0.58	37.55	"
0.58	12.86	"	0.58	40.88	"
0.58	16.21	"	0.58	43.90	"+$(NH_4)_2SO_4$
0.58	24.25				

1.1.8 = $Nd_2(SO_4)_3.(NH_4)_2SO_4.8H_2O$.

NEODYMIUM Rubidium SULFATE $Nd_2(SO_4)_3.Rb_2SO_4.8H_2O$.

100 gms. H_2O sat. with $NdRb(SeO_4)_2.4H_2O$ contain 12.5 gms. of the compound at 0° and 13.6 gms. at 20°. (Meyer and Kittlemann, 1931.)

EQUILIBRIUM IN THE SYSTEM NEODYMIUM SULFATE, RUBIDIUM SULFATE AND WATER AT 25 .

(Zambonini and Cagliotl, 1927.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$Nd_2(SO_4)_3$	Rb_2SO_4		$Nd_2(SO_4)_3$	Rb_2SO_4	
4.90	1.05	$Nd_2(SO_4)_3.8H_2O$ + 1.1.8	—	5.16	1.1.8
4.73	1.20	1.1.8	—	7.93	"
2.29	1.43	"	—	24.92	"
0.74	1.80	"	—	33.63	"
0.21	2.99	"	—	45.54	"+Rb_2SO_4

1.1.8 = $Nd_2(SO_4)_3.Rb_2SO_4.8H_2O$.

EQUILIBRIUM IN THE SYSTEM NEODYMIUM SULFATE, THALLIUM SULFATE AND WATER AT 25°. (Zambonini and Cagliotti, 1925.)

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
$Nd_2(SO_4)_3$.	Tl_2SO_4.	Solid Phase.	$Nd_2(SO_4)_3$.	Tl_2SO_4.	Solid Phase.
4.89	0.25	$Nd_2(SO_4)_3.8H_2O$+1.1.3	0.30	3.00	1.1.8
4.50	0.25	»	0.27	3.51	» +1.4½
3.84	0.26	1.1.3	0.26	3.81	»
3.81	0.27	»	0.26	3.85	1.4½
3.80	0.27	»	0.24	4.10	»
3.78	0.28	1.1.8	0.19	4.70	»
3.15	0.30	»	0.16	4.85	» +Tl_2SO_4
1.86	0.45	»	0.11	4.90	» »
0.76	1.11	»	0.09	5.02	» »

1.1.3 = $Nd_2(SO_4)_3.Tl_2SO_4.3H_2O$; 1.1.8 = $Nd_2(SO_4)_3.Tl_2SO_4.8H_2O$; 1.4½ = $Nd_2(SO_4)_3.4\frac{1}{2}Tl_2SO_4$.

NEODYMIUM SELENATE $Nd_2(SeO_4)_3.Aq.$

SOLUBILITY OF NEODYMIUM SELENATE IN WATER.
(Friend, 1931.)

The authors results were plotted and the following values taken from the average curve.

SeO

t°	Gms. $Nd_2(SeO_4)_3$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Nd_2(SeO_4)_3$ per 100 gms. sat. sol.	Solid Phase
0	31.0	$Nd(SeO_4)_3.Aq.$	50	29.2	$Nd_2(SeO_4)_3.Aq.$
10.6	30.9	"	60	30.5	" + $Nd_2(SeO_4)_3.6H_2O$
20.0	29.5	"	62.5	22.0	$Nd_2(SeO_4)_3.6H_2O$
25.0	29.0	"	65	16.0	"
30	28.5	"	70	12.0	"
40	28.5	""	80	6.5	"
			90	3.2	"

The following results, differing very greatly from the above, are given by Meyer and Kittlemann, 1931.

t°	Gms. $Nd_2(SeO_4)_3$ per 100 gms. H_2O in contact with:	
	$Nd_2(SeO_4)_3.8H_2O$	$Nd_2(SeO_4)_3.8H_2O$
0	4	30
20	12	40

SOLUBILITY OF NEODYMIUM SELENATE IN AQUEOUS SOLUTIONS OF SELENIC ACID.
(Friend. 1931.)

t°	Gms. per 100 gms. sat. sol.		t°	Gms. per 100 gms. sat. sol.	
	H_2SeO_4	$Nd_2(SeO_4)_3$		H_2SeO_4	$Nd_2(SeO_4)_3$
0	3.84	29.54	40	60.0	7.9
8.6	5.87	26.29	45.6	1.34	28.27
13.0	5.93	24.92	45.6	5.49	27.35
17.6	8.6	25.23	45.6	6.39	27.18
17.0	12.4	23.72	55.4	1.66	27.29
24.0	4.14	26.35	84.4	44.0	7.55
30.0	4.52	25.32			

NEODYMIUM TUNGSTATE $Nd_2(WO_4)_3$.

One liter H_2O dissolves 0.0190 gm. $Nd_2(WO_4)_3$ at 22°, 0.0168 gm. at 65° and 0.0152 gm. at 98°. The mixtures were not constantly agitated and only two hours were allowed for saturation. (Hitchcock, 1895.)

NEON Ne.

SOLUBILITY OF NEON IN WATER. (von Antropoff, 1910.)

The following new determinations were made in a refined apparatus arranged so that the solvent and its vapor touched no cock, and in which other improvements were introduced. The results are given in terms of the Bunsen coefficient as modified by Kuenen, that is, in terms of the volume of gas in cc. (reduced to normal conditions) dissolved by 1 gram of H_2O.

t°.	Absorb. coef. β.	t°.	Absorb. coef. β.	t°.	Absorb. coef. β.
0	0.0114	20	0.0147	40	0.0217
10	0.0108	30	0.0155	50	0.0322

Determinations which are not in agreement with the above are given by Valentiner, 1922. This author questioned the report that neon differed from the other noble gases in showing an increase of solubility with temperature. Three series of determinations made by him agreed in showing on the contrary that the solubility of neon decreases with temperature. The results were as follows:

t°.	Cc. Neon dissolved per 1.0 gm. H_2O.	t°.	Cc. Neon dissolved per 1.0 gm. H_2O.	t°.	Cc. Neon dissolved per 1.0 gm. H_2O.
0	0.026	17	0.018	45	0.011

Ne

Tables showing the density and volume of neon at temperatures between 20° and —217°.52 and at pressures varying from about 22 to 90 atmospheres are given by Crommelin, Martinez and Kamerlingh-Onnes, 1919, 1920.

SOLUBILITY OF NEON IN WATER AND IN OTHER SOLVENTS.

(Lannung, 1930.)

The results are expressed both in terms of a, the Bunsen Coefficient of solubility, and l the Ostwald solubility expression (See page 553)

Solvent		Solubility of Neon at: 15°	18°	20°	25°	30°	37°
Water	a	0.0108	0.0105	0.0104	0.0101	0.0099	0.0096
	l	0.0114	0.0112	0.0113	0.0110	0.0110	0.0111
Methyl Alcohol	a	0.0413	0.0423	0.0430	0.0444	0.0459	0.0480
	l	0.0436	0.0451	0.0462	0.0485	0.0509	0.0545
Ethyl Alcohol	a	0.0381	0.0394	0.0402	0.0417	0.0433	0.0442
	l	0.0402	0.0420	0.0431	0.0455	0.0481	0.0502
Acetone	a	0.043	0.045	0.046	0.048	—	—
	l	0.045	0.048	0.049	0.052	—	—
Benzene	a	0.0254	0.0264	0.0271	0.0288	0.0306	0.0330
	l	0.0268	0.0287	0.0291	0.0314	0.0340	0.0375
Cyclohexane	a	0.0333	0.0345	0.0353	0.0373	0.0392	0.0419
	l	0.0351	0.0368	0.0379	0.0407	0.0435	0.0476
Cyclohexanol	a	—	—	—	0.0152	0.0161	0.0173
	l	—	—	—	0.0166	0.0179	0.0196

One liter of Cyclohexanol ($C_6H_{11}OH$) dissolve 171.2 cc Ne_2 at 26° and 755 mm pressure. (Canquil, 1927.)

NICKEL Ni

Qualitative data showing that just as iron, nickel is considerably attacked by water containing carbon dioxide, with formation of nickel carbonate, are given by Robl, 1924 A few quantitative results for special conditions are given.

Data for the distribution of nickel between zinc and lead are given by Tammann and Schaftmeister, 1924.

SOLUBILITY OF NICKEL IN MILK.

(Quam, 1929.)

Highly polished 4 x 7.5 cm. strips of nickel were each immersed in 50 cc portions of raw milk and rocked 46 times per minute for one-half hour. The loss in weight of the Ni strips was determined and expressed as milligrams Ni dissolved per sq. decimeter of surface exposed. The dissolved nickel was also determined in the ash of the 50 cc of milk by a modification of the α benzil dioxane method.

t°	Mgs. Ni dissolved per sq. decimeter of metal	t°	Mgs. Ni dissolved per sq. decimeter of metal
20	0.86	75	6.54
30	1.22	80	6.54
45	3.442	85	5.17
55	4.31	90	3.442
62.8	5.85	95	1.22

SOLUBILITY OF NICKEL IN MERCURY.

(Irvin and Russell, 1932.)

An amalgam prepared from 0.2 gm. Ni in about 200 gms. Hg by electrolysis was filtered after two days through its own paste on a ground glass filter and the dissolved nickel in this filtrate found to be less than 0.00002 gm. per 100 gms. Hg. A determination by Tammann, Kollmann and Hinnuber, 1927, by potential difference measurements gave the result 0.0057 gm. mol. Ni per 1.0 gm. mol. Hg at 15°.

NICKEL BROMIDE $NiBr_2.6H_2O$. Br

SOLUBILITY IN WATER.

(Etard, 1894.)

t°.	Gms. $NiBr_2$ per 100 Gms. Solution.	t°.	Gms. $NiBr_2$ per 100 Gms. Solution.	t°.	Gms. $NiBr_2$ per 100 Gms. Solution.
−20	47.7	25	57.3	80	60.6
−10	50.5	30	58	100	60.8
0	53	40	59.1	120	60.9
+10	55	50	60	140	61
20	56.7	60	60.4		

Solubility of Nickel Bromide in Pure Methyl Alcohol.

(Lloyd, Brown, Glynwyn, Bonnel and Jones, 1928.)

t°	Gms. $NiBr_2$ per 100 gms. CH_3OH	Solid Phase	t°	Gms. $NiBr_2$ per 100 gms. CH_3OH	Solid Phase
10	33.0	$NiBr_2.6CH_3OH$	50	49.1	$NiBr_2$
20	35.1	"	60	53.7	"
30	38.1	"	70	59.6	"
40	43.3	"			

Solubility of Nickel Bromide in Absolute Acetone.

(Bell, Rowlands, Bamford, Thomas and Jones, 1930.)

Br

t°	Gms. $NiBr_2$ per 100 gms. CH_3COCH_3	Solid Phase	t°	Gms. $NiBr_2$ per 100 gms. CH_3COCH_3	Solid Phase
0	1.66	$NiBr_2$	30	0.55	$NiBr_2$
10	1.16	"	40	0.36	"
20	0.81	"	50	0.27	"

NICKEL BROMATE $Ni(BrO_3)_2.6H_2O$.

100 gms. cold water dissolve 27.6 gms. nickel bromate.

NICKEL ACETATE $Ni(CH_3COO)_2$

The mean of four determinations of the Solubility of Nickel Acetate in pure acetic acid, by Davidson and Chappell, 1933, was 12.37 mol. percent $Ni(CH_3COO)_2$ at 30°. The solid phase consisted of a finely divided greenish while substance without crystalline structure and containing from 54 to 66 mol. percent $Ni(CH_3COO)_2$, thus indicating a solvated product of variable composition. Freezing-point determinations of $Ni(CH_3COO)_2$ + CH_3COOH mixtures are also given.

CH

NICKEL β Methyl**ADIPATE**.

100 cc. of sat. solution of neutral nickel racemic β methyladipate in water, contain 7.3 gms of the salt at 20°. (Meurisse.)

NICKEL CITRATE $Ni_3[(COOCH_2)_2C(OH)COO]_2.2H_2O$.

100 cc. sat. solution in water contain 0.28 gm. Ni = 0.94 gm. anhydrous salt at 10°. (Pickering, 1915.)

NICKEL Potassium **CITRATE** $K_4Ni[(COOCH_2)_2COHCOO]_2$.

100 cc. sat. sol. in water contain 3.9 gms. Ni = 41 gms. salt at 10°. (Pickering, 1915.)

NICKEL MALATE $Ni[CH_2CHOH(COO)]_2.3H_2O$.

100 cc. sat. solution in water contain 0.02 gm. Ni = 0.06 gm. salt at 10°. (Pickering, 1915.)

NICKEL FUMARATE $Ni.C_4H_2O_4.5H_2O$.

100 gms. H_2O dissolve 0.36 gm. $NiC_4H_2O_4$ at 30°. (Weiss and Downs, 1923.)

NICKEL GLUCONATE $Ni(C_6H_{11}O_7)_2.3H_2O$.

100 cc sat. solution of Nickel Gluconate in Water contain 9.65 gms. $Ni(C_6H_{11}O_7)_2$ at 25°. (May, Weisberg and Herrick, 1929.)

NICKEL BENZOATE $Ni(C_6H_5COO)_2.3H_2O$.

NICKEL Chlor, Oxy and Nitro **BENZOATES**.

Solubility of Each Separately in Water at 20°.
(Ephraim and Pfister, 1925.)

Compound.	Formula.	Gms. anhydrous cmpd. per 100 cc. sat. sol.
Nickel Benzoate............	$Ni(C_6H_5.COO)_2.3H_2O$	1.291
» -4-Chlor Benzoate...	$Ni(C_6H_4.Cl.COO)_2.4H_2O$	0.660
» -4-Oxy » ...	$Ni(C_6H_4.OH.COO)_2.7H_2O$	0.871
» -4 Nitro » ...	$Ni(C_6H_4.NO_2.COO)_2.8H_2O$	0.777

100 gms. Methyl Alcohol (CH_3OH) dissolve 0.29 gm. $Ni(C_6H_5COO)_2$ at 15° and 0.30 gm. at 66° (b.pt.). (Henstock, 1934.)

NICKEL Nitroso β Phenyl **HYDROXYLAMINE** $Ni[C_6H_5.N(NO).O]_2$.

The compound is prepared by precipitating Cupferron (the ammonium salt of nitroso phenyl hydroxylamine) with a nickel salt.

One liter sat. solution of the compound in water contains 0.00089 gm. at. (= 0.052 gm.) $Ni[C_6H_5.N(NO.O]_2$ at 18°. (Pinkus and Martin, 1927.)

NICKEL CINNAMATE $Ni.C_{18}H_{14}O_4.2H_2O$.

100 cc. sat. sol. of nickel cinnamate in water contain 0.293 gm. $Ni\ C_{18}H_{14}O_4$ at 20°. (Ephraim and Pfister, 1925.)

NICKEL HELIANTHATE $Ni(C_{14}H_{14}N_3SO_3)_2.4H_2O$. CH

1000 cc. H_2O dissolve 0.072 gms. of the salt at 20-25°. (Stark and Dehn, 1918.)

NICKEL Anthracene, Benzene and Naphthalene **SULFONATES**.

Solubility of Each Separately in Water.
(Ephraim and Pfister. 1925, 1925 a; Ephraim and Segor, 1925.)

Compound.	Formula.	t°.	Gms. anhydrous cmpd. per 100 cc. sat. sol.
Nickel Anthracene-1-sulfonate...........	$Ni(C_{14}H_9SO_3)_2.6H_2O$	20	0.0253
» » -2- »	$Ni(C_{14}H_9SO_3)_2.6H_2O$	20	0.00463
» Benzene sulfonate...............	$Ni(C_6H_5SO_3)_2.6H_2O$	18	12.561
» » »	»	34	16.518
» » »	»	49.5	20.972
» » »	»	64.5	26.685
» » »	»	80.5	33.295
» » »	»	82.0	34.044
» Naphthalene-1-sulfonate..........	$Ni(C_{10}H_7SO_3)_2.6H_2O$	17	4.978
» » -2- »	$Ni(C_{10}H_7SO_3)_2.6H_2O$	16.5	0.2833
» » » »	»	34.5	0.5289
» » » »	»	45.5	0.7434
» » » »	»	58.5	1.1658
» » » »	»	70.5	1.5972
» » » »	»	77.0	1.9973
» » » »	»	81.5	2.4136
» » » »	»	83.0	2.6886
» » 5 Chlor 1-sulfonate...	$Ni(C_{10}H_6SO_3.Cl)_2.6H_2O$	20.0	0.618
» » 6- Oxy -2- » ...	$Ni(C_{10}H_6SO_3)_2.8H_2O$	20.0	0.529

NICKEL Naphthylamine DiSULFONATES $Ni.C_{10}H_5(NH_2)(SO_3)_2$, 2.6.8 and 2.5.7.

100 gms. sat. solution of nickel naphthylamine disulfonate 2.6.8 in water contain 33.2 gms. of the anhydrous compound at 15°. An aqueous solution of the 2.5.7 compound contains 35.5 gms. per 100 gms. sat. solution at 15°.

(Braunschweig, 1922, 1926.)

NICKEL Xylol SELENATES and SULFONATE.

SOLUBILITY OF EACH IN WATER.

(Anschütz, Kallen and Riepenkröger, 1919.)

Compound.	Formula.	t°.	Gms. anhydrous cmpd. per 100 gms. H_2O.
Nickel *o* Xylol Selenate......	$Ni[(CH_3)_2(1,2)C_6H_3.SeO_3(4)]_2.6H_2O$	20	3.95
» *p* » »	$Ni[(CH_3)_2(1,4)C_6H_3.SeO_3]_2.7H_2O$	15	2.31
» *o* » Sulfonate.....	$Ni[(CH_3)_2(1,2)C_6H_3SO_3(4)]_2.6H_2O$	16	3.63

NICKEL CYANIDE $Ni(CN)_2$.

CN One liter sat. solution of nickel cyanide in water contain 0.000535 gm. mol. $Ni(CN)_2$ at 18°, as determined by E.M.F. measurements.

(Masaki, 1931.)

NICKEL NITROPRUSSIATE $NiFe(CN)_5NO$.

One liter sat. solution of nickel nitro prussiate in water contain 0.00006 gm. mol. $NiFe(CN)_5NO$ at 20°. (Tomicek and Kubik, 1937.) A previous determination by Zuccari, 1914, 1915, gave 0.1 gm. $NiFe(CN)_5NO$ per liter of water which is about six time the present value.

NICKEL THIOCYANATE $Ni(SCN)_2$.

100 gms. sat. solution in Water contain 35.48 gms. $Ni(SCN)_2$ at 25°. (de Sweemer, 1932.) The author also gives results for the system $Ni(SCN)_2 + KSCN + H_2O$ and $Ni(SCN)_2 + Co(SCN)_2 + H_2O$ at 25°.

NICKEL CARBONATE $NiCO_3$.

CO One liter H_2O dissolves 7.789×10^{-4} mols. $NiCO_3$ = 0.0925 gm. at 25°.

(Ageno and Valla, 1911.)

NICKEL CARBOXYL.

100 gms. of the aqueous solution saturated at 9.8° contain 2.36 cc. of the vapor = 6.43 milligrams Ni. In blood serum it is 2½ times as soluble. (Armit, 1907.)

NICKEL OXALATE $Ni(C_2O_4).2H_2O$.

One liter sat. solution in water contain 0.003 gm. NiC_2O_4 at 18°, as determined by electrolytic conductivity. (Scholder, Gadenne and Niemann, 1927.)

SOLUBILITY OF NICKEL OXALATE IN AQUEOUS SOLUTIONS OF FORMIC ACID AT 20°.

(Ledrut and Hauss, 1937.)

The saturated solutions were analyzed by warming on the steam bath with excess of H_2SO_4 to eliminate the HCOOH and titrating with 0.001n $KMnO_4$.

COO

Gms. HCOOH per 100 gms. solvent	Gms. NiC_2O_4 per liter sat. sol.	Solid Phase
0.0 (= H_2O)	0.041	$NiC_2O_4.2H_2O$
25.0	0.022	"
50.0	0.028	"
95.0	0.100 (1)	"
100.0	0.075	"

(1) per 1000 gms. sat. solution. (Aschan, 1913.)

NICKEL CHLORIDE $NiCl_2.6H_2O$.

SOLUBILITY OF NICKEL CHLORIDE IN WATER.

(Boye, 1934.)

Cl

t°	Gms. $NiCl_2$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $NiCl_2$ per 100 gms. sat. sol.	Solid Phase
- 0.5	2.17	Ice	- 9.8	34.1	$NiCl_2.6H_2O$
- 3.6	7.88	"	0	34.8	"
-11.3	15.6	"	+17.5	37.1 (1)	"
-19.0	20.6	"	25	39.6 (1)	"
-26.7	24.2	"	27.9	41.3	"
-35.3	26.9	"	28.8	41.6	" + $NiCl_2.4H_2O$
-41.0	29.0	"	35.0	42.0	$NiCl_2.4H_2O$
-45.3	29.9	" + $NiCl_2.7H_2O$	50.0	43.2 (1)	"
-40.8	30.0	$NiCl_2.7H_2O$	60.0	44.8 (1)	"
-36.1	30.3	"	64.3	46.1	" + $NiCl_2.2H_2O$
-34.2	31.3	"	67.6	46.1	$NiCl_2.2H_2O$
-33.3	33.8	" + $NiCl_2.6H_2O$	75.0	46.3 (1)	"
-29.1	33.8	$NiCl_2.6H_2O$	100.2	46.7	"
-20.2	33.9	"	110.4	46.8	"
-14.9	34.0	"	117.9 b.pt.	46.9	"

(1) Benrath, 1932.

NICKEL CHLORIDE $NiCl_2.6H_2O$.

EQUILIBRIUM IN THE SYSTEM NICKEL CHLORIDE, HYDROCHLORIC ACID AND WATER AT 0°. (Foote, 1923.)

Saturation was secured by constant rotation. The composition of the solid phases was determined by Schreinemakers graphic method.

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
$NiCl_2$.	HCl.	Solid Phase.	$NiCl_2$.	HCl.	Solid Phase.
35.27	0.0	$NiCl_2.6H_2O$	4.45	26.23	$NiCl_2.4H_2O$
26.71	6.53	"	2.92	28.82	"
15.67	14.09	"	1.37	34.57	"
9.68	18.62	"	1.40	35.03	" $+NiCl_2.2H_2O$
6.15	21.70	"	2.29	33.96	" (unstable)
5.30	23.03	"	1.57	34.7	" "
3.65	25.74	"	1.06	36.0	$NiCl_2.2H_2O$
4.02	26.16	"	0.82	37.22	"
4.56	26.00	" $+NiCl_2.4H_2O$	0.43	40.61	"

100 gms. sat. sol. of nickel chloride in selenium oxychloride ($SeOCl_2$) contain 0.15 gm. $NiCl_2$ at 25°. (Wise, 1923.)

EQUILIBRIUM IN THE SYSTEM NICKEL CHLORIDE, HYDROCHLORIC ACID AND WATER.

(Bebeev and Archako, 1935.)

C1

Results at 20°			Results at 80°		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
HCl	$NiCl_2$		HCl	$NiCl_2$	
0.0	38.29	$NiCl_2.6H_2O$	0.0	45.96	$NiCl_2.4H_2O$
4.20	32.15	"	1.0	44.00	"
11.25	22.87	"	3.82	39.29	"
16.22	16.24	"	6.64	34.86	"
20.51	12.04	"	11.54	28.09	"
21.20	11.60	" $+NiCl_2.4H_2O$	15.04	22.79	"
22.07	9.58	$NiCl_2.4H_2O$	19.54	16.40	"
24.01	7.38	"	23.20	11.12	"
30.74	2.73	"	26.20	8.63	"

1000 cc. sat. HCl solution dissolve 4 gms. $NiCl_2$ at 12°. (Ditte, 1881.)

100 gms. abs. alcohol dissolve 10.05 gms. $NiCl_2$ at room temperature.

100 gms. abs. alcohol dissolve 53.71 gms. $NiCl_2.6H_2O$ at room temperature. (Bödtker, 1897.)

100 gms. abs. alcohol dissolve 2.16 gms. $NiCl_2.7H_2O$ at 17°, and 1.4 gms. at 3°. (de Bruyn, 1892.)

100 gms. saturated solution in glycol contain 16.2 gms. $NiCl_2$ at room temperature. (de Coninck, 1905.)

100 cc. anhydrous hydrazine dissolve 8 gms. $NiCl_2$ at room temp. and solution is colored violet. (Welsh and Broderson, 1915.)

100 gms. 95% formic acid dissolve 5.9 gms. $NiCl_2$ at 20.5°. (Aschan, 1913.)

When 1 gm. of nickel, as chloride, is dissolved in 100 cc. of 10% aq. HCl and shaken with 100 cc. of ether, 0.01 per cent of the Nickel enters the ethereal layer. (Mylius, 1911.)

NICKEL CHLORATE $Ni(ClO_3)_2$.

SOLUBILITY IN WATER.

(Meusser — Ber. 35, 1419, '02.)

t°.	Gms. $Ni(ClO_3)_2$ per 100 Gms. Solution.	Mols. $Ni(ClO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Ni(ClO_3)_2$ per 100 Gms. Solution.	Mols. $Ni(ClO_3)_2$ per 100 Mols. H_2O.	Solid Phase.
−18	49.55	7.84	$Ni(ClO_3)_2.6H_2O$	48	67.60	16.65	$Ni(ClO_3)_2.4H_2O$
− 8	51.52	8.49	"	55	68.78	17.59	"
0	52.66	8.88	"	65	69.05	18.01	"
+18	56.74	10.47	"	79.5	75.50	24.68	"
40	64.47	15.35	"	−13.5	31.85	3.73	Ice
				− 9	26.62	2.90	"

Sp. Gr. of solution saturated at + 18 = 1.661.

According to Carlson (1910) 100 gms. sat. sol. in H_2O at 16° contain 64.1 gms. $Ni(ClO_3)_2$ and d_{16} of sat. sol. = 1.76.

NICKEL PerCHLORATE $Ni(ClO_4)_2.9H_2O$.

SOLUBILITY IN WATER.

(Goldblum and Terlikowski, 1912.)

C10

t°.	d of Sat. Sol.	Gms. $Ni(ClO_4)_2$ per 100 Gms. H_2O.	Solid Phase.	t°.	d of Sat. Sol.	Gms. $Ni(ClO_4)_2$ per 100 Gms. H_2O.	Solid Phase.
0	...	0	Ice	−21.3	...	92.5	$Ni(ClO_4)_2.9H_2O$
−10.9	...	33.19	"	0	1.573	104.6	$Ni(ClO_4)_2.5H_2O$
−21.3	...	46.68	"	7.5	1.576	106.8	$Ni(ClO_4)_2.5H_2O$
−30.7	...	70	"	18	1.576	110.1	"
−49	...	...	Ice + $Ni(ClO_4)_2.9H_2O$	26	1.584	112.2	"
−30.7	...	90	$Ni(ClO_4)_2.9H_2O$	45	1.594	118.6	"

SOLUBILITY OF NICKEL PERCHLORATE IN FURFURAL AND IN CELLOSOLVE AT ABOUT 20°.

(Chaney and Mann, 1931.)

Solvent	Gms. $Ni(ClO_4)_2.7H_2O$ per 100 cc solvent	Solid Phase
Furfural	60	$Ni(ClO_4)_2.6H_2O$
"	20	$Ni(ClO_4)_2.2H_2O$
Cellosolve (1)	100+	$Ni(ClO_4)_2.6H_2O$
"	35	$Ni(ClO_4)_2.2H_2O$

(1) Monoethyl ether of ethylene glycol.

NICKEL Hexa Antipyrine Per CHLORATE $[Ni(OC_{10}H_{12}N_2)_6](ClO_4)_2$.

100 cc. sat. sol. of the salt in water contain 17.75 gms. $[Ni(OC_{10}H_{12}N_2)_6](ClO_4)_2$ at 20°. (Wilke-Dörfurt and Schliephake, 1929.

NICKEL FLUORIDE $NiF_2.4H_2O$.

SOLUBILITY OF NICKEL FLUORIDE IN WATER.

(Kurtenacker, Finger and Hey, 1933.)

t°	Gms. NiF_2 per 100 gms. sat. sol.	Solid Phase
10	2.49	$NiF_2.4H_2O$
20	2.50	"
50	2.50	"
90	2.52	"

100 cc. sat. solution of anhydrous (?) nickelous fluoride in water contain 4.03 gms. NiF_2 at 25°. (Carter, 1928.)

SOLUBILITY OF NICKEL FLUORIDE IN AQUEOUS SOLUTIONS OF HYDROFLUORIC ACID AT 20°.

(Kurtenacker, Finger and Hey, 1933.)

F

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
NiF_2	HF		NiF_2	HF	
2.50	0	$NiF_2.4H_2O$	11.45	17.46	$NiF_2.4H_2O$
7.73	9.25	"	13.72	28.51	"
10.02	12.39	"	13.30	30.10	"

SOLUBILITY OF NICKEL FLUORIDE IN AQUEOUS SOLUTIONS OF AMMONIUM FLUORIDE.

(Kurtenacker, Finger and Hey, 1933.)

Results at 20°			Results at 50°		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
NiF_2	NH_4F		NiF_2	NH_4F	
1.07	3.4	$NiF_2.4H_2O$	1.60	5.0	$NiF_2.4H_2O$
0.91	6.4	"	1.04	8.1	"
0.72	9.4	"	0.36	13.1	$NiF_2.2NH_4F.2H_2O$
0.51	10.4	$NiF_2.2NH_4F.2H_2O$	0.15	17.7	"
0.17	17.1	"	0.10	20.5	"
0.07	23.0	"	0.04	26.2	"
0.02	28.5	"	0.02	32.4	"
0.01	37.4	"	0.01	37.3	"
0.00	41.2	"	0.0	41.5	"

EQUILIBRIUM IN THE SYSTEM NICKEL FLUORIDE, POTASSIUM FLUORIDE AND WATER.

(Kurtenacker, Finger and Hey, 1933.)

Results at 20°			Results at 50°		
Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
NiF_2	KF		NiF_2	KF	
1.98	1.21	Mixed Crystals	2.01	1.18	Mixed Crystals
1.20	3.52	"	1.12	4.30	"
0.80	6.32	"	0.26	9.25	"
0.52	9.64	"	0.03	15.4	"
0.40	12.9	"	0.01	19.2	"
0.01	16.8	"	0.0	27.7	"
0.0	37.5	"	0.0	41.3	"

F

NICKEL Hexa Antipyrine Boro **FLUORIDE** $[Ni(COC_{10}H_{12}N_2)_6](BF)_4)_2$.

100 cc. sat. solution of the salt in water contain 4.8 gm. $[Ni(COC_{10}H_{12}N_2)_6](BF_4)_2$ at 20°. (Wilke-Dörfurt and Hureck, 1929.)

NICKEL Phospho **FLUORIDE** $Ni(PF_6)_2.6NH_3$.

Solubility results for a long series of organic nickel phospho fluorides in water are given by Lange and Müller, 1930.

NICKEL IODIDE $NiI_2.6H_2O$.

SOLUBILITY IN WATER. (Etard, 1894.)

I

t°.	Gms. NiI_2 per 100 Gms. Solution	t°.	Gms. NiI_2 per 100 Gms. Solution.	t°.	Gms. NiI_2 per 100 Gms. Solution.
−20	52	25	60.7	60	64.8
0	55.4	30	61.7	70	65
10	57.5	40	63.5	80	65.2
20	59.7	50	64.7	90	65.3

By interpolation the tr. pt. for $NiI_2.6H_2O + NiI_2.4H_2O$ is at 43°.

NICKEL IODATE $Ni(IO_3)_2$.

SOLUBILITY IN WATER.

(Meusser — Ber. 34, 2440, '01.)

t°.	Gms. $Ni(IO_3)_2$ per 100 Gms. Solution.	Mols. $Ni(IO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Ni(IO_3)_2$ per 100 Gms. Solution.	Mols. $Ni(IO_3)_2$ per 100 Mols. H_2O.	Solid Phase.
0	0.73	0.033	$Ni(IO_3)_2.4H_2O$	18	0.55	0.0245	$Ni(IO_3)_2.2H_2O$ (2)
18	1.01	0.045	"	50	0.81	0.035	"
30	1.41	0.063	"	75	1.03	0.045	"
0	0.53	0.023	$Ni(IO_3)_2.2H_2O$ (1)	80	1.12	0.049	"
18	0.68	0.030	"	30	1.135	0.050	$Ni(IO_3)_2$
30	0.86	0.039	"	50	1.07	0.046	"
50	1.78	0.080	"	75	1.02	0.045	"
8	0.52	0.023	$Ni(IO_3)_2.2H_2O$ (2)	90	0.988	0.044	"

(1) α Dihydrate. (2) β Dihydrate.

IO

NICKEL AMMONIATES of the type $[Ni(NH_3)_6]X_2$.

SOLUBILITY OF SEVERAL NICKEL AMMONIATES IN A MIXTURE OF EQUAL VOLUMES OF AQUEOUS AMMONIA ($d_{22} = 0.95$) AND 96 PER CENT ETHYL ALCOHOL AT 18°

(Ephraim and Mosimann, 1922.)

Compound.		Formula.	Gms. cmpd. per liter sat. sol.	Gm mols. cmpd. per liter sat. sol.
Nickel Hexamine	Chlorate......	$[Ni(NH_3)_6](ClO_3)_2$	74.75	0.228
"	Nitrate.......	$[Ni(NH_3)_6](NO_3)_2$	44.55	0.156
"	Chloride......	$[Ni(NH_3)_6]Cl_2$	15.39	0.066
"	Sulfate.......	$[Ni(NH_3)_6]SO_4$	14.22	0.055
"	Thio sulfate...	$[Ni(NH_3)_6]S_2O_3$	12.87	0.047
"	Tetrathionate.	$[Ni(NH_3)_6]S_4O_6$	11.96	0.031
"	Bromide......	$[Ni[NH_3)_6]Br_2$	7.384	0.023
"	Perchlorate...	$[Ni(NH_3)_6](ClO_4)_2$	2.503	0.0069
"	Iodide........	$[Ni(NH_3)_6]I_2$	1.906	0.0046

NICKEL NITRATE $Ni(NO_3)_2.6H_2O$.

SOLUBILITY OF NICKEL NITRATE IN WATER.

(Sieverts and Schreiner, 1934.)

The following results supplement and correct in certain details, the previous determinations of Funk, 1900.

NO

t°	Gms. $NiNO_3$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $NiNO_3$ per 100 gms. sat. sol.	Solid Phase
− 1.6	8.7	Ice	0	44.2	$Ni(NO_3)_2.6H_2O$
− 6.0	16.2	"	+20.0	48.5	"
−10.3	22.3	"	25	50.0	"
−15.0	27.4	"	30	51.3	"
−22.1	33.4	"	40	54.3	"
−27.8	36.0	" + $Ni(NO_3)_2.9H_2O$	50	58.2	"
−25.4	36.7	$Ni(NO_3)_2.9H_2O$	54	60.0	" + $Ni(NO_3)_2.4H_2O$
−23.7	37.2	"	60	61.2	$Ni(NO_3)_2.4H_2O$
−20.0	38.3	"	75.4	64.3	"
−13.8	40.2	"	80.6	65.6	"
−11.1	41.2	"	85.4	67.2	" + $Ni(NO_3)_2.2H_2O$
−34.1	38.7	Ice+$Ni(NO_3)_2.6H_2O$	90.4	68.2	$Ni(NO_3)_2.2H_2O$
−25.9	40.0	$Ni(NO_3)_2.6H_2O$	95	68.2	"
−20.6	40.5	"	99.5	69.2	"
−13.1	42.6	"	110.5	69.7	"
− 2.9	43.6	"	119.8	70.8	"

EQUILIBRIUM IN THE SYSTEM NICKEL NITRATE, NITRIC ACID AND WATER AT 25°.

(Sieverts and Schreiner, 1934.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$Ni(NO_3)_2$	HNO_3		$Ni(NO_3)_2$	HNO_3	
43.5	7.6	$Ni(NO_3)_2.6H_2O$	5.3	73.9	$Ni(NO_3)_2.4H_2O$
38.9	13.2	"	5.2	78.6	"
34.3	19.1	"	5.0	80.5	"
30.2	24.1	"	4.1	81.6	$Ni(NO_3)_2.2H_2O$
24.7	32.1	"	2.7	84.3	"
20.1	40.0	"	1.3	89.8	"
16.0	52.0	" + $Ni(NO_3)_2.4H_2O$	0.3	95.3	"
9.9	60.2	$Ni(NO_3)_2.4H_2O$	0.05	99.5	"
7.4	65.2	"	(−25°) → 31.5	5.7	$Ni(NO_3)_2.9H_2O$
--- -		"	(+50°) → 0.4	99.3	$Ni(NO_3)_2.2H_2O$

100 gms. sat. solution in glycol contain 7.5 gms. $Ni(NO_3)_2$ at room temperature. (de Coninck.)

100 cc. anhydrous hydrazine dissolve 3 gms. $Ni(NO_3)_2$ at room temp. (Welsh and Broderson, 1915.)

NICKEL HYDROXIDE $Ni(OH)_2$.

SOLUBILITY OF NICKEL HYDROXIDE IN WATER AT 20°.

(Almkvist, 1918.)

Ordinary distilled water containing a little CO_2 was used. The hydroxide was, therefore, probably converted to basic carbonate. Constant stirring was employed. Two liters of saturated solution were used for analysis. 1000 cc. sat. solution contaihed 0.0127 gm. $Ni(OH)_2$.

Aqueous ammonia solutions of nickel hydroxide were evaporated in a vacuum desiccator and samples withdrawn at intervals for analysis. The results obtained in duplicate series yielded different curves. For 2 *n* NH_3 the gms. Ni per liter varied from 0.17 to 0.83. For 4 *n* NH_3, the gms. Ni per liter varied from 0.36 to 1.8. (Bonsdorff, 1904.) OH

NICKEL Hexammin Per RHENATE $[Ni(NH_3)_6](ReO_4)_2$.

One liter of aqueous ammonia of d. = 0.930 dissolve 33.4 gms. $[Ni(NH_3)_6](ReO_4)_2$ at 26°. (Wilke-Dörfurt and Gunzert, 1933.)

NICKEL SULFIDE NiS

Attention is called by Kolthoff, 1931, to the incorrectness of the results of Weigel, 1906, for the solubility of nickel sulfide in water. It is considered that the values for the solubilities of most sulfides in water are of small or no practical importance. It is recommended that the relations between the solubility and the hydrogen ion and hydrogen sulfide concentrations be expressed by the reaction constant.

1000 cc of sat. solution of nickel sulfide in aqueous 2.0 normal sulfuric acid contain 0)0094 gm. NiS at 20°. (Moser and Behr, 1924.)

NICKEL SULFATE $NiSO_4.7H_2O$. SO

SOLUBILITY IN WATER. (Steele and Johnson, 1904; see also Tobler, Etard and Mulder.)

t°.	Grams $NiSO_4$ per 100 Gms.		Solid Phase.	t°.	Grams $NiSO_4$ per 100 Gms.		Solid Phase.
	Solution.	Water.			Solution.	Water.	
−5	20.47	25.74	$NiSO_4.7H_2O$	33.0	30.25	43.35	$NiSO_4.6H_2O$
0	21.40	27.22	"	35.6	30.45	43.79	" (blue)
9	23.99	31.55	"	44.7	32.45	48.05	"
22.6	27.48	37.90	"	50.0	33.39	50.15	"
30	29.99	42.46	"	53.0	34.38	52.34	"
32.3	30.57	44.02	"	54.5	34.43	52.50	$NiSO_4.6H_2O$
33	31.38	45.74	"	57.0	34.81	53.40	" (green)
34	31.20	45.5	"	60	35.43	54.80	"
32.3	30.35	43.57	$NiSO_4.6H_2O$	70	37.29	59.44	"
33.0	30.25	43.35	" (blue)	80	38.71	63.17	"
34.0	30.49	43.83	"	99	43.42	76.71	"

Transition points, hepta hydrate ⇄ hexa hydrate = 31.5°.
Hexa hydrate (blue) ⇄ hexa hydrate (green) = 53.3°.

SOLUBILITY OF NICKEL SULFATE IN WATER.

(Vilbrandt and Bender, 1923: Tantsov, 1924, 1925.)

The determinations of Vilbrandt and Bender were made by a *float method.* A glass float calibrated at 25° for a nickel sulfate solution containing a definite concentration of the salt was prepared in advance. By means of this float the volume of water necessary to dilute any solution of higher but unknown concentration of nickel sulfate, to the concentration of the standard solution, could be very accurately determined. From this result the concentration of the unknown solution could be readily calculated. In the following table the results of Tantzov are designated (T).

t°.	Gms. $NiSO_4$ per 100 gms. H_2O.	Solid Phase.	t°.	Gms. $NiSO_4$ per 100 gms. H_2O.	Solid Phase.
−4.25	27.335	$NiSO_4 \cdot 7H_2O$ (Green)	20	40.09 (T)	$NiSO_4 \cdot 6H_2O$ (Blue)
−2.0	23.366	»	25	41.56 (T)	»
0.0	26.189	»	30	43.56 (T)	»
3.19	28.884	»	31.71	45.299	»
6.0	30.282	»	35.0	45.58 (T)	»
15.65	35.491	»	40	47.533–47.6 (T)	»
20.0	37.70 (T)	»	50	52.171	»
25	40.594	»	53.25	54.041	»
25	40.40 (T)	»	20	44.37 (T)	$NiSO_4 \cdot 6H_2O$ (Green)
30	43.568	»	25	45.36 (T)	»
30	43.28 (T)	»	30	46.56 (T)	»
35	47.03 (T)	»	40	49.16 (T)	»
40	50.42 (T)	»	58.21	55.389	»
31.55 (tr. pt.)	— (T)	» + $NiSO_4 \cdot 6H_2O$ (Blue)	60.11	55.557	»
36.7 (tr. pt.)	— (T)	» » (Green)	79.75	64.476	»
			94.22	72.597	»

SO

The following recent very careful determinations of the Solubility of Nickel Sulfate in Water are by Rohmer, 1939.

t°	Gms. $NiSO_4$ per 100 gms.		Solid Phase	t°	Gms. $NiSO_4$ per 100 gms.		Solid Phase
	H_2O	sat. sol.			H_2O	sat. sol.	
−0.9	10.0	9.1	Ice	80.5	67.0	40.1	$NiSO_4 \cdot 6H_2O\beta$
−1.6	14.6	12.7	"	90.7	73.6	42.4•	"
−3.4	26.6	21.0	" + $NiSO_4 \cdot 7H_2O$	100.8	82.0	45.1•	"
0	28.1	21.9	$NiSO_4 \cdot 7H_2O$	106.0	89.0	47.1•	"
10	33.0	24.9	"	98	79.2	44.2•	" + $NiSO_4 \cdot 5H_2O$
20	38.4	27.7	"	100	80.0	44.4•	$NiSO_4 \cdot 5H_2O$
25	41.2	29.2	"	105	82.5	45.2•	"
30	44.1	30.6	"	97	78.5	44.0•	$NiSO_4 \cdot 6H_2O\beta$+$NiSO_4 \cdot 4H_2O$
32.6	45.6	31.3•	"	100	78.6	44.0•	$NiSO_4 \cdot 4H_2O$
27	43.1	30.1•	$NiSO_4 \cdot 6H_2O\alpha$	106	80.1	44.4•	"
30.7	44.3	30.7	" + $NiSO_4 \cdot 7H_2O$	96.4	78.0	43.8•	$NiSO_4 \cdot 6H_2O\beta$+$NiSO_4 \cdot 3H_2O$
35.0	46.0	31.5	$NiSO_4 \cdot 6H_2O\alpha$	100	77.3	43.6•	$NiSO_4 \cdot 3H_2O$
40.0	48.2	32.5	"	106	76.8	43.5	"
50.0	52.8	34.6	"	90.3	73.1	42.2•	$NiSO_4 \cdot 6H_2O\beta$+$NiSO_4 \cdot 2H_2O$
58.2	56.6	36.1•	"	104	73.0	42.2•	$NiSO_4 \cdot 2H_2O$
50.0	53.2	34.7	$NiSO_4 \cdot 6H_2O\beta$	84.8	69.3	40.9•	$NiSO_4 \cdot 6H_2O\beta$+$NiSO_4 \cdot H_2O$
53.8	54.6	35.3	" + $NiSO_4 \cdot 6H_2O\alpha$	104	69.3	40.9•	$NiSO_4 \cdot H_2O$
55	55.0	35.5	$NiSO_4 \cdot 6H_2O\beta$				
60	56.9	36.3	"				
70	61.0	37.9	"				

• = Metastable

Additional results for the stable solutions, agreeing in general with the above, are given by Benrath and Theimann, 1934.

EQUILIBRIUM IN THE SYSTEM NICKEL SULFATE, SULFURIC ACID AND WATER AT 12.5°.

(Montemartini and Losana, 1929.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid
	$NiSO_4$	H_2SO_4			$NiSO_4$	H_2SO_4	
1.3208	24.06	0.0	$NiSO_4.7H_2O$	1.4076	4.51	45.02	$NiSO_4.6H_2O$
1.2988	18.91	10.25	" "	1.4721	2.62	53.20	"+$NiSO_4.2H_2O$
1.2958	13.62	18.16	$NiSO_4.6H_2O$	1.5450	0.87	63.32	$NiSO_4.2H_2O$
1.3992	8.56	23.42	"	1.6466	0.22	72.61	"+$NiSO_4$
1.3236	6.84	32.10	"	1.7728	0.17	81.80	$NiSO_4$
1.3598	5.20	40.82	"	1.8430	0.11	98.91	"

EQUILIBRIUM IN THE SYSTEM NICKEL SULFATE, SULFURIC ACID AND WATER AT 20°.

(Babajewa and Daniluschkina, 1936.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$NiSO_4$	H_2SO_4		$NiSO_4$	H_2SO_4	
27.53	0.0	$NiSO_4.7H_2O$	17.63	13.33	$NiSO_4.6H_2O$(blue)
24.13	4.28	"	13.72	19.86	"
22.64	5.92	"	8.56	30.46	"
21.14	8.80	"	6.71	40.67	"
20.60	10.20	" + $NiSO_4.6H_2O$	9.56	52.45	"
18.60	11.85	$NiSO_4.6H_2O$(blue)	0.77	68.01	$NiSO_4.2H_2O$

SO

The authors also give similar results for the temperatures 0°, 40° and 80°.

EQUILIBRIUM IN THE SYSTEM NICKEL SULFATE, SULFURIC ACID AND WATER AT 25°.

(Rohmer, 1939.)

Gms. per 100 gms. sat. sol		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$NiSO_4$	H_2SO_4		$NiSO_4$	H_2SO_4	
29.2	0.0	$NiSO_4.7H_2O$	9.2	46.7*	$NiSO_4.4H_2O$
24.9	5.1	"	8.6	50.0*	"
23.4	7.4	" + $NiSO_4.6H_2O$	7.0	45.3	$NiSO_4.H_2O$
22.0	9.4	$NiSO_4.6H_2O$	4.0	50.4	"
19.8	12.6	"	2.1	54.6	"
14.2	21.1	"	1.0	59.1	"
8.1	35.3	"	0.3	61.0	"
9.0	40.6	"	0.0	66.0	""
9.0	42.0	" + $NiSO_4.H_2O$	0.0	89.0	"
10.8	43.5*	"	0.0	91.0	" + $NiSO_4$
12.5	43.7*	"	0.0	91.2	$NiSO_4$
16.9	42.7*	"	0.0	94.8	"
20.1	41.1*	"			
10.5	43.2*	" + $NiSO_4.4H_2O$			

This author also gives similar results for the temperatures 0°, 50° and 90° showing both stable and metastable equilibrium at each temperature.

EQUILIBRIUM IN THE SYSTEM NICKEL SULFATE, POTASSIUM SULFATE AND WATER AT 25°. (Caven and Johnston, 1926.)

Gms. per 100 gms. sat. sol. $NiSO_4$.	Gms. per 100 gms. sat. sol. K_2SO_4.	Solid Phase.	Gms. per 100 gms. sat. sol. $NiSO_4$.	Gms. per 100 gms. sat. sol. K_2SO_4.	Solid Phase.
27.94	0.00	$NiSO_4.7H_2O$	15.66	4.75	$NiSO_4.K_2SO_4.6H_2O$
27.87	3.82	»	10.15	4.11	»
27.92	6.30	»	3.90	4.15	»
27.90	8.26	»+$NiSO_4.K_2SO_4.6H_2O$	1.35	4.93	»
23.09	6.82	$NiSO_4.K_2SO_4.6H_2O$	0.33	11.16	»+K_2SO_4
19.33	5.62	»	0.0	10.59	K_2SO_4

Additional results for this system at other temperatures, by Benrath 1932, will be found recorded in connection with potassium sulfate.

EQUILIBRIUM IN THE SYSTEM NICKEL SULFATE, RUBIDIUM SULFATE AND WATER.

(Benrath, 1932.)

SO

t°	Gms. per 100 gms. sat. sol. Rb_2SO_4	Gms. per 100 gms. sat. sol. $NiSO_4$	Solid Phase	t°	Gms. per 100 gms. sat. sol. Rb_2SO_4	Gms. per 100 gms. sat. sol. $NiSO_4$	Solid Phase
0	1.84	22.59	$NiSO_4.7H_2O$+1.1.6	44.5	11.04	6.38	1.1.6
"	3.25	7.89	1.1.6	54	3.94	35.75	"+$NiSO_4.6H_2O\alpha$
25	33.7	0.08	Rb_2SO_4+1.1.6	60	14.6	8.45	1.1.6
"	6.81	3.96	1.1.6	69	16.8	9.73	"
"	2.17	30.9	$NiSO_4.7H_2O$+1.1.6	88	22.35	12.96	"
29	2.32	34.6	" + "	100	46.99	0.91	" + Rb_2SO_4
			+ $NiSO_4.6H_2O\alpha$	"	25.57	14.88	1.1.6
				"	7.98	42.8	"+$NiSO_4.6H_2O\beta$

1.1.6 = $NiSO_4.Rb_2SO_4.6H_2O$

EQUILIBRIUM IN THE SYSTEM NICKEL SULFATE, THALLIUM SULFATE AND WATER.

(Benrath, 1932.)

t°	Gms. per 100 gms. sat. sol. Tl_2SO_4	Gms. per 100 gms. sat. sol. $NiSO_4$	Solid Phase	t°	Gms. per 100 gms. sat. sol. Tl_2SO_4	Gms. per 100 gms. sat. sol. $NiSO_4$	Solid Phase
0	2.69	0.16	Tl_2SO_4+1.1.6	46	5.77	1.77	1.1.6
"	1.68	0.51	1.1.6	"	1.55	32.62	"+$NiSO_4.6H_2O\alpha$
"	0.63	21.30	"+$NiSO_4.7H_2O$	55	7.30	2.25	1.1.6
25	5.15	0.33	"+Tl_2SO_4	"	2.28	33.85	"+$NiSO_4.6H_2O\beta$
"	3.20	1.01	1.1.6	80	14.65	3.15	"+Tl_2SO_4
"	0.89	27.92	"+$NiSO_4.7H_2O$	"	13.42	4.13	"
30	2.28	33.85	"+ " +	"	4.32	37.99	"+$NiSO_4.6H_2O\beta$
			$NiSO_4.6H_2O\alpha$	100	20.08	7.34	"+Tl_2SO_4
46	8.29	0.85	1.1.6+Tl_2SO_4	"	7.03	41.45	"+$NiSO_4.6H_2O\beta$

SOLUBILITY OF NICKEL SULFATE IN AQUEOUS SOLUTIONS OF METHYL ALCOHOL AT 14°.

(de Bruyn, 1903.)

Small test tubes of 4–6 cc. capacity were used. They were almost completely filled with the salt and solvent and placed in the bath in an inclined position with salt occupying the upper part of the tube. This caused a "spontaneous circulation of the solvent." The solutions were analyzed by precipitating NiO with KOH at the boiling point, in porcelain vessels.

Wt. Per cent CH_3OH in Solvent.	Gms. $NiSO_4$ per 100 Gms. Sat. Sol. in Contact with:			
	$NiSO_4.7H_2O$ as Solid Phase.	$NiSO_4.6H_2O$ α as Solid Phase.	$NiSO_4.6H_2O$ β as Solid Phase.	$NiSO_4.4H_2O$ as Solid Phase.
0 (H_2O)	26.4	26 (low)	27.2	25.1
10	19.7	22 (?)	20.4	...
20	13.1	14.7	14	14.8
30	6.8	6.6	7.5	...
40	2.8	2.4	3.1	...
50	1.3	1	1.4	1.4
60	0.8	0.4	0.6	...
70	0.6	0.2	0.4	..
80	0.65	0.2	0.4	0.66
85	1.5	0.3	0.7	...
90	5.7	1.2	2.5	...
95	11	6	9 (?)	...
100	16.8	12.4 (low)	15.7 (low)	7.38

$NiSO_4.6H_2O$ α is greenish blue. $NiSO_4.6H_2O$ is more greenish than the α salt. SO

SOLUBILITY OF $NiSO_4.3CH_3OH.3H_2O$ IN AQUEOUS CH_3OH AT 14°.

(de Bruyn, 1903.)

Wt. Per cent CH_3OH.	Gms. $NiSO_4$ per 100 Gms. Sat. Sol.	Wt. Per cent CH_3OH.	Gms. $NiSO_4$ per 100 Gms. Sat. Sol.
85	1.93	90	0.70
86	1.73	92.5	0.50
87	1.48	95	0.455
88	1.25	97.5	0.77
89	1.01	100	3.72

Approximately two hours were allowed for attainment of equilibrium.

In solutions containing more than 15% H_2O the salt is gradually transformed to $NiSO_4.6H_2O$ β.

100 gms. absolute ethyl alcohol dissolve 1.4 gm. $NiSO_4.7H_2O$ at 4° and 2.2 gms. at 17°. (de Bruyn, 1892.)

100 gms. sat. solution in glycol contain 9.7 gms. $NiSO_4$ at room temp. (de Coninck, 1905.)

SOLUBILITY OF NICKEL SULFATE IN ABSOLUTE METHYL AND ETHYL ALCOHOLS.

(Gibson, Driscoll and Jones, 1929.)

Results for Methyl Alcohol

t°	Gms. $NiSO_4$ per 100 gms. CH_3OH	Solid Phase
15	0.061	$NiSO_4$
25	0.081	"
35	0.110	"
45	0.157	"
55	0.222	"

Results for Ethyl Alcohol

t°	Gms. $NiSO_4$ per 100 gms. C_2H_5OH	Solid Phase
15	0.017	$NiSO_4$
35	0.020	"
45	0.022	"
55	0.025	"

OXYGEN O_2.

SOLUBILITY IN WATER. (Winkler, 1891; Bohr and Bock, 1891.)

t°.	Coef. of Absorption β.		q.	t°.	Coef. of Absorption β.		q.
0	0.0489*	0.0496†	0.00695	40	0.0231*	0.0233†	0.00308
5	0.0429	0.0439	0.00607	50	0.0209	0.0207	0.00266
10	0.0380	0.0390	0.00537	60	0.0195	0.0189	0.00227
15	0.0342	0.0350	0.00480	70	0.0183	0.0178	0.00186
20	0.0310	0.0317	0.00434	80	0.0176	0.0172	0.00138
25	0.0283	0.0290	0.00393	90	0.0172	0.0169	0.00079
30	0.0261	0.0268	0.00359	100	0.0170	0.0168	0.00000

* W. † B. and B.

β = the Bunsen Coefficient of Absorption, which shows the volume of gas (reduced to 0° and 760mm pressure) absorbed by 1 volume of liquid when the pressure of the gas itself minus the vapor tension of the liquid amounts to 760mm.

q = the weight of gas in grams which is dissolved by 100 gms. of the pure solvent at the indicated temperature and a total pressure (that is, partial pressure of the gas plus the vapor pressure of the liquid) of 760mm.

According to determinations by Fox (1909a), which agree satisfactorily with the above, the solubility of oxygen in water is expressed by the formula:

$1000 \times \text{abs. coef. } \beta = 49.239 - 1.3440\, t + 0.28752\, t^2 - 0.0003024\, t^3.$

References to more recent papers on the solubility of oxygen are given by Coste (1917, 1918).

SOLUBILITY OF THE OXYGEN OF AIR IN WATER.

t°.	5.2°.	5.65°.	14.78°.	24.8°.
O Solubility*	8.856	8.744	7.08	5.762

* cc. Oxygen per 1000 cc. H_2O saturated with air at 760 mm.

SOLUBILITY OF OXYGEN IN WATER.

A table showing the solubility of oxygen in water in contact with air at various temperatures between 5° and 30° and at absolute pressures from 0 to 760 mm mercury is given by White, 1919. The results are based upon the tables of Roscoe and Lunt and Henry's law. They are given in terms of milligrams of oxygen per liter and are intended for practical application in industrial problems.

Extensive data upon the rate of solution of atmospheric oxygen and nitrogen in water are given in a series of papers by Adeney and Becker 1916-1920, 1919, 1920 and 1921. See also remarks under Nitrogen, p. 1317.

100 cc. H_2O dissolve 3.0 cc. oxygen (reduced to 0° and 760 mm.) at 21°. (Venable and Fuwa, 1922.)

Experiments made by Morgan and Richardson, 1930, showed that the Winkler analytical method modified by using oxygen instead of air, gives the same results for the solubility of oxygen in water as that based upon measurement of loss of volume of oxygen in contact with water. It was also shown by experimental determinations that the solubility of oxygen in water obeys Henry's Law at pressures between 175 and 760mm. The solubility of oxygen at 25° and 760mm pressure was found to be 0.0408 gm. O_2 per liter of water

OXYGEN

The solubility of Oxygen in Water at 25° in terms of the Bunsen Absorption Coefficient (β above) was found by Orcutt and Seevers, 1936, to be 0.0281. The authors made use of the Van Slyke-Neill manometric apparatus which is based upon the principal of extracting the gas from the solvent and measuring its pressure. By means of a special technique and method of calculating the correction for unextracted gas, this becomes a simple method of determining the solubility of any gas in any liquid without the aid of previously determined constants.

SOLUBILITY OF OXYGEN IN WATER AND OTHER SOLVENTS AT 25°.

(Frolich, Tauch, Hogan and Peer, 1931.)

The determinations were made by shaking the solvent and oxygen together at various pressures in a 2 liter steel cylinder at 25° and after attainment of equilibrium withdrawing a sample of the saturated solution over mercury in one of three burets, so designed that the volumes could be measured with the same degree of accuracy at any ratio of gas to liquid. The results show that if the gas does not form a chemical compound with the solvent it follows Henry's Law over a wide pressure range within the limits of error allowed in engineering calculations. The solubility may for practical purposes be considered a linear function of the absolute pressure. In the case of the following results for oxygen, y is the volume of O_2 at 25° and 1 atmosphere per unit volume of liquid, and x is the absolute pressure in atmospheres.

Solvent	Pressure Range in atmospheres	Solubility Equation
Water	0 - 70	$y = 0.028x$
Formic Acid	0 - 70	$y = 0.047x$
Carbon Tetrachloride	0 - 70	$y = 0.031x$
Pentane	0 - 100	$y = 0.576x$
Gas Oil (d.= 0.8319	0 - 70	$y = 0.154x$

SOLUBILITY OF OXYGEN IN SEA WATER.

(Fox, 1909a.)

Before using the sample of sea water for the solubility determinations, it was found necessary to add acid, otherwise the CO_2 could not be boiled out or the precipitation of neutral carbonates prevented. The very small amount of acid was titrated back, using phenolphthaleine as indicator.

Results in terms of cc. of oxygen absorbed by 1000 cc. of sea water from a free dry atmosphere at 760 mm. pressure.

The calculated formula expressing the solubility is: $1000\,a = 10.291 - 0.2809\,t + 0.006009\,t^2 + 0.0000632\,t^3 - \mathrm{Cl}\,(0.1161 - 0.003922\,t + 0.0000631\,t^2)$.

Parts Chlorine per 1000.	t° = 0°.	4°.	8°.	12°.	16°.	20°.	24°.	28°.
0	10.29	9.26	8.40	7.68	7.08	6.57	6.14	5.75
4	9.83	8.85	8.04	7.36	6.80	6.33	5.91	5.53
8	9.36	8.45	7.68	7.04	6.52	6.07	5.67	5.31
12	8.90	8.04	7.33	6.74	6.24	5.82	5.44	5.08
16	8.43	7.64	6.97	6.43	5.96	5.56	5.20	4.86
20	7.97	7.23	6.62	6.11	5.69	5.31	4.95	4.62

A recalculation of Fox's determinations to parts per million, with correction for vapor pressure, is published by Whipple and Whipple (1911).

Additional data on the solubility of atmospheric oxygen in sea water are given by Clowes and Biggs (1904).

Data for the solubility of oxygen in water under pressures up to 10 atmospheres are given by Cassuto (1913). The solubility increases at a somewhat slower rate than proportional to the pressure.

SOLUBILITY OF OXYGEN IN AQUEOUS SALT SOLUTIONS AT 25°.

(MacArthur, 1916.)

Aq. Salt Solution.	d_{25} Aq. Solution.	cc oxygen per Liter.	Aq. Salt Solution.	d_{25} Aq. Solution.	cc. Oxygen per Liter.	Aq. Salt Solution.	d_{25} of Solution.	cc. Oxygen per Liter.
Dist. H_2O	1	5.78	0.25 *n* KBr	1.019	5.29	0.125*n* NaBr	1.007	5.65
0.125*n* NH_4Cl	1.0015	2.31	2 *n* "	1.079	3.27	0.25 *n* "	1.017	5.52
0.25 *n* "	1.0025	1.16	4 *n* "	1.162	1.84	0.50 *n* "	1.036	5.15
1 *n* "	1.014	0.07	0.125*n* KCl	1.003	5.52	1 *n* "	1.075	4.47
0.125*n* $BaCl_2$	1.019	5.40	0.25 *n* "	1.0086	5.30	2 *n* "	1.150	3.37
0.25 *n* "	1.042	5.04	0.50 *n* "	1.020	4.98	3 *n* "	1.219	2.57
0.50 *n* "	1.082	4.27	1 *n* "	1.042	4.26	4 *n* "	1.305	2.02
1 *n* "	1.177	3.10	2 *n* "	1.086	3.21	6 *n* "	1.455	1.28
0.25 *n* $CaCl_2$	1.022	5.08	3 *n* "	1.134	2.36	0.125*n* NaCl	1.0022	5.52
1 *n* "	1.084	3.71	4 *n* "	1.170	1.86	0.25 *n* "	1.0067	5.30
5 *n* "	1.34	2.14	0.125*n* KI	1.013	5.65	0.50 *n* "	1.017	4.92
0.125*n* CsCl	1.014	5.67	0.25 *n* "	1.027	5.49	1 *n* "	1.038	4.20
0.125*n* LiCl	1.0004	5.63	0.50 *n* "	1.056	5.20	2 *n* "	1.075	3.05
0.50 *n* "	1.0091	5.17	1 *n* "	1.116	4.75	3 *n* "	1.112	2.24
1 *n* "	1.021	4.59	2 *n* "	1.23	3.77	4 *n* "	1.149	1.62
2 *n* "	1.044	3.63	5 *n* "	1.46	1.81	0.125*n* Na_2SO_4	1.014	5.04
3 *n* "	1.113	1.97	0.25 *n* KNO_3	1.015	5.49	0.25 *n* "	1.032	4.60
4 *n* "	1.220	1.12	0.50 *n* "	1.029	5.11	0.50 *n* "	1.063	3.97
0.125*n* $MgCl_2$	1.011	5.35	1 *n* "	1.059	4.61	1 *n* "	1.130	3
0.50 *n* "	1.044	4.37	2 *n* "	1.110	3.65	0.125*n* Sucrose	1.015	5.40
1 *n* "	1.085	3.18	0.125*n* K_2SO_4	1.016	5.11	0.25 *n* "	1.033	4.82
2 *n* "	1.160	2.22	0.25 *n* "	1.032	4.66	0.50 *n* "	[illegible]	4.39
4 *n* "	1.284	0.78	0.5 *n* "	1.060	3.89	1 *n* "	1.147	3.20
5 *n* "	1.343	0.54	0.125*n* RbCl	1.0094	5.65	2 *n* "	1.330	1.84

SOLUBILITY OF OXYGEN IN WATER AND IN AQUEOUS SOLUTIONS OF ACIDS, BASES AND SALTS. (Geffcken, 1904.)

Aq. Solution of:	Concentration per Liter.		Solubility of Oxygen.*	
	Gram Equiv.	Grams.	$l_{15°}$.	l_{25}.
Water alone	...	...	0.0363	0.0308
Hydrochloric Acid	0.5	18.22	0.0344	0.0296
"	1.0	36.45	0.0327	0.0287
"	2.0	72.90	0.0299	0.0267
Nitric Acid	0.5	36.52	0.0348	0.0302
"	1.0	63.05	0.0336	0.0295
"	2.0	126.10	0.0315	0.0284
Sulphuric Acid	0.5	24.52	0.0338	0.0288
"	1.0	49.04	0.0319	0.0275
"	2.0	98.08	0.0335	0.0251
"	3.0	147.12	0.0256	0.0229
"	4.0	196.16	0.0233	0.0209
"	5.0	245.20	0.0213	0.0194
Potassium Hydroxide	0.5	28.08	0.0291	0.0252
"	1.0	56.16	0.0234	0.0206
Sodium Hydroxide	0.5	20.03	0.0288	0.0250
"	1.0	40.06	0.0231	0.0204
"	2.0	80.12	0.0152	0.0133
Potassium Sulphate	0.5	43.59	0.0294	0.0253
"	1.0	87.18	0.0237	0.0207
Sodium Chloride	0.5	29.25	0.0308	0.0262
"	1.0	58.5	0.0260	0.0223
"	2.0	119.0	0.0182	0.0158

* l = the Ostwald Solubility Expression which shows the ratio of the volume (v) of gas absorbed at any pressure and temperature, to the volume (V) of the absorbing liquid. Thus $l = \frac{v}{V}$. The Ostwald Expression and the Bunsen Absorption Coefficient (see table for solubility of oxygen in water) are related thus,

$$l = \beta(1 + 0.00367\,t), \quad \beta = l \div (1 + 0.00367\,t)$$

SOLUBILITY OF OXYGEN IN AQUEOUS POTASSIUM CYANIDE SOLUTIONS AT 20°.
(Maclaurin, 1893.)

Gms. KCN per 100 gms. sol.	1	10	20	30	50
Coefficient of absorption β	0.029	0.018	0.013	0.008	0.003

SOLUBILITY OF OXYGEN IN AQUEOUS SULFURIC ACID SOLUTIONS.

Results at 21°. (Bohr, 1910.)

Normality of H_2SO_4.	Absorp. Coef. β.	Normality of H_2SO_4.	Absorp. Coef. β.
0	0.0310	24.8	0.0103
4.9	0.0195	29.6	0.0117
8.9	0.0155	34.3	0.0201
10.7	0.0143	35.8 (=96%)	0.0275
20.3	0.0119		

Results at 20°. (Christoff, 1906).

Wt. % H_2SO_4.	Ostwald Solubility Expression l_{20}.
0	0.03756
35.82	0.01815
61.62	0.01407
95.60	0.03303

SOLUBILITY OF OXYGEN IN AQUEOUS SOLUTIONS OF:

Chloral Hydrate at 20°. (Müller, 1912–13.)

Gms. $CCl_3.CH(OH)_2$ per 100 Gms. Aq. Sol.	d_{20} of Aq. Sol.	Abs. Coef. β (Bunsen) at 20°.
16.9	1 0798	0.02795
32	1.1630	0.02495
52.9	1.2935	0.02325
61.08	1.354	0.02410
65.5	1.382	0.02580
71.4	1.4404	0.02730
78	1.46	0.03280

Glycerol at 15°. (Müller, 1912–13.)

Gms. $(CH_2OH)_2CHOH$ per 100 Gms. Aq. Sol.	d of Aq. Sol.	Abs. Coef. β (Bunsen) at 15°.
20.5	$d_{12.5}$ = 1.0509	0.02742
25	d_{13} = 1.0621	0.02521
37.3	$d_{14.5}$ = 1.0957	0.02022
45	$d_{12.5}$ = 1.1161	0.01744
52	$d_{12.5}$ = 1.1351	0.01570
71.5	$d_{12.5}$ = 1.1908	0.00950
88.5	$d_{12.5}$ = 1.236	0.00886

SOLUBILITY OF OXYGEN IN AQUEOUS SOLUTIONS OF:

Glucose at 20°. (Müller, 1912–13.)

Gms. $C_6H_{12}O_6$ per 100 Gms. Aq. Sol.	d_{20} of Aq. Sol.	Abs. Coef. β (Bunsen) at 20°.
10.84	1.0413	0.02690
20.7	1.0835	0.02250
33.8	1.1370	0.01815
51.9	1.2295	0.01390
58.84	1.2649	0.01250

Cane Sugar at 15°. (Müller, 1912–13.)

Gms. $C_{12}H_{22}O_{11}$ per 100 Gms. Aq. Sol.	d_{15} of Aq. Sol.	Abs. Coef. β (Bunsen) at 15°.
12.1	1.0482	0.02969
24.38	1.1022	0.02396
28.44	1.1205	0.02181
42.96	1.1938	0.01600
50	1.2318	0.01359

INFLUENCE OF ANESTHETICS UPON THE SOLUBILITY OF OXYGEN IN OLIVE OIL.

(Hamberger, 1911.)

Name and Conc. of Narcotic Added to the Oil.		Solubility of Oxygen in:		Name and Conc. of Narcotic Added to the Oil.		Solubility of Oxygen in:	
		Pure Solvent.	Narcotic Solution.			Pure Solvent.	Narcotic Solution.
Sulfonal	(0.8 per 100)	9.69	4.55	Monochlorhydrine	(5 per 100)	9.10	7.50
"		9.69	5.68	"	(2.5 ")	9.10	7.50
"		9.69	6.25	"	(1.25 ")	9.10	7.90
Trional	(saturated)	9.10	4.55	Dichlorhydrine	(10 ")	9.10	7.96
"		9.10	5.68	"	(5 ")	9.10	8
Tetronal	(2 per 100)	9.67	9.10	Phenylurethan	(5 ")	8.53	6.25
"		9.67	9.20	"	(2.5 ")	8.53	7.50
Camphor	(10 per 100)	8.53	7.96				

Data for the solubility of oxygen in liquid air are given by Baly (1900).

Data for the solubility of oxygen in hemoglobin are given by Jolin (1889).

Data for the solubility of oxygen in defibrinated ox-blood and ox-serum, at pressures varying from 760 to about 1400 mm. Hg, are given by Findlay and Creighton (1911).

SOLUBILITY OF OXYGEN IN PLASMA AND IN BLOOD.

(O'Brien and Parker, 1922, quoted from Bohr, 1905.)

Solvent.	Coef. abs. α (cc. O_2 per cc. solvent, at 0° and 760 mm.) at 15°.	at 38°.
Blood plasma	0.033	0.023
Whole blood	0.031	0.022
Blood corpuscles	0.025	0.019

SOLUBILITY OF OXYGEN IN BLOOD AT 38°.

(Sendroy, Dillon and Van Slyke, 1934.)

The authors point out that the result reported by Bohr was not directly determined but estimated on the assumption that since his experiments showed hydrogen to be only 92 percent as soluble in blood as in water, oxygen would also have the same "relative solubility". The authors, have therefore, made direct determinations of the solubility of oxygen in blood and also determined the effect of its various constituents upon this solubility. The Van Slyke-Neil (1924) manometric gas apparatus was used((see preceding remarks in connection with results for the solubility of oxygen in water by Orcutt and Seevers). The results are given in terms of the Bunsen Abs. Coef. as defined in connection with the preceding table for the solubility of oxygen in water.

Solvent	Oxygen Abs. Coef. β
Water	0.02323
Aq. 0.155 normal NaCl	0.02211
Plasma	0.0209
Cells	0.0261
Whole Blood of normal hemoglobin content	0.0230 (0.034 at 20°)
Hemoglobin	0.0280*

*This result shows the cc.O_2 taken up by 1 gm. of dissolved hemoglobin when the gas tension is 760mm.

100 cc. rubber dissolve 7.3 cc. oxygen (reduced to 0° and 760 mm.) at 21°. The gas dissolved by a given amount of air free rubber was pumped out with a Töpler pump and measured over mercury. (Venable and Fuwa, 1922.)

SOLUBILITY OF OXYGEN IN ETHYL ALCOHOL, METHYL ALCOHOL AND IN ACETONE.

(Timofejew — Z. physik. Ch. 6, 151, '90; Levi — Gazz. chim. ital. 31, II, 513, '01.)

t°.	In Ethyl Alcohol of 99.7% (T.).		In Methyl Alcohol (L.)	In Acetone (L.)
	β.	β'.	l =	l =
0	0.2337	0.2297	0.31864	0.2997
5	0.2301	0.2247	0.30506	0.2835
10	0.2266	0.2194	0.29005	0.2667
15	0.2232	0.2137	0.27361	0.2493
20	0.2201	0.2073	0.25574	0.2313
25	0.2177 (24°)	0.2017 (24°)	0.23642	0.2127
30	...	...	0.21569	0.1935
40	...	...	0.16990	0.1533
50	...	...	0.11840	0.1057

β and l are defined in the preceding pages. β' shows the volume of gas (reduced to 0° and 760mm) which is absorbed by one volume of the liquid when the barometer indicates 760mm pressure.

The formulæ expressing the solubility of oxygen in methyl alcohol and in acetone as shown in the above table are as follows:

In Methyl Alcohol $l = 0.31864 - 0.002572\,t - 0.00002866\,t^2$.
In Acetone $l = 0.2997 - 0.00318\,t - 0.000012\,t^2$.

The formula expressing the absorption coefficient of oxygen in ethyl alcohol is $\beta = 0.23370 - 0.00074688\,t + 0.000003288\,t^2$.

SOLUBILITY OF OXYGEN IN AQUEOUS ALCOHOL AT 20° AND 760 MM.

(Lubarsch, 1889?)

Wt. Per cent Alcohol.	Vol. Per cent Absorbed O.	Wt. Per cent Alcohol.	Vol. Per cent Absorbed O.	Wt. Per cent Alcohol.	Vol. Per cent Absorbed O.
0	2.98	23.08	2.52	50	3.50
9.09	2.78	28.57	2.49	66.67	4.95
16.67	2.63	33.33	2.67	80	5.66

SOLUBILITY OF OXYGEN IN PETROLEUM. COEFFICIENT OF ABSORPTION AT 10° = 0.229, AT 20° = 0.202.

(Gniewasz and Walfisz, 1887.)

SOLUBILITY OF OXYGEN ETHYL ETHER.

(Christoff, 1912.)

O Results in terms of the Ostwald Solubility Expression, $l_0 = 0.4235$, $l_{10} =$ 0.4215.

The Solubility of Oxygen in Benzene at 25° in terms of the Ostwald Solubility Expression was found by Morgan and Pyne, 1930 to be, $l =$ 0.2079.

One liter of cyclohexanol ($C_6H_{11}OH$) dissolve 193.5cc Oxygen at 26° and 766mm. (Cauquil, 1927.)

The coefficient of absorption of O_2 in mineral oil (d = 0.868 at 27°, viscosity 285 at 100°F (Saybolt) and f. pt. = -37°) was found by Kubie, 1927, using the Van Slyke-Neil, 1924, apparatus, to be 0.134cc O_2 (reduced to 0° and 760mm) per 1.0cc of oil at 24° and 760mm.

SOLUBILITY OF OXYGEN IN SEVERAL ORGANIC SOLVENTS.

(Horiuti, 1931, 1932.)

t°	Solubility of O_2 in terms of the Ostwald Expression l in :					
	CCl_4	C_6H_5Cl	C_6H_6	$(CH_3)_2CO$	$CH_3CO_2CH_3$	$(C_2H_5)_2O$
-78	—	—	—	0.2147	0.1901	0.4505
-60	—	—	—	0.2175	0.1987	0.4329
-40	—	—	—	0.2253 (-41.3)	0.2126	0.4244
-20	—	—	—	0.2385	0.2288	0.4247
0	0.2865	0.1748	—	0.2550	0.2488	0.4325
+10	0.2926	0.1804	0.2091	0.2649	0.2583	—
20	0.2996	0.1863	0.2186	0.2736	0.2703 (21.85)	0.4511
25	0.302	0.189	0.223	0.280	0.273	0.455
30	0.3056	0.1915	0.2281	0.2846	0.2789	—
40	0.3124	0.1974	0.2371	0.2954	0.2877	—
50	0.3196	0.2031	0.2483	—	—	—
60	0.3246	0.2094	0.2576	—	—	—
70	—	0.2163	—	—	—	—
80	—	0.2214	—	—	—	—

SOLUBILITY OF OXYGEN IN VARIOUS ORGANIC SOLVENTS.

(Fischer and Pfleiderer, 1922.)

The determinations were made by two procedures for which highest accuracy is not claimed but which yield comparative values of much interest. (1) An autoclave of known volume is nearly filled with a measured amount of the solvent. The apparatus is shaken and oxygen introduced untill a constant pressure of the gas is reached. The pressure is then released to one atmosphere and the volume of liberated gas is measured. By calculating from the total pressure, the volume of free space above the solvent and the volume of liberated gas, a value for the solubility is obtained. The correction for vapor pressure of solvent is relatively small by this method. (2) The solvent is saturated in an autoclave under known pressure by means of a gas outlet under the liquid. A sample of the saturated solution is withdrawn, its volume or weight determined and its dissolved gas released and measured in a gas buret.

Solvent.	d of solvent.	Vapor pressure of solvent mm.	t°.	t° of saturation.	Abs. coef. α.	Solubility l (Ostwald).
Water	1.00	19	21.3	20	0.021	0.023
Aq. 0.1 *n* KOH	1.004	18	20.3	20	0.024	0.026
Petroleum Ether (b. pt. →65°).	0.668	348	18,5	18.5	0.409	0.436
Benzine (b. pt. 65°–100°).	0.709	115	20	18	0.292	0.312
Com. Petroleum	0.809	4.4	19	18	0.159	0.170
Paraffine Oil	0.8805	–	17	18	0.114	0.122
Chloroform	1.49	136	16	16	0.205	0.217
Carbon Tetrachloride	1.595	86	17.8	18	0.230	0.245
Acetylene » ($C_2H_2Cl_4$)	1.602	7	18	18	0.100	0.107
Methyl Alcohol	0.792	96	20	18.5	0.175	0.187
Ethyl Alcohol (96 %)	0.809	(35-40)	20	20	0.143	0.154
Amyl Alcohol (iso)	0.812	2	17	16	0.163	0.173
Acetone	0.795	165	18	19	0.207	0.222
Ethyl Ether	0.718	434	20.2	20.2	0.415	0.446
Ethyl Acetate	0.868	73	20	20	0.163	0.175
Benzene	0.8785	74.5	19.8	19	0.163	0.174
Toluene	0.864	21	18.5	18	0.168	0.179
Xylene (Com.)	0.865	8.4	16	16	0.169	0.179
Nitrobenzene	1.202	–	20	18	0.070	0.075
Tetra hydro naphthalene (Tetralin).	0.98	–	–	17	0.094	0.100
Pyridine.	0.981	12	18.5	18	0.099	0.105

The Abs. Coef. α is the volume of gas dissolved in 1 cc. of solvent when its partial pressure is 1 atmosphere (reduced to normal conditions of 0° and 760 mm.). The Ostwald solubility expression *l* is the volume of gas per 1 volume of liquid, on the basis of Henry's law, measured at the saturation temperature. The results for water are probably in error due to removal of oxygen by oxidation of the iron of the autoclave.

SOLUBILITY OF OXYGEN IN LIQUID SULFUR DIOXIDE.

(Dornte and Ferguson, 1939.)

The determinations were made in an apparatus which permitted measurements under static and under circulating conditions. An equation for the variation of absorption with pressure was calculated and from this the following mean values were derived.

t°	cc O_2 (at 0° and 760mm) dissolved by 1 gm. SO_2 at 1 atmosphere pressure	t°	cc O_2 (at 0° and 760mm) dissolved by 1 gm. SO_2 at 1 atmosphere pressure
-20	25	10	183
-10	50	20	331
0	98	30	575

The solubility of oxygen and other gases in Metals has been extensively studied. A very complete bibliography of this work and of gas solubility in general is given in Landolt and Börnstein "Tabellen", 5th edition, 3rd supplement, first part, 1935.

OZONE O_3.

SOLUBILITY IN WATER.

(von Mailfert, 1894; Carius; Schöne, 1873.)

t°.	W.	G.	R.	t°.	W.	G.	R.
0	39.4	61.5	0.641	27	13.9	51.4	0.270
6	34.3	61	0.562	33	7.7	39.5	0.195
11.8	29.9	59.6	0.500	40	4.2	37.6	0.112
13	28	58.1	0.482	47	2.4	31.2	0.077
15	25.9	56.8	0.456	55	0.6	19.3	0.031
19	21	55.2	0.381	60	0	12.3	0

W = milligrams ozone dissolved per liter water. *G* = milligrams ozone in one liter of the gas phase above the solutions. *R* = ratio of the dissolved to undissolved ozone (*W* + *G*).

The experiments of Schöne (See Above) were repeated by Inglis (1903). "The results confirm Schöne's experiments and indicate that ozone, when passed through water, is partly decomposed."

According to Moufang (1911) the solubility of ozone in distilled water ranges from about 10 milligrams per liter at 2° to about 1.5 milligrams per liter at 28°. The solubility is greatly affected by other substances in solution. Small amounts of acids increase the solubility and render the aqueous solution of the ozone more permanent. Alkalis decrease the solubility. Neutral salts (*i.e.*, calcium sulfate) increase the solubility.

SOLUBILITY OF OZONE IN DILUTE SULFURIC ACID.

(Rothmund, 1912.)

The explanation of the discrepancies concerning the solubility of ozone in water is that the ozone quickly decomposes as the saturation point is reached. Rothmund, therefore, determined the solubility in dilute H_2SO_4 in which decomposition takes place much more slowly than in pure water. At 0° the absorption coef. β (Bunsen, see p.1352) in 0.1 *n* H_2SO_4, is 0.487. The coef. remains practically the same when the concentration of the ozone is changed over a wide range, hence Henry's Law holds for ozone. The dissolved ozone has the same molecular weight as the gaseous. The solubility depression which ozone experiences through 0.1 *n* H_2SO_4 is calculated as 1.5%. Therefore, by extrapolation, it is calculated that the abs. coef. β of ozone in H_2O at 0°, is 0.494.

SOLUBILITY OF OZONE IN WATER.

(Briner and Perrottet, 1939.)

Conc. of Ozone, in gaseous phase		Bunsen Coef. of Absorption β at: 3.5°	19.8°
0.3		0.463	—
1.2		0.506	—
6.0		0.475	0.308
6.3		0.470*	—
7.0		—	0.334*
9.0		0.473*	—
	average	0.480	0.323

In these cases the liquid was previously put in contact with a gas phase richer in ozone and equilibrium was thus approached from above.

The Bunsen Coefficient β of ozone in aq. NaCl solution containing 35 gms. NaCl per liter was found to be 0.24 at 3.5° and 0.17 at 19.8°.

Additional results for the solubility of ozone in water and aqueous solutions of sulfuric acid are given by Kachtanow and Obstchouk, 1937.

SOLUBILITY OF OZONE IN SEVERAL SOLVENTS.

(v. Wartenberg and Podjaski, 1925.)

Solvent	t°	Bunsen Abs. Coef. β
Acetic acid	18.2	2.57
"	30.2	1.74
"	38.3	1.54
Acetic anhydride	0	2.08
Dichlor acetic acid	0	1.65
Propionic acid	17.3	3.73
Propionic anhydride	18.2	2.82
Carbon tetra chloride	0	3.04

*See p. 1352.

OSMIUM TETROXIDE OsO_4

SOLUBILITY OF OSMIUM TETROXIDE IN WATER.

The results of Squire and Caines, 1905; v. Wartenborg, 1924; Tschugajew and Fritmann, 1928 and Anderson and Yost, 1938, were plotted and the following values taken from the average curve.

t°	Gms. OsO_4 per 100 gms. sat. sol.
0	5.00
5	5.20
10	5.44
15	5.70
20	6.04
25	6.56

DISTRIBUTION OF OSMIUM TETROXIDE BETWEEN WATER AND CARBON TETRACHLORIDE AT 25°.

(Anderson and Yost, 1938.)

Gm. Mol. OsO_4 per 1.0 gm. mol.		$\frac{c}{w}$	Gm. Mol. OsO_4 per 1.0 mol.		$\frac{c}{w}$
H_2O layer (w)	CCl_4 layer (c)		H_2O layer (w)	CCl_4 layer (c)	
0.0001464	0.01204	82.2	0.00189	0.1563	82.7
0.000405	0.0320	79.0	0.00196	0.175	89.3
0.000582	0.0424	72.9	0.00234	0.22	94
0.000614	0.0424	81.2	0.002715	0.2564	94.5
0.000653	0.0530	81.2	0.00381	0.426	112.0
0.000715	0.0582	81.4	0.00423	0.520	123
0.00135	0.109	80.7	0.00459	0.6065	132.2
0.00137	0.117	85.4	0.00470	0.598	127.3
			0.00507	0.693	136.5

100 gms. H_2O dissolve 7.24 gms. OsO_4 at 25°.
100 gms. CCl_4 dissolve 375 ± 17 gms. OsO_4 at 25°.
The authors also give vapor pressure measurements of solution of OsO_4 in CCl_4 at 25°.

PHOSPHORUS P. (yellow)

SOLUBILITY IN BENZENE.

(Christomanos — Z. anorg. Ch. 45, 136, '05.)

t°.	Gms. P per 100 Gms. C_6H_6.	Sp. Gr. of Solution.	t°.	Gms. P per 100 Gms. C_6H_6.	Sp. Gr. of Solution.	t°.	Gms. P per 100 Gms. C_6H_6
0	1.513	...	23	3.399	0.8875	50	6.80
5	1.99	...	25	3.70	0.8861	55	7.32
8	2.31	0.8990	30	4.60	...	60	7.90
10	2.4	0.8985	35	5.17	...	65	8.40
15	2.7	0.894	40	5.75	...	70	8.90
18	3.1	0.892	45	6.11	...	75	9.40
20	3.2	0.890				81	10.03

SOLUBILITY OF PHOSPHORUS IN ETHER.

(Christomanos.)

t°.	Gms. P per 100 Gms. $(C_2H_5)_2O$.	Sp. Gr. of Solutions.	t°.	Gms. P per 100 Gms. $(C_2H_5)_2O$.	Sp. Gr. of Solutions.	t°.	Gms. P per 100 Gms. $(C_2H_5)_2O$.
0	0.434	...	15	0.90	0.723	28	1.60
5	0.62	...	18	1.01	0.719	30	1.75
8	0.79	0.732	20	1.04	0.718	33	1.80
10	0.85	0.729	23	1.12	0.722	35	2.00
			25	1.39	0.728		

SOLUBILITY OF YELLOW PHOSPHORUS IN SEVERAL SOLVENTS AT 15°.

(Stich, 1903.)

Solvent.	Gms. P per 100 Gms. Solution.
Almond Oil	1.25
Oleic Acid	1.06
Paraffin	1.45
Water	0.0003
Acetic Acid (96%)	0.105

100 gms. Phosphorus Tri Oxide (P_2O_3) dissolve 1.7 gm. P at 25°.
(Miller, 1928.)

SOLUBILITY OF PHOSPHORUS IN CARBON DISULFIDE.

(Cohn and Inouye, 1910.)

t°.	Gms. P per 100 Gms. Sat. Sol.	t°.	Gms. P per 100 Gms. Sat. Sol.	t°.	Gms. P per 100 Gms. Sat. Sol.
−10	31.40	−3.5	66.14	0	81.27
−7.5	35.85	−3.2	71.72	+5	86.3
−5	41.95	−2.5	75	10	89.8

The above determinations were made with very great care. The authors show that the previous determinations of Giran (1903) are inaccurate.

100 gms. alcohol ($d = 0.799$) dissolve 0.312 gm. P, cold, and 0.416 gm., hot. (Büchner.)

100 gms. glycerol ($d_{15} = 1.256$) dissolve 0.25 gms. P at 15–16°. (Ossendowski, 1907.)

Red phosphorus is completely insoluble in turpentine even up to 270° provided the determination is made without access of air (sealed tube). If air is not excluded a portion of the red phosphorus may be converted to yellow phosphorus which would dissolve. (Colson, 1907.)

RECIPROCAL SOLUBILITY OF PHOSPHORUS AND SULFUR, DETERMINED BY THE SYNTHETIC (Sealed Tube) METHOD.

(Giran, 1906.)

(Mixtures of P and S were sealed in small tubes and first heated to about 200° to cause combination. They were then cooled to the solidification point and gradually heated to the temperature at which the last crystal disappeared. The following results, which were read from the diagram, show the eutectics and maxima of the curves.)

Eutectics.			Maxima of Curves.		
t°.	Mols. % S in Mixture.	Solid Phase.	t°.	Mols. % S in Mixture.	Solid Phase.
−40	33.5	$P_4S_3+P_2$	+167	43.6	P_4S_3
+46	50	$P_4S_3+P_2S_3$	296	60.8	P_2S_3
230	67.5	$P_2S_3+P_2S_5$	272	72.1	P_2S_5
243	75	$P_2S_5+PS_6$	314	86.1	PS_6

Additional data for this system are given by Boulouch (1902 and 1906) and by Helff, 1893.

Fusion-point data for mixtures of Phosphorus and Selenium are given by Robinson and Scott, 1933. Results for mixtures of Phosphorus and Thallium are given by Mansuri, 1927.

Br

PHOSPHORUS BROMIDE PBr_3.

Fusion-point data are given for:

$PBr_3 + S_2Br_2$ (Pusin and Makuc, 1938.)
" + $SnBr_4$ " " "
" + $SbBr_3$ " " "
" + $PSBr_3$ (Van Arkel and Lebbink, 1937.)

Cl

PHOSPHORUS CHLORIDE PCl_3.

Fusion-point data are given for:

$PCl_3 + SnCl_3$ (Pusin and Makuc, 1938.)

PHOSPHORUS IODIDE PI_3.

I

Fusion-point data are given for:

$PI_3 + SbI_3$ (Jaeger and Doornbosch, 1912.)

PHOSPHORUS Oxy CHLORIDE $POCl_3$.

Fusion-point data are given for:

$POCl_3 + SO_2Cl_2$ (Lutschinsky Litchatschewa, 1935.)

PHOSPHORUS SULFIDES P_4S_3, P_4S_7, P_4S_{10}.

SOLUBILITY IN CARBON DISULFIDE, BENZENE, AND IN TOLUENE.
(Stock, 1910.)

S

t°.	Gms. P_4S_3 per 100 Gms.: CS_2.	C_6H_6.	$C_6H_5CH_3$.	Gms. P_4S_7 per 100 Gms. CS_2.	Gms. P_4S_{10} per 100 Gms. CS_2.
−20	11.1	...	...	...	0.083
0	27	...	...	0.005	0.182
+17	100	2.5	3.125	0.0286	0.223
80	...	11.1	...	...	...
110	...	...	15.4	...	...

PHOSPHORUS SELENIDE P_4Se_3.

100 cc carbon disulfide dissolve 7.1 gm. P_4Se_3 at about 20°.
(Mai, 1926.)

Se

PHOSPHO MOLYBDIC ACID $P_2O_5.20MoO_3.52H_2O$.

SOLUBILITY IN ETHER. (Parmentier, 1887.)

t°.	0°.	8.1°.	19.3°.	27.4°.	32.9°.
Gms. Acid per 100 gms. Ether	80.6	84.7	96.7	103.9	107.9

LEAD Pb.

An extensive investigation of the solubility of lead in the water passing through lead pipes is described by Paul, Ohlmüller, Heise and Auerbach, 1906. The solubility is increased by oxygen, CO_2, sulfates and perhaps other salts; it is decreased by hydrocarbonates.

More recent experiments upon this subject are described by Zink, 1933. Lead of 98.24 percent purity was subjected to the action water free from and containing CO_2 and various salts for periods of 24 hours. The bearing of these results upon the use of lead pipes as conductors for water supplies is discussed. Since the constituents of water passing through lead pipes form compounds which coat the interior of the pipes, the author gives the following values for the solubility of some of these products.

Compound		Mgs. Pb dissolved per liter
Lead Oxide PbO		63.8
Lead Hydroxide	$3PbO.H_2O$	93.3
Lead Carbonate	(observed)	1.75
" "	(calculated)	0.04
½ basic "	(observed)	1.3
$PbO.2PbCO_2.H_2O$	(calculated)	less than 0.04
Lead Sulfate	$PbSO_4$	26.0
½ basic "	$PbO.PbSO_4$	10.6
¾ " "	$3PbO.PbSO_4.H_2O$	22.0
Lead Chloride	$PbCl_2$	696.0
½ basic "	$PbO.PbCl_2.H_2O$	79.0
¾ " "	$3PbO.PbCl_2.H_2O$	21.0
Lead Nitrate	$Pb(NO_3)_2$	516.0

SOLUBILITY OF LEAD IN LIQUID AMMONIA-SODIUM SOLUTIONS AT −33°.

(Smith, F. H., 1917.)

Gm. Atoms Sodium per Liter of Liquid Ammonia.	Gm. Atoms Pb Dissolved per Gm. Atom Na.	Gm. Atoms Na per Liter of Liquid Ammonia.	Gm. Atoms Pb Dissolved per Gm. Atom Na.
0.078	1.95	0.13	2.17
0.093	2.20	0.14	2.12
0.094	2.03	0.33	1.83
0.110	2.24	0.34	1.73
0.12	1.78		

SOLUBILITY OF LEAD IN MERCURY.

(Thompson, 1935.)

A special apparatus and technique was necessary to avoid the oxidation which rapidly occurs in lead amalgams.

t°	Gm. Atom Percent Pb in sat. sol.	t°	Gm. Atom Percent Pb in sat. sol.
20	1.476	50	2.742
30	1.780	60	3.419
40	2.199	70	4.330

AsO

LEAD ARSENATE.

SOLUBILITY OF COMMERCIAL LEAD ARSENATE IN AQUEOUS SOLUTIONS OF SALTS.

(Stewart, 1922.)

The sample of commercial lead arsenate was guaranteed to contain not less than 25 per cent of arsenic and not more than 1 $^1/_2$ per cent water soluble arsenic. The aqueous solutions containing an excess of the lead arsenate were shaken two or more times daily for three weeks or more at room temperature. One liter of each sat. solution was treated with 10 cc. of HNO_3 + 10 cc. of H_2SO_4 and evaporated to appearance of white fumes. The arsenic in the residue was determined by the modified Williamson method. Two concentrations of salt solutions were used, namely 0.01447 normal and 0.0723 normal. The solubility of the lead arsenate in distilled water was found to be 3.0 parts arsenic per million. In tap-water containing 212 parts of solids per million (mostly Ca and Mg bicarbonates) it was 33.8 parts arsenic per million.

RESULTS FOR THE SOLUBILITY OF LEAD ARSENATE IN 0.01447 NORMAL SALT SOLUTIONS.

	Parts Arsenic dissolved per million parts of aqueous solution of							
Salt of.	Carbonate.	Chloride.	Nitrate.	Bicarbonate.	Sulfate.	Bisulfate.	Secondary Phosphate.	Primary Phosphate.
K......	165.2	39.3	4.5	139.9	4.6	241.9	174.2	29.1
Na.....	184.8	31.7	5.3	136.4	5.9	260.9	168.9	11.8
NH_4....	175.6	37.0	3.4	136.4	3.5	271.5	177.6	18.7
Ca.....	73.4	54.7	2.0	–	5.6	296.3	73.9	36.6
Mg....	4.1	36.6	3.5	37.4	4.5	268.5	93.5	21.0

SOLUBILITY OF COMMERCIAL LEAD ARSENATE IN AQUEOUS SOLUTIONS OF SALTS.

(Stewart, 1922.)

Results for the solubility in 0.0723 normal salt solutions.

	Parts Arsenic dissolved per million parts of aqueous solution of							
Salt of .	Carbonate.	Chloride.	Nitrate.	Bicarbonate.	Sulfate.	Bisulfate.	Secondary Phosphate.	Primary Phosphate.
K	115.9	156.0	8.1	99.8	5.8	647.2	292.9	78.0
Na	131.8	130.5	13.5	96.7	5.7	1016.9	357.0	84.6
NH_4	119.2	-	5.4	162.5	-	838.3	392.1	63.0
Ca........	36.5	105.4	4.3	13.5	4.2	615.2	57.7	67.5
Mg.......	20.1	101.2	3.5	85.4	2.6	572.3	46.1	38.0

Each result in the tables represent an average of 2 to 10 determinations.

Data are also given for the solubility of lead arsenate in soil solutions.

Data for equilibrium in the system lead oxide, arsenic trioxide and water at 25° are given by Story and Anderson, 1924.

Fusion point data for the systems $Pb_3(AsO_4)_2 + PbF_2$, $Pb_3(AsO_4)_2 + PbCl_2$ and $Pb_3(AsO_4)_2 + PbO$ are given by Amadori, 1916-1917, 1919.

The solubility of commercial lead hydrogen arsenate, containing 64.2% PbO and 32.54% As_2O_5, in aqueous solutions of acids and salts and their combinations was studied by Robinson, 1929, for the purpose of finding the best solvent for use in removing arsenical spray residues from fruit under commercial conditions. It was found that acids dissolve the maximum amount of arsenate in 5 minutes with no increase up to 30 minutes. Most of the dilute salt solutions dissolved only a trace of the arsenical. When 0.25 percent Na_2SO_4 was combined with 0.1 percent HCl the solubility was increased to more than 5 times that for HCl alone. This combination was found to be the most effective.

LEAD ARSENATE $PbHAsO_4$.

Two gm. portions of amorphous dilead arsenate were agitated at 32° with 90 to 180 cc. portions of 0.0338 normal aqueous ammonia for two days. The saturated solutions were found to contain only traces of lead but amounts of As_2O_5 varying from 1.956 to 1.429 gms. per liter. (McDonnell and Smith, 1916.)

EQUILIBRIUM IN THE SYSTEM LEAD OXIDE, ARSENIC PENTOXIDE AND WATER AT 25 . (Acid Region)

(Tartar, Rice and Sweo, 1931.)

d. of sat. sol.	Gms. As_2O_5 per 100 gms. sat. sol.	Solid Phase	d. of sat. sol.	Gms. As_2O_5 per 100 gms. sat. sol.	Solid Phase
1.031	2.10	$PbHAsO_4$	1.732	54.56	$PbHAsO_4$
1.113	13.40	" "	1.894	61.35	"$+Pb(H_2AsO_4)_2$
1.219	23.50	"	2.032	65.90	$Pb(H_2AsO_4)_2$
1.476	42.61	"	2.201	70.70	"
1.232	54.56	"	—	71.4	"$+H_3AsO_4 \cdot \frac{1}{2}H_2O$

The results show that the lead arsenates are very insoluble. Qualitative tests of the liquid phase for the precipitation of lead as sulfate, chromate and sulfide gave negative results. It is suggested that precipitation as dilead arsenate can be used as a quantitative method for the determination of lead.

LEAD BORATE $Pb(BO_2)_2.H_2O$.

100 cc. anhydrous hydrazine dissolve about 2 gms. $Pb(BO_2)_2$ at room temp. (Welsh and Broderson, 1915.)

LEAD Sub BROMIDE PbBr.

1000 cc. sat. solution of lead subbromide in water contain 0.4 milliequivalents Pb Br at 25°, as determined by the conductivity method. (Denham, 1918.)

LEAD BROMIDE $PbBr_2$.

SOLUBILITY IN WATER.

(Lichty — J. Am. Chem. Soc. 25, 474, '03.)

t°.	Density of Solutions, H_2O at 0°.	Gms. $PbBr_2$ per 100		Milligram Mols. $PbBr_2$ per 100	
		cc. Solution.	Gms. H_2O	cc. Solution.	Gms. H_2O.
0	1.0043	0.4554	0.4554	1.242	1.242
15	1.0053	0.7285	0.7305	1.987	1.989
25	1.0061	0.9701	0.9744	2.646	2.655
35	1.0060	1.3124	1.3220	3.577	3.603
45	1.0059	1.7259	1.7457	4.705	4.760
55	1.0046	2.1024	2.1376	5.731	5.827
65	1.0028	2.516	2.574	6.859	7.016
80	1.0000	3.235	3.343	8.819	9.113
95	0.9995	4.1767	4.3613	11.386	11.890
100	...	4.550	4.751	12.40	12.94

SOLUBILITY OF LEAD BROMIDE IN WATER AT TEMPERATURES ABOVE 100°.

(Benrath, Gjedebo, Schiffers and Wunderlich, 1937.)

t°	Gms. $PbBr_2$ per 100 gms. sat. sol.	t°	Gms. $PbBr_2$ per 100 gms. sat. sol.
143	7.3	285	33.5
181	12.0	302	46.7
217	17.1	302	57.5
245	22.4	302	71.0
26.7	28.2	307	86.6

Between 39 and 80 percent $PbBr_2$ two liquid layers are formed at 302°.

SOLUBILITY OF LEAD BROMIDE IN AQUEOUS HYDROBROMIC ACID AT 10°.

100 grams H_2O containing 72.0 grams HBr dissolve 55.0 grams $PbBr_2$ per 100 gms. solvent, and solution has Sp. Gr. 2.06.

(Ditte — Compt. rend 92, 719, '81.)

SOLUBILITY OF LEAD BROMIDE IN AQUEOUS SOLUTIONS OF HYDROBROMIC ACID AT 25°.

(v. Hevesy and Wagner, 1930.)

d. of sat. sol.	Normality of aq. HBr solution	Gms. $PbBr_2$ per 100 cc sat. sol.
1.005	0.0	0.9711
1.0074	0.014	0.946
1.056	1.065	0.390
1.099	1.721	0.980
1.443	4.200	24.540

LEAD BROMIDE $PbBr_2$.

SOLUBILITY OF LEAD BROMIDE IN AQUEOUS SOLUTIONS OF SALTS AT 25°.

(Herz and Hellebrandt, 1923.)

Aq. salt solution.	Gm. mol. $PbBr_2$ per liter sat. sol.	Aq. salt solution.	Gm. mol. $PbBr_2$ per liter sat. sol.	Aq. salt solution.	Gm. mol. $PbBr_2$ per liter sat. sol.
H_2O alone	0.02625	0.73 *n* NaBr	0.00860	2.95 *n* $\frac{CaCl_2}{2}$	0.01357
0.48 *n* KCl	0.00556	1.47 »	0.02247	3.93 »	0.02355
0.97 »	0.00582	2.20 »	0.07043	0.52 *n* $\frac{CaBr_2}{2}$	0.00677
1.94 »	0.00620	2.93 »	0.1958	1.04 »	0.01205
2.91 »	0.01057	3.67 »	0.3936	2.08 »	0.04380
3.88 »	0.01505	4.40 »	0.7337	3.13 »	0.1175
0.79 *n* KBr	0.00725	0.52 *n* $\frac{BaCl_2}{2}$	0.00574	4.17 »	0.5187
1.58 »	0.00874	1.04 »	0.00765	0.66 *n* $\frac{SrCl_2}{2}$	0.00564
2.16 »	0.02650	2.08 »	0.02388	1.23 »	0.00627
3.23 »	0.08542	0.45 *n* $\frac{BaBr_2}{2}$	0.00607	2.66 »	0.01545
4.28 »	0.17900	0.91 »	0.01091	3.09 »	0.02000
0.47 *n* NaCl	0.00456	1.82 »	0.04443	4.18 »	0.02718
0.95 »	0.00561	2.76 »	0.1604	0.52 *n* $\frac{SrBr_2}{2}$	0.00673
1.89 »	0.00844	3.67 »	0.4140	1.04 »	0.01273
2.84 »	0.01466	0.49 *n* $\frac{CaCl_2}{2}$	0.00462	2.08 »	0.04367
3.79 »	0.03053	0.98 »	0.00544	3.12 »	0.1559
4.74 »	0.06144	1.97 »	0.00693	4.16 »	0.5687

Br

SOLUBILITY OF LEAD BROMIDE IN AQUEOUS SALT SOLUTIONS AT 25°.

(Randall and Vietti, 1928.)

In Aqueous Solutions of:

Lead Nitrate		Barium Nitrate		Cadmium Bromide		Potassium Nitrate	
Gm. Mols. per 1000 gms. H_2O		Gm. Mols. per 1000 gms. H_2O		Gm. Mols. per 1000 gms. H_2O		Gm. Mols. per 1000 gms. H_2O	
$Pb(NO_3)_2$	$PbBr_2$	$Ba(NO_3)_2$	$PbBr_2$	$CdBr_2$	$PbBr_2$	KBr	$PbBr_2$
0.002	0.02664	0.000	0.02680	0.0010	0.02637	0.001	0.02645
0.005	0.02644	0.002	0.02735	0.0020	0.02591	0.002	0.02611
0.010	0.02622	0.005	0.02808	0.0050	0.02466	0.005	0.02500
0.050	0.02663	0.010	0.02883	0.0100	0.02307	0.010	0.02345
0.100	0.02954	0.020	0.03034	0.0500	0.01450	0.050	0.01380
0.200	0.03544	0.050	0.03370	0.1000	0.01117	0.100	0.00859
0.500	0.05342	0.100	0.03780	0.2000	0.00939	0.200	0.00694
0.952	0.07754	0.200	0.04385	0.5000	0.01072	0.389	0.00700**
1.655	0.1268	0.3513	0.05008	1.000	0.01597	0.804	0.00740**
1.964	0.1346*	0.4116	0.05337*	4.182	0.06508*	1.200	0.01137**

* These solutions simultaneously saturated with both salts.

**Solid phase $2PbBr_2.KBr$.

SOLUBILITY OF LEAD BROMIDE IN AQUEOUS SOLUTIONS OF POTASSIUM BROMIDE AT 25° AND VICE VERSA. (Burrage, 1926.)

Gms. per 1000 gms. sat. sol.			Gms. per 1000 gms. sat. sol.		
KBr.	$PbBr_2$.	Solid Phase.	KBr.	$PbBr_2$.	Solid Phase.
0.0	9.69	$PbBr_2$	190.5	6.66	$KBr.2PbBr_2$
0.56	9.46	»	206.4	7.53	»
1.31	8.75	»	216.1	8.68	»
4.23	7.82	»	256.9	14.94	»
13.25	3.47	»	301.1	31.60	»+$KBr.PbBr_2.1/3H_2O$
22.92	2.56	»	319.7	36.22	$KBr.PbBr_2.1/3H_2O$
49.67	3.10	»+$KBr.2PbBr_2$	338.0	42.48	»
56.09	2.92	$KBr.2PbBr_2$	356.8	50.38	»
129.4	3.30	»	388.7	72.05	»+KBr
131.8	3.45	»	393.2	49.29	KBr
145.4	4.27	»	402.8	18.35	»
182.7	5.60	»	405.2	0.0	»

Data for the solubility of mixed crystals of lead bromide and lead chloride in water are given by Meyer, 1922, 1926.

SOLUBILITY OF LEAD BROMIDE IN PYRIDINE.

(Heise, 1912.)

t°.	Gms. $PbBr_2$ per 100 Gms. Pyridine.	Solid Phase.	t°.	Gms. $PbBr_2$ per 100 Gms. Pyridine.	Solid Phase.
−26	1.02	$PbBr_2.3C_5H_5N$	45	0.661	$PbBr_2.2C_5H_5N$
−10	0.89	"	64	0.800	"
− 5	0.84	"	77	0.969	"
0	0.80	"	95	1.33	"
+13	0.661	"	100	1.44	"
19 tr. pt.	...	" +$PbBr_2.2C_5H_5N$	105	1.56	"
26	0.583	$PbBr_2.2C_5H_5N$			

100 gms. liquid Sulfur Dioxide (SO_2) dissolve 0.012 gm. $PbBr_2$ at 0°. (Jander and Ruppolt, 1937.)

Fusion-point data are given for:

$PbBr_2$ + AgBr (Tubandt and Eggert, 1920.)
" + $PbCl_2$ (Monkemeyer, 1906.)
" + PbF_2 (Sandonnini, 1911.)
" + PbI_2 (Monkemeyer, 1906.)
" + PbO (Sandonnini, 1914; Baroni, 1934.)

LEAD Dicyclohexyl Di**BROMIDE** $(C_6H_{11})_2PbBr_2$.

LEAD Dicyclohexyl Di**CHLORIDE** $(C_6H_{11})_2PbCl_2$.

SOLUBILITY OF EACH IN SEVERAL SOLVENTS AT 22.5°.

(Grüttner, 1914.)

Solvent.	Grams per 100 Grams Solvent.	
	$(C_6H_{11})_2PbBr_2$.	$(C_6H_{11})_2PbCl_2$.
Benzene	0.014	0.016
Carbon Tetrachloride	0.004	0.004
Chloroform	0.078	0.083
Alcohol + Pyridine (1:1)	2.560	2.904

Similar results are also given for lead tetracyclohexyl, $Pb(C_6H_{11})_4$, lead tetraphenyl, $Pb(C_6H_5)_4$, and lead diphenyldicyclohexyl, $Pb(C_6H_5)_2(C_6H_{11})_2$.

Solvent.	Gms. per 100 Gms. Solvent.		
	$Pb(C_6H_{11})_4$.	$Pb(C_6H_5)_4$.	$Pb(C_6H_5)_2(C_6H_{11})_2$.
Alcohol	0.010	0.020	0.324
Benzene	1.068	1.145	2.298
Carbon Tetrachloride	0.244	0.303	0.845

LEAD BROMATE $Pb(BrO_3)_2$.

Solubility of Lead Bromate in Aqueous Salt Solutions at 25°.

(MacDougall and Hoffman, 1936.)

Results for Aqueous Solutions of:

Potassium Nitrate

d. of sat. sol.	Gm. Mols. per liter sat. sol.	
	KNO_3	$Pb(BrO_3)_2$
1.0112	0.0	0.03437
1.0156	0.04883	0.03924
1.0181	0.09934	0.04378
1.0286	0.1956	0.05104
1.0456	0.3901	0.06396
1.0608	0.5784	0.07577
1.0906	0.9339	0.09818
1.1327	1.4419	0.1293
1.1833	2.0352	0.1685
1.2220	2.6423	0.1732

Sodium Nitrate

d. of sat. sol.	Gm. Mols. per liter sat. sol.	
	$NaNO_3$	$Pb(BrO_3)_2$
1.0141	0.04833	0.03884
1.0184	0.1013	0.04317
1.0266	0.1991	0.04984
1.0424	0.3938	0.06144
1.0564	0.5874	0.07112
1.0837	0.9655	0.08898
1.1460	1.8655	0.1294
1.2010	2.6860	0.1651
1.3378	4.8546	0.2536
1.4824	7.1770	0.3416

Lithium Nitrate

d. of sat. sol.	Gm. Mols. per liter sat. sol.	
	$LiNO_3$	$Pb(BrO_3)_2$
1.0135	0.04925	0.03849
1.0158	0.09873	0.04224
1.0244	0.2049	0.04874
1.0348	0.3633	0.04800
1.0446	0.5815	0.06517
1.0649	0.9644	0.07867
1.0880	1.4258	0.09337
1.1302	2.3032	0.1190
1.1887	3.5192	0.1534
1.2562	4.9703	0.1930

Strontium Nitrate

d. of sat. sol.	Gm. Mols. per liter sat. sol.	
	$Sr(NO_3)_2$	$Pb(BrO_3)_2$
1.0117	0.00557	0.03581
1.0129	0.01031	0.03702
1.0144	0.01958	0.03893
1.0226	0.05020	0.04455
1.0332	0.09944	0.05180
1.0548	0.1975	0.06339
1.0933	0.3903	0.08177
1.1301	0.5804	0.09739
1.1971	0.9446	0.1249
1.3438	1.7789	0.1765
1.5261	2.8704	0.2228

Calcium Nitrate

d. of sat. sol.	Gm. Mols. per liter sat. sol.	
	$Ca(NO_3)_2$	$Pb(BrO_3)_2$
1.0099	0.00627	0.03565
1.0117	0.01116	0.03640
1.0135	0.02156	0.03921
1.0195	0.05162	0.04298
1.0313	0.1215	0.05387
1.0425	0.1975	0.06202
1.0869	0.4920	0.08769
1.1283	0.7784	0.1105
1.2090	1.3805	0.1435
1.3074	2.1719	0.1813
1.4215	3.1950	0.2118

Lead Nitrate

d. of sat. sol.	Gm. Mols. per liter sat. sol.	
	$Pb(NO_3)_2$	$Pb(BrO_3)_2$
1.0104	0.00495	0.03371
1.0118	0.00992	0.03312
1.0132	0.01990	0.03258
1.0219	0.04981	0.03161
1.0356	0.0994	0.03145
1.0643	0.1978	0.03264
1.1120	0.3882	0.03657
1.1735	0.5804	0.04102
1.2786	0.9470	0.05046
1.3402	1.1663	0.05613
1.4011	1.3807	0.06183

LEAD FORMATE $Pb(HCOO)_2$.

SOLUBILITY OF LEAD FORMATE IN AQUEOUS SOLUTIONS OF BARIUM FORMATE AT 25°.
(Fock, 1897.)

Mol. % in Solution.		Grams per Liter.		Sp. Gr. of Solutions.	In Solid Phase Mol. % of	
$Pb(HCO_2)_2$.	$Ba(HCO_2)_2$.	$Pb(HCO_2)_2$.	$Ba(HCO_2)_2$.		$Pb(HCO_2)_2$.	$Ba(HCO_2)_2$.
0	100	...	28.54	1.2204	0	100
0.29	99.71	1.104	28.65	1.2213	1.72	98.28
0.74	99.26	2.803	28.90	1.2251	5.29	94.71
1.24	98.76	5.309	32.24	1.2529	11.94	88.06
2.91	97.09	11.42	29.29	1.2341	24.81	75.19
5.92	94.08	23.11	28.13	1.2355	56.54	43.46
100	0	28.35	...	1.0911	100	0

SOLUBILITY OF LEAD FORMATE IN FORMIC ACID DETERMINED BY THE FREEZING-POINT METHOD.
(Kendall and Adler, 1921.)

t°	Gm. Mol. $Pb(HCOO)_2$ per 100 gm. mol. sat. sol.	Solid Phase
20	0.21	$Pb(HCOO)_2$
73.1	0.30	"
109.4	0.42	"
124.5	0.51	"

LEAD METHIONATE Pb $CH_2O_6S_2.2H_2O$.

100 gms. H_2O dissolve 8.4 gm. $PbCH_2O_6S_2$ at 25°. (Backer and Terpstra, 1929.)

CH

LEAD ACETATE $Pb(CH_3COO)_2.3H_2O_2$.

SOLUBILITY OF LEAD ACETATE IN WATER. (Dundon and Henderson, 1922.)

The analysis of the saturated solutions was made by a method of « floating equilibrium ». To a known weight of saturated solution of unknown concentration, water was added untill the mixture attained the same density as a glass float calibrated at a definite arbitrary temperature. The saturated solutions were prepared by constant stirring in a thermostat and approaching equilibrium from 0°.5 to 3°.0 above the temperature desired. The solid was Pb $(CH_3 CO O)_2.3 H_2 O$ in all cases.

		Gms. $Pb(CH_3COO)_2$ per 100 gms.				Gms. $Pb(CH_3COO)_2$ per 100 gms.	
t°.	d of sat. sol.	H_2O.	sat. sol.	t°.	d of sat. sol.	H_2O.	sat. sol.
0...	1.140	19.7	16.5	30 ..	1.41	69.7	41.1
5...	–	23.6	19.4	35...	1.48	88.9	47.1
10...	1.195	29.3	22.8	40...	1.60	116.0	53.7
15...	1.220	35.6	26.4	45...	1.73	153.0	60.7
20...	1.260	44.3	30.7	50...	1.88	221.0	67.6
25...	1.330	55.2	35.6				

SOLUBILITY OF LEAD ACETATE IN AQUEOUS SOLUTIONS OF ACETIC ACID.
(Osaka and Hara, 1917.)

The saturated solutions were prepared by constant agitation for two days. The lead in the saturated solutions was determined as sulfate.

	Gms. $Pb(CH_3COO)_2$ per 100 gms. sat. sol. at		
Normality of Aq. CH_3COOH.	25°.	35°.	45°.
0.025....................	35.11	46.65	60.61
0.05....................	34.96	46.56	60.55
0.10....................	34.72	46.35	69.42

LEAD ACETATE

EQUILIBRIUM IN THE SYSTEM LEAD ACETATE, ACETIC ACID AND WATER AT 25°.

(Tarbutton and Vosburgh, 1932.)

From 7 to 14 days were required for attainment of equilibrium depending upon the manner of preparing the solutions. The previous results of Sandved, 1927, are shown to be in error in certain respects.

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
CH_3COOH	$Pb(CH_3COO)_2$		CH_3COOH	$Pb(CH_3COO)_2$	
0.00	35.50	(1) $Pb(CH_3COO)_2.3H_2O$	24.13	68.33	$Pb(CH_3COO)_2.\frac{1}{2}H_2O$
8.21	35.44	"	25.50	70.54	"
19.14	39.13	"	25.20	71.54	"
26.91	47.11	"	30.94	66.00	$Pb(CH_3COO)_2.\frac{1}{2}CH_3COOH$
26.55	57.38	"	31.71	65.66	"
22.27	67.90	" + $Pb(CH_3COO)_2.\frac{1}{2}H_2O$	40.19	58.29	"
			41.82	57.06	"
23.25	68.15	$Pb(CH_3COO)_2.\frac{1}{2}H_2O$	44.56	54.95	"

(1) Jackson, 1914.

The authors also give the following results at 30°.

CH

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
CH_3COOH	$Pb(CH_3COO)_2$		CH_3COOH	$Pb(CH_3COO)_2$	
9.64	41.61	$Pb(CH_3COO)_2.3H_2O$	25.40	69.45	$Pb(CH_3COO)_2\frac{1}{2}H_2O$
17.47	45.81	"	20.49	69.27	"
23.78	55.43	"	24.36	73.50	"
22.45	63.08	"	23.66	72.13	"
23.86	71.08	"	19.92	70.18	"
			23.39	70.45	

LEAD ACETATE $Pb(C_2H_3O_2)_2.3H_2O$.

EQUILIBRIUM IN THE SYSTEM LEAD OXIDE, ACETIC ACID, WATER AT 25°.

(Sakabe, 1914.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
PbO.	CH_3COOH.		PbO.	CH_3COOH.	
4.18	21.53	$Pb(C_2H_3O_2)_2.3H_2O$	7.15	7.26	$(C_2H_3O_2)(HO)Pb+$ $(C_2H_3O_2)_2Pb.2(HO)_2Pb$
3.80	16.78	"			
3.16	13.07	"	5.20	5.61	$(C_2H_3O_2)_2Pb.2(HO)_2Pb$
2.64	5.49	"	3.78	4.17	"
3.34	5.36	"	2.89	2.51	"
4.38	7.30	"	1.45	1.03	"
5.18	7.92	" $+(C_2H_3O_2)(HO)Pb$	1.05	0.54	PbO
5.59	7.72	$(C_2H_3O_2)(HO)Pb$	1.07	0.48	"
6.51	7.79	"	1	0.20	"

Equilibrium was attained quickly in the acid solutions but 2-3 days were required in case of the basic salts. Both sat. solutions and solid phases were analyzed.

EQUILIBRIUM IN THE SYSTEM LEAD ACETATE, LEAD OXIDE, WATER AT 25°.

(Jackson, 1914.)

d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat. Sol. PbO.	Gms. per 100 Gms. Sat. Sol. $Pb(C_2H_3O_2)_2$.	Solid Phase.	d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat. Sol. PbO.	Gms. per 100 Gms. Sat. Sol. $Pb(C_2H_3O_2)_2$.	Solid Phase.
1.326	−0.27*	35.19	1.3	2.280	24.74	49.21	3.1.3+1.2.4
1.334	+0.10	35.60	"	2.048	23.59	43.17	1.2.4
1.367	1.01	37.14	"	1.951	22.78	40.78	"
1.422	3.38	38.93	"	1.657	19.63	31.40	"
1.531	6.01	41.95	"	1.599	18.73	29.63	"
1.658	9.47	44.71	"	1.382	14.62	20.96	"
...	14.22	47.88	"	1.348	13.41	19.65	"
1.852	14.44	47.92	"	1.229	10.66	12.99	"
...	15.89	48.95	1.3+3.1.3	1.157	8.47	8.64	"
1.930	15.90	48.42	3.1.3	1.119	7.87	5.27	"
1.942	16.25	48.85	"	1.117	7.79	5.25	"
1.956	16.65	49.04	"	...	7.17	4.17	$Pb(OH)_2$
2.024	18.83	48.71	"	1.100	6.84	4.31	"
2.161	22.23	48.52	"	1.095	6.54	4.25	"
2.193	22.94	48.96	"	1.085	5.91	3.82	"
...	23.28	49.14	"	1.075	5.29	3.40	"
2.220	23.53	49.01	"	...	0.20	0.11	"

* In this case the acidity is expressed in terms of PbO.

1.3 = $Pb(C_2H_3O_2)_2.3H_2O$, 3.1.3 = $3Pb(C_2H_3O_2)_2.PbO.3H_2O$, 1.2.4 = $Pb(C_2H_3O_2)_2.2PbO.4H_2O$.

The above results show the solubility of lead acetate in aqueous solutions containing increasing amounts of lead hydroxide. The mixtures were constantly agitated for periods varying from 2 to 7 days. Both the saturated solutions and the solid phases were analyzed. The basic lead in a given sample was determined by measuring the volume of standard acid neutralized by it. The neutral lead acetate was determined by precipitation of the lead as sulfate or as oxalate.

CH

SOLUBILITY OF LEAD ACETATE IN AQ. SOLUTIONS OF POTASSIUM ACETATE AT 25°.

(Fox, 1909.)

Gms. per 100 Gms. Sat. Sol. CH_3COOK.	Gms. per 100 Gms. Sat. Sol. $(CH_3COO)_2Pb$.	Solid Phase.
0	35.9	$(CH_3COO)_2Pb.3H_2O$
13.87	38.05	"
15.40	36.90	"

Experiments on the formation of basic lead acetates in aqueous ammonium hydroxide and sodium hydroxide solutions are described by Dubrisay and Saint Maxen, 1936. The temperature or method of securing saturation is not stated. The results are given only in the form of a diagram which shows that in each case the amount of lead in solution increases from about 20 to 34 percent as the concentration of alkali increases from 0 to 0.04 gm. mol. percent (?) and then very rapidly decreases as the concentrations of alkali increases to about 0.1 gm. mol. percent.

EQUILIBRIUM IN THE SYSTEM LEAD ACETATE, LEAD CHLORIDE AND WATER AT 25°.

(Sandved, 1929.)

The mixtures were prepared at 35° and after cooling to 25° equilibrium was attained in 5 hours. The concentration of free acid in the solutions varied from 1.4 to 1.6 percent. The system is therefore strictly speaking not ternary but "pseudo ternary".

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$PbCl_2$	$Pb(CH_3COO)_2$		$PbCl_2$	$Pb(CH_3COO)_2$	
0.0	35.53	$Pb(CH_3COO)_2 \cdot 3H_2O$	3.32	25.95	D.S
0.73	35.92	"	4.48	21.25	" + $PbCl_2$
1.08	36.40	"	4.00	20.63	$PbCl_2$
1.46	37.43	" + D.S	3.01	13.47	"
2.03	36.44	D.S	2.07	6.91	"
2.43	30.21	"	1.06	0.0	"

D.S. = $PbCl.CH_3COO.Pb(CH_3COO)_2 \cdot \frac{1}{2}CH_3COOH$.

The author also gives similar results for the temperature 35° as well as complete results for the quarternary system $Pb(CH_3COO)_2 + PbCl_2 + CH_3COOH + H_2O$ at 25°.

CH

SOLUBILITY OF LEAD ACETATE IN ACETIC ACID DETERMINED BY THE FREEZING-POINT METHOD.

(Davidson and Chappell, 1933; Davidson and McAllister, 1930.)

t°	Gm. mol. $Pb(CH_3COO)_2$ per 100 gm. mols. sat. sol.	Solid Phase	t°	Gm. mol. $Pb(CH_3COO)_2$ per 100 gm. mols. sat. sol.	Solid Phase
16.5	0.0	CH_3COOH	40.5	24.77	Pb.½H
15.52	5.18	"	48.7	30.23	"
14.24	8.42	"	52.9	33.55	"
13.40	11.53	" + Pb.½H	56.4	36.6	" + $Pb(CH_3COO)_2$
9.55	19.78*	"	49.0	35.69*	$Pb(CH_3COO)_2$
8.05	21.99*	"	68.0	38.27	"
-0.3	32.97*	"	100.5	44.95	"
-3.1	37.48*	"	139.0	59.55	"
20.3	14.67	Pb.½H	165.0	71.83	"
32.8	20.57	"	204	100.00	"

* = Metastable.

Pb.½H = $Pb(CH_3COO)_2 \cdot \frac{1}{2}CH_3COOH$. This branch of the curve could be located only by seeding the mixtures with crystals of the salt. The solubility of this hemisolvate in acetic acid is 16.75 mol. percent or 52.16 gms. per 100 gms. sat. solution at 25°.

100 gms. Methyl Alcohol (CH_3OH) dissolve 74.75 gms. $Pb(CH_3COO)_2 \cdot 3H_2O$ at 15° and 214.95 gms. at the b. pt.
100 gms. Methyl Alcohol (CH_3OH) dissolve 102.75 gms. $Pb(CH_3COO)_2$ at 66.1° (b.pt.). (Henstock, 1934.)

SOLUBILITY OF LEAD ACETATE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 25°.

(Seidell, 1910.)

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $(C_2H_3O_2)_2Pb$ per 100 Gms. Sat. Sol.	Solid Phase.	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $(C_2H_3O_2)_2Pb$ per 100 Gms. Sat. Sol.	Solid Phase.
0	1.343	36.5	$(C_2H_3O_2)_2Pb.3H_2O$	70	0.955	12.4	$(C_2H_3O_2)_2Pb.3H_2O$
10	1.275	32.3	"	80	0.907	9.4	"
20	1.215	28.6	"	81	0.905	9	"
30	1.157	25	"	85	0.855	4	$(C_2H_3O_2)_2Pb$
40	1.105	21.9	"	90	0.826	1.6	"
50	1.055	18.7	"	95	0.806	0.6	"
60	1.002	15.6	"	100	0.790	0.4	"

100 gms. 95% formic acid dissolve 0.99(?) gm. $Pb(C_2H_3O_2)_2$ at 19.8°. (Aschan, 1913.)

100 gms. anhydrous lanolin (m. pt. 46°) dissolve 1.1 gm. $Pb(C_2H_3O_2)_2$ at 45°. (Klose, '07.)

100 gms. glycerol dissolve about 20 gms. $Pb(C_2H_3O_2)_2$ at 15°. (Ossendowski, 1907.)

100 gms. glycerol of $d = 1.2326$ (= 86.5%) dissolve 129.3 gms. $Pb(CH_3COO)_2$ at 20°
» of $d = 1.2645$ (= 98.5%) » 143.0 » »

(Holm, 1921, 1921 *a*, 1922.)

LEAD salt (neutral) of racemic β Methyl **ADIPIC ACID.**

100 gms. sat. solution in water contain 0.35 gm. of the salt at 20°. (Meurisse.)

LEAD TARTRATE $PbC_4O_6H_4$.

SOLUBILITY IN WATER.

(Cantoni and Zachoder — Bull. soc. chim. [3] 33, 751, '05; Partheil and Hübner — Archiv. Pharm. 241, 413, '03.)

t°.	Gms. $PbC_4O_6H_4$ per 100 cc. Solution.	t°.	Gms. $PbC_4O_6H_4$ per 100 cc. Solution.	t°.	Gms. $PbC_4O_6H_4$ per 100 cc. Solution.
18	0.010 (P. and H.)	50	0.00225	70	0.0032
25	0.0108 "	55	0.00295	75	0.0033
35	0.00105	60	0.00305	80	0.0038
40	0.0015	65	0.00315	85	0.0054

CH

NOTE. — The positions of the decimal points here shown are just as given in the original communications.

100 gms. alcohol of 0.8092 Sp. Gr. (about 95%) dissolve 0.0028 gm. $PbC_4O_6H_4$ at 18°, and 0.00315 gm. at 25°. (P. and H.)

LEAD TARTRATES Active, $PbC_4H_4O_6$; Racemic, $Pb_2C_8H_8O_{12}.4H_2O$.

SOLUBILITY OF EACH SEPARATELY IN WATER.

(Duboux and Cuttat, 1921.)

Results for the Active salt.			Results for the Racemic salt.		
t°.	Gms. $PbC_4H_4O_6$ per 100 gms. sat. sol.	Solid Phase	t°.	Gms. $Pb_2C_8H_8O_{12}$ per 100 gms. sat. sol.	Solid Phase.
0......	0.0027	$Pb.C_4H_4O_6$	0......	0.0038	$Pb_2C_8H_8O_{12}.4H_2O$
12.5....	0.0030	»	12.5....	0.0020	»
25......	0.0035	»	25......	0.0034	»
37.5....	0.0046	»	37.5....	0.0066	»

SOLUBILITY OF LEAD TARTRATE IN WATER AND IN AQUEOUS SOLUTIONS AT 18°.

(Auerbach and Weber, 1925.)

Solvent	Gms $PbC_4H_4O_6$ per liter sat. sol.	Solvent.	Gms $PbC_4H_4O_6$ per liter sat. sol.
Water...................	0.0125 (p_H = 5.6)	Aq. 4.0 *n* CH_3COONa..	14.64
Aq. 0.01 *n* HCl..	0.526	» 1.0 *n* CH_3COONH_4.	1.95
» 0.10 *n* »	6.75	» 4.0 *n* » .	13.02
» 1.0 *n* CH_3COONa.	1.38	» 50 wt. % C_2H_5OH.	0.00

LEAD FUMARATE $PbC_4H_2O_4$.

100 gms. H_2O dissolve 0.025 gm. $Pb(C_4H_2O_4)$ at 30°. (Weiss and Downs, 1923.)

LEAD MALATE $Pb.C_4H_4O_5.3H_2O$.

SOLUBILITY IN WATER AND ALCOHOL.

(Partheil and Hübner, 1903.)

100 gms. H_2O dissolve 0.0288 gm. $PbC_4H_4O_5.3H_2O$ at 18°, and 0.06504 gm. at 25°.

100 gms. 95% alcohol dissolve 0.0048 gm. $PbC_4H_4O_5.3H_2O$ at 18°–25°.
Density of alcohol employed = 0.8092.

LEAD MALATE (*i*) $Pb(C_4H_4O_5).{}^1/_2H_2O$.

100 cc. sat. solution of lead malate in water contain 0.0902 gm. $Pb(C_4H_4O_5)$ at 18° and the solution has $p_H = 5.9$. (Auerbach and Weber, 1925.)

100 gms. H_2O dissolve 0.21 gm. *i* lead malate at 30°. (Weiss and Downs, 1923.)

SOLUBILITY OF LEAD MALATE IN AQUEOUS SOLUTIONS AT 18°.

(Auerbach and Weber, 1925.)

Aqueous solution.	Gms $Pb(C_4H_4O_5)$ per liter of sat. sol.	Aqueous solution.	Gms. $Pb(C_4H_4O_5)$ per liter of sat. sol.
0.01 *n* HCl	2.205	4.0 *n* CH_3COONa	171.2
0.10 *n* HCl	16.05	4.0 *n* CH_3COONH_4	300.6
1.0 *n* CH_3COONa	23.52	50 wt. per cent C_2H_5OH	26.0
1.0 *n* CH_3COONH_4	36.3		

SOLUBILITY OF ACTIVE AND RACEMIC LEAD MALATES IN WATER.

(Duboux and Cuttat, 1921.)

CH

Results for Active Lead Malate.			Results for Racemic Lead Malate.		
t°.	Gms. $Pb(C_4H_4O_5)$ per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. $Pb_2C_8H_8O_{10}$ per 100 gms. sat. sol.	Solid Phase.
0	0.015	$Pb(C_4H_4O_5).2H_2O$	0	0.015	$Pb_2C_8H_8O_{10}.2H_2O$
12.5	0.027	"	12.5	0.023	"
25.0	0.052	"	25	0.035	"
37.5	0.089	"	37.5	0.0545	"

LEAD MALEATE $PbC_4H_2O_4$.

100 gms. H_2O dissolve 0.052 gms. $PbC_4H_2O_4$ at 30°. (Weiss and Downs, 1923.)

LEAD SUCCINATE $PbC_4H_4O_4$.

SOLUBILITY IN WATER AND IN ALCOHOL.

(Partheil and Hübner, 1903.)

100 gms. H_2O dissolve 0.0253 gm. $PbC_4H_4O_4$ at 18°, and 0.0285 gm. at 25°.

100 gms. 95% alcohol dissolve 0.00275 gm. $PbC_4H_4O_4$ at 18°, and 0.003 gm. at 25°.
Density of alcohol used = 0.8092.

SOLUBILITY OF LEAD SUCCINATE IN WATER.

(Cantoni and Diotalevi, 1905.)

t°.	10°.	21°.	32°.	39°.	50°.
Gms. $PbC_4H_4O_4$ per 100 cc. sat. sol.	0.015	0.019	0.024	0.027	0.029

SOLUBILITY OF LEAD SUCCINATE IN WATER AND IN AQUEOUS SOLUTIONS AT 18

(Auerbach and Weber, 1925.)

Solvent.	Gms. $PbC_4H_4O_4$ per liter sat. sol.
Water	0.228 (the sat. sol. has $p_H = 6.1$)
Aq. 0.01 *n* HCl	2.04
" 0.10 *n* HCl	6.98
" 1.0 *n* CH_3COONa	9.60
" 1.0 *n* CH_3COONH_4	13.21
" 50% C_2H_5OH	0.017

LEAD CITRATE $Pb(C_6H_6O_7)_2.H_2O$.

SOLUBILITY IN WATER AND IN ALCOHOL.

100 gms. H_2O dissolve 0.04201 gm. $Pb(C_6H_6O_7)_2.H_2O$ at 18°, and 0.05344 gm. at 25°.

100 gms. alcohol (95%) dissolve 0.0156 gm. $Pb(C_6H_6O_7)_2.H_2O$ at 18°, and 0.0167 gm. at 25°. (Partheil and Hübner — Archiv. Pharm. 241, 413, '03.)

SOLUBILITY OF LEAD CITRATE IN WATER AND IN AQUEOUS SOLUTIONS AT 18°
(Auerbach and Weber, 1925.)

Solvent.	Gms. $Pb_3(C_6H_5O_7)_2$ per liter sat. sol.
Water	0.159 (p_H of sat. sol. = 6.3)
Aq. 0.01 *n* HCl	1.465
» 0.10 *n* HCl	8.28
» 1.00 *n* CH_3COONa	6.70
» 1.00 *n* CH_3COONH_4	6.83
» 50 wt. % C_2H_3OH	14.00

LEAD ERUCATE $Pb[C_8H_{17}CH : CH(CH_2)_{11}COO]_2$.

100 gms. anhydrous ethyl ether dissolve 0.408 gms. lead erucate at 25°. The presence of moisture affects this solubility greatly. (Thomas and Mattikow, 1926.)

LEAD CINNAMATE $Pb.C_{18}H_{14}O_4.2H_2O$.

100 gms. sat. solution of lead cinnamate in water contain 0.141 gm. $Pb.C_{18}H_{14}O_4$ at 20°. (Ephraim and Pfister, 1925.)

LEAD GLUCONATE $Pb(C_6H_{11}O_7)_2$.

100cc sat. solution of Lead Gluconate in water contain 5.1 gms. $Pb(C_6H_{11}O_7)_2$ at 25°. (May, Weisberg, and Herrick, 1929.)

CH

LEAD BENZOATE $Pb(C_7H_5O_2)_2.H_2O$.

SOLUBILITY IN WATER.
(Pajetta, 1906.)

t°.	18°.	40.6°.	49°.
Gms. $Pb(C_7H_5O_2)_2$ per 100 gms. sat. sol.	0.149	0.249	0.310

SOLUBILITY OF LEAD BENZOATE IN WATER AND IN AQUEOUS SOLUTIONS AT 18°.

(Auerbach and Weber, 1925.)

Solvent.	Gms. $Pb(C_6H_5COO)_2$ per liter sat. sol.	Solvent.	Gms. $Pb(C_6H_5COO)$ per liter sat. sol.
Water	1.647	Aq. 1.0 *n* CH_3COONH_4	16.70
Aq. 0.01 *n* HCl	3.17	Aq. 50 % C_2H_5OH	1892.0
» 1.0 *n* CH_3COONa	14.18		

The sat. sol. in water had p_H = 6.0.

SOLUBILITY OF SEVERAL LEAD BENZOATES IN WATER AT 20°. (Ephraim and Pfister, 1925.)

Compound.	Formula.	Gms. anhydrous cmpd. per 100 cc. sat. sol.
Lead Benzoate	$Pb(C_6H_5COO)_2.H_2O$	0.179
» .4.Oxy benzoate	$Pb(C_6H_4OH.COO)_2.2H_2O$	0.470
» .4.Nitro benzoate	$Pb(C_6H_4.NO_2.COO)_2$	0.159
» .4.Chlor benzoate	$Pb(C_6H_4.Cl.COO_2)_2 2H_2O$	0.078
» .4.Methoxy benzoate	$Pb(C_6H_4.OCH_3.COO)_2H_2O$	0.0486

100 gms. Methyl Alcohol (CH_3OH) dissolve 1.32 gms. $Pb(C_6H_5COO)_2$ at 15° and 2.65 gms. at 66° (b.pt.).

100 gms. Acetone ($(CH_3)_2CO$) dissolve 0.20 gms. $Pb(C_6H_5COO)_2$ at 15°. (Henstock, 1934.)

LEAD Tetra**PHENYL** $Pb(C_6H_5)_4$.

Freezing-point data for $Pb(C_6H_5)_4 + Si(C_6H_5)_4$ are given by Pascal (1912).

LEAD Nitroso Phenyl **HYDROXYLAMINE** (Cupferronate) $Pb[C_6H_5N(NO).O]_2$.

One liter water dissolve 0.025 gm. $Pb[C_6H_5N(NO).O]_2$ at 18°. (Pinkus and Martin, 1927.)

Tri cyclo Hexyl **LEAD** $(C_6H_{11})_3Pb$.

100 gms.	C_2H_5OH	dissolve	6.076 gm. $(C_6H_{11})_3Pb$	at 30°	(Krause and Reissaus, 1921.)
"	C_6H_6	"	2.28	"	"
"	$CHCl_3$	"	1.27	"	"

LEAD HYDNOCARPATE $Pb(\underline{CH = CH.CH_2.CH_2}CH(CH_2)_{10}COO)_2$.

CH **LEAD CHAULMOOGRATE** $Pb(\underline{CH = CH.CH_2CH_2.}CH(CH_2)_{12}COO)_2$.

SOLUBILITY OF EACH SEPARATELY IN SEVERAL SOLVENTS.
(Cole, 1932.)

Solvent	t°	Gms. Hydnocarpate per 100 cc solvent	Gms. Chaulmoograte per 100 cc solvent
95% Ethyl Alcohol	15	0.11	0.08
"	30	0.20	0.19
"	b.pt.	1.13	0.91
Ethyl Ether	15	0.16	0.05
"	30	0.32	0.10
"	b.pt.	0.98	0.29
Benzene	15	0.09	0.05
"	30	0.15	0.06
"	b.pt.	2.92	2.42
Petroleum Ether (b.pt. 30-60°)	30	0.014	0.008

LEAD SULFONATES. SOLUBILITY IN WATER.

Name.	Formula.	t°.	Gms. Salt per 100 Gms. H_2O.	Authority.
Lead 2.5 Diiodobenzenesulfonate	$C_{12}H_6O_6I_4S_2Pb.4H_2O$	20	0.77	(Boyle, 1909.)
Lead β Naphthalene Sulfonate	$(C_{10}H_7SO_3)_2Pb.H_2O$	25	0.4	(Witte, '15; Euwes, '09.)
" α " "	$(C_{10}H_7SO_3)_2Pb.2H_2O$	24.9	4.195	(Euwes, 1909.)
Lead 2 Phenanthrene Monosulfonate	$1H_2O$	20	0.014	(Sandquist, 1912.)
" 3 " "	$3H_2O$	20	0.08	"
" 10 " "	$4H_2O$	20	0.14	"

SOLUBILITY OF LEAD CHLORO BENZENE SULFONATES IN WATER.

(Bollinger, 1928.)

Compound	Formula	t°	Gms. compound per 100 cc sat. sol.
Lead m chloro benzene sulfonate	$Pb[C_6H_4ClSO_3]_2$	18	0.29
" p " " "	"	"	0.28

SOLUBILITY OF SEVERAL LEAD NAPHTHALENE AND NAPHTHYLAMINE SULFONATES IN WATER.

Compound.	Formula.	t°.	Gms anhydrous cmpd. per 100 cc. sat. sol	Gms anhydrous cmpd. per 100 gms. H_2O.
Lead Naphtalene-2-sulfonate........	$Pb(C_{10}H_7SO_3)_2.H_2O$	16.5	0.541	– (1)
α » » mono »	α $Pb(C_{10}H_7SO_3)_2.3H_2O$	10	–	3.7 (2)
β » » » »	β »	10	-	0.87 (2)
» » 2.6-disulfonate......	$PbC_{10}H_6(SO_3)_2$	25	-	0.19 (3)
» » 2.7 »	»	25	–	8.2 (3)
» » 5-chlor-1-sulfonate..	$Pb(C_{10}H_6Cl SO_3)_2.2H_2O$	20	0.20	– (1)
» » 6-oxy-2-sulfonate...	$Pb(C_{10}H_6OH SO_3)_2 6H_2O$	20	1.814	(1)
» Naphthylamine disulfonate-2.6.8.	$Pb(C_{10}H_5NH_2 SO_3)_2$	15	–	80.19 (4)
» » » -2.5.7.	»	15		92.66 (4)

(1) Ephraim and Pfister, 1925 *a*.
(2) Merz and Mulhauser, 1870.
(3) Haller and Lynch, 1924.
(4) Braunschweig, 1922, 1926.

SOLUBILITY OF LEAD β NAPHTHALENE MONO SULFONATE IN AQUEOUS SOLUTIONS OF LEAD α NAPHTHALENE MONO SULFONATE AT 24°.9. (Euwes, 1909.

Gms α salt added per 100 cc.	Gms. total α and β salt. found per 100 cc.	Gms. β salt dissolved per 100 cc. sat. sol
0.00	0.407	0.407
0.095	0.468	0.373
0.189	0.539	0.350
0.284	0.604	0.320
0.473	0.738	0.265
0.945	1.114	0.169
1.890	1.969	0.079

CH

These results were used as the basis of a method for the analysis of unknown mixtures of α and β naphthalene mono sulfonic acids. The unknown mixture was converted to the lead salt and its solubility compared with the above results.

SOLUBILITY OF LEAD NAPHTHALENE 2.6 DISULFONATE IN AQUEOUS SOLUTIONS OF LEAD NAPHTHALENE 2.7 DISULFONATE AT 25°.

(Haller and Lynch, 1924)

An excess of the 2.6 salt was constantly agitated in a thermostat for 24 hours with 100 cc. of H_2O containing increasing amounts of the 2.7 salt.

Gms. anhydrous Lead 2.7 salt per 100 cc.	Gms total 2.7 and 2.6 salt per 100 cc sat sol.	Gms. dissolved 2.6 salt per 100 cc.
0.0	0.188	0.188
0.395	0.483	0.088
0.98	1.045	0.065
1.58	1.595	0.015
1.966	2.008	0.042
1.966	2.043	0.077
2.97	2.98	0.010
8.23 (sat)	8.20	–

LEAD PHTHALATE $PbC_6H_4(COO)_2o$.

Data for the solubility of lead phthalate in water are given by Blecta, 1919.

Normal LEAD Trinitro RESORCINOLATE.

100 gms. glycol diacetate ($CH_3.CO\,O.CH_2 — CH_2\,O\,OC.CH_3$) dissolve 0.1 normal lead trinitro resorcinolate at 20-25°. (Taylor and Rinkenbach, 1

LEAD STEARATE $Pb[CH_3(CH_2)_{16}COO]_2$.

100 cc. chloroform sat. at ord. temp. with Lead Stearate contain from 0.0 to 0.0094 gm. stearic acid.

100 cc. ethyl ether sat. at ord. temp. with Lead Stearate contain from 0.01 0.021 gm. stearic acid.

Approx. determinations of the solubility of lead salts of other fatty acids i mixture of 3 vols of $CH\,Cl_3$ and 1 vol. of acetone at 0° are also given. (Strauli, 1918, 1

100 gms. anhydrous ether dissolve 0.021 gms. lead stearate at 25°. (Thomas and Yu, 1

LEAD PALMITATE $Pb(C_{16}H_{31}O_2)_3$.

100 gms. of a sat. sol. of lead palmitate in turpentine contain 0.106 g $Pb(C_{16}H_{31}O_2)_2$ at 15°. (Morrell, 1

LEAD OLEATE $Pb(C_{18}H_{33}O_2)_2$.

CH 100 gms. anhydrous ether dissolve 9.59 gms. $Pb(C_{18}H_{33}O_2)_2$ at 25°. (Thomas and Yu, 1

LEAD LAURATE, MYRISTATE, PALMITATE and STEARATE.

SOLUBILITY OF EACH IN SEVERAL SOLVENTS.

(Jacobson and Holmes, 1916.)

(See Lithium Laurate, p. 907, for formulas and other details.)

Solvent.	t°.	Gms. of Each Salt (Determined Separately) per 100 Gms. Solvent.			
		Pb Laurate.	Pb Myristate.	Pb Palmitate.	Pb Stearate.
Water	35	0.009	0.005	0.005	0.005
"	50	0.007	0.006	0.007	0.006
Abs. Ethyl Alcohol	25	0.009	0.004	0	0
" " "	35	0.032	0.004	0.001	0.001
" " "	50	0.264	0.052	0.012	0.004
Methyl Alcohol	15.5	0.061	0.056	0.051	0.039
" "	25	0.096	0.078	0.069	0.051
" "	35	0.113	0.082	0.076	0.062
" "	50	0.280	0.119	0.093	0.083
Ether	14.5	0.010	0.013	0.010	0.007
Ethyl Acetate	14	0.017	0.010	0.009	0.007
" "	35.5	0.035	0.015	0.009	0.008
" "	50	0.201	0.077	0.033	0.020
Benzene	15	0.011	0.010	0.009	0.008

LEAD CAPROATE, CAPRYLATE, CAPRATE, etc.

SOLUBILITY OF EACH IN ETHER AND IN PETROLEUM ETHER.
(Neave, 1912.)

Lead Salt.	Melting point.	Solubility in Ethyl Ether. Gms. Salt per 100 cc. Sat. Sol. At 20°.	Solubility in Ethyl Ether. Gms. Salt per 100 cc. Sat. Sol. At B. pt. of Sat. Sol.	Solubility in Pet. Ether. Gms. Salt per 100 cc. Sat. Sol. At 20°.	Solubility in Pet. Ether. Gms. Salt per 100 cc. Sat. Sol. At B. pt. of Sat. Sol.
Pb Caproate	73-74	...	1.364	...	0.0608
" Heptylate	90.5-91.5	0.2397	1.490	0.020	0.0528
" Caprylate	83.5-84.5	0.0938	0.546	practically insol.	0.0384
" Nonylate	94-95	0.1115	0.2404	"	0.0450
" Caprate	100	0.0290	0.4285	"	0.0170
" Myristate	107	practically insol.	0.0555	"	0.0210
" Laurate	103-104	"	0.0205	"	practically insol.
" Palmitate	112	"	0.0261	"	"
" Stearate	125	"	practically insol.	"	0.0170

The ethyl ether was distilled over sodium. Petroleum ether distilling between 40°-60° was used. The solutions were stirred constantly at 20°. A definite volume of the sat. solution was evaporated to dryness and residue weighed in each case.

CH

LEAD HELIANTHATE $Pb(C_{14}H_{14}N_3SO_3)_2.4H_2O$.

1000 cc. H_2O dsisolve 0.111 gm. lead helianthate (= 0.08 gm. helianthine) at 20°-25°. (Stark and Dehn, 1918.)

LEAD LIGNOCERATE.

100 gms. anhydrous ether dissolve 0.025 gm. lead lignocerate at 25°. (Thomas and Yu, 1923.

LEAD CYANIDE $Pb(CN)_2$

100 gms. Liquid Sulfur Dioxide (SO_2) dissolve 0.01 gm. $Pb(CN)_2$ at 0°. (Jander and Ruppolt, 1937.)

LEAD DOUBLE CYANIDES.

SOLUBILITY IN WATER.
(Schuler — Sitzber. Akad. Wiss. Wien, 79, 302, '79.)

CN

Double Salt.	Formula.	t°.	Gms. per 100 Gms. H₂O.
Lead Cobalticyanide	$Pb_3[Co(CN)_6]_2.7H_2O$	18	56.5
Lead Cobalticyanide	$Pb_3[Co(CN)_6]_2.7H_2O$	19	61.3
Lead Potassium Cobalticyanide	$PbKCo(CN)_6.3H_2O$	18	14.8
Lead Cobalticyanide Nitrate	$Pb_3[Co(CN)_6]_2.Pb(NO_3)_2.12H_2O$	18	5.9
Lead Ferricyanide Nitrate	$Pb_3[Fe(CN)_6]_2.Pb(NO_3)_2.12H_2O$	16	7.5
Lead Potassium Ferricyanide	$PbKFe(CN)_6.3H_2O$	16	21.0

LEAD THIOCYANATE $Pb(SCN)_2$.

One liter water dissolves 0.0137 gm. mol. $Pb(SCN)_2$ at 18°, as determined by E.M.F. measurements. (Masaki, 1931.)

100 gms. Liquid Sulfur Dioxide (SO_2) dissolve 0.012 gm. $Pb(SCN)_2$ at 0°. (Jander and Ruppolt, 1937.)

LEAD CARBONATE $PbCO_3$.

SOLUBILITY IN WATER BY ELECTRICAL CONDUCTIVITY METHOD.

(Kohlrausch and Rose, 1893; Böttger, 1903.)

1 liter of water dissolves 0.0011 – 0.0017 gm. $PbCO_3$ at 20°.

SOLUBILITY OF LEAD CARBONATE (NEUTRAL) IN AQUEOUS SOLUTIONS OF CARBON DIOXIDE AT 18°.

(Pleissner, 1907.)

Millimols per Liter.		Milligrams per Liter.	
CO_2.	$PbCO_3$.	CO_2.	$PbCO_3$.
0	0.008	0	1.75
0.064	0.029	2.8	6
0.123	0.034	5.4	7
0.328	0.040	14.4	8.2
0.592	0.048	26	9.9
0.988	0.053	43.5	10.9
2.40	0.076	106	15.4

A determination of the solubility of basic lead carbonate in water gave 1.6 mg. $Pb_3(CO_3)_2(OH)_2$ per liter = 1.3 mg. Pb or 0.006 millimol Pb.

LEAD CARBONATE $PbCO_3$.

100 gms. of a sat. solution of lead carbonate in water at 18° and in contact with CO_2 at a pressure of 1 atmosphere, contain 0.014 gm. Pb CO_3. At a pressure of 56 atmospheres of CO_2, 0.015 gm. Pb CO_3 are dissolved. (Haehnel, 1924.)

CO

SOLUBILITY OF LEAD CARBONATE AND OTHER LEAD SALTS IN BLOOD SERUM AT 25°.

(Fairhall, 1924 *a*.)

An excess of metallic lead or of the lead salt was added to 250 cc. bottles containing fresh horse serum preserved with a small amount of thymol. The bottles were rotated for 24 hours in a thermostat at 25°. The undissolved solid was thrown down by centrifugation and portions of the clear sat. solution were analyzed by evaporating, ashing, converting the lead to chromate and titrating with 0.005 *n* thiosulfate solution.

Lead compound employed.	Gms. lead cmpd. per liter of Serum at 25°.	Comparative solubility in Water.
Lead carbonate ($PbCO_3$)..	0.0333 (0.0125)	0.0017 at 18° as det. by Pleissner
» sulfate ($PbSO_4$)....	0.0437 (0.0300)	0.044 at 24°.95 as det. by Böttger
» chromate $PbCrO_4$..	— —	0.00001 at 25° as det. by von Hevesy
» oxide PbO.........	1.1520 (1.1600)	0.0171 at 20° as det. by Pleissner
» Pb...............	0.578 (0.193)	

The results in parentheses were obtained by saturating the fresh serum suspensions of the solid with CO_2 at 25°, and determining the solubility as above. The high value for Pb O is due to the formation of lead hydroxide, which is removed by protein with, which it combines to form an alkali metaprotein.

LEAD CARBONATE (Basic) $Pb_3(CO_3)_2(OH)_2$.

Results for the solubility of basic lead carbonate and of lead oxides in aqueous potassium hydroxide solutions at 25° are given by Randall and Spencer, 1928. The change of the stoichiometrical equilibrium constant with concentration shows that the activity coefficient of the plumbite ion is about the same as that of the nitrate ion in dilute solutions. From the extrapolated values of the equilibrium constants, the free energies of the solutions have been calculated."

LEAD OXALATE PbC_2O_4.

One liter of water dissolves 0.0015 gm. PbC_2O_4 at 18° (conductivity method). (Böttger — Z. physik. Chem. 46, 602, '03; Kohlrausch — *Ibid* 50, 356, '04–'05.)

LEAD Sub **CHLORIDE** PbCl.

1000 cc. sat. solution of lead subchloride in water contain 2.2 milli equivalents PbCl at 25° as determined by the conductivity method. (Denham, 1918.)

LEAD CHLORIDE $PbCl_2$.

SOLUBILITY IN WATER. (Lichty; see also Formanek, 1887; Bell, 1867; Ditte, 1881.)

t°.	Density of Solutions, H_2O at 0°.	Gms. $PbCl_2$ per 100		Milligram Mols. $PbCl_2$ per 100	
		cc. Solution.	Gms. H_2O.	cc. Solution.	Grams H_2O.
0	1.0066	0.6728	0.6728	2.421	2.421
15	1.0069	0.9070	0.9090	3.265	3.272
25	1.0072	1.0786	1.0842	3.882	3.903
35	1.0060	1.3150	1.3244	4.733	4.767
45	1.0042	1.5498	1.5673	5.579	5.644
55	1.0020	1.8019	1.8263	6.486	6.573
65	0.9993	2.0810	2.1265	7.490	7.651
80	0.9947	2.5420	2.6224	9.150	9.439
95	0.9894	3.0358	3.1654	10.926	11.394
100	...	3.208	3.342	11.52	12.01

Cl

More recent determinations of the solubility of Lead Chloride in Water as follows.

t°	Gms. $PbCl_2$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. PbC'_2 per 100 gms. sat. sol.	Solid Phase
15	0.85 (1)	$PbCl_2$	25	1.028 (4)	$PbCl_2$
15	(1.0071) 0.876 (2)	"	25	1.083 (5)(6)	"
20	(1.0070) 0.971 (2)	"	30	1.17 (7)	"
25	(1.0069) 1.076 (2)	"	50	1.75 ((1)	"
25	1.075 (3)	"	100	3.10 (1)	"

(1) Demassieux, 1923; (2) Flöttmann, 1928; (3) Deacone, 1927; (4 (4) Weber, 1929; (5) Burage, 1926; (6) Herz and Hellebrandt, 1923; (7) Sowerby, 1927.

SOLUBILITY OF LEAD CHLORIDE IN WATER AT TEMPERATURES ABOVE 100°.
(Benrath, Gjedebo, Schiffers and Wunderlich, 1937.)

t°	Gms. $PbCl_2$ per 100 gms. sat. sol.	t°	Gms. $PbCl_2$ per 100 gms. sat. sol.	t°	PGms. $PbCl_2$ per 100 gms. sat. sol.
141	4.74	230	11.3	345	24-76*
160	5.67	257	14.3	351	81.2
187	7.39	276	16.7	362	87.8
195	8.47	287	18.4	407	84.4

* Two liquid layers are formed and there is present salt solution, melt and vapor.

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF MERCURIC CHLORIDE AT 25°. (Kendall and Sloan, 1925.)

Gm. equiv. per liter		Solid Phase.
[$HgCl_2$].	[$PbCl_2$].	
0.06	0.0885	$HgCl_2.PbCl_2$
0.10	0.0983	»
0.15	0.1074	»
0.50	0.1384	»

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM BROMIDE AT 25°. (Herz and Hellebrandt, 1923.)

Normality of KBr......	0.53	1.07	2.14	3.21	4.28
Mols. Pb per liter......	0.00789	0.00888	0.02577	0.06705	0.1774

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT 25°. (Burrage, 1926.)

Constant agitation in a thermostat was employed and great care exercised to insure that equilibrium had been attained. The solid phases were analyzed by the « rest method ».

Cl

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
KCl.	$PbCl_2$.		KCl.	$PbCl_2$	
0.0	1.083	$PbCl_2$	7.048	0.128	$KCl.2PbCl_2$
0.037	1.008	»	9.787	0.127	»
0.075	0.961	»	12.93	0.142	»
0.152	0.877	»	18.74	0.236	»+$KCl.PbCl_2.{}^1/_3H_2O$
0.296	0.747	»	22.54	0.303	$KCl.PbCl_2.{}^1/_3H_2O$
0.735	0.462	»	26.43	0.386	»+KCl
1.469	0.301	»	26.52	0.267	KCl
3.022	0.205	»	26.44	0.122	»
4.969	0.227	» + $KCl.2PbCl_2$	26.53	0.00	»

Subsequent determinations upon this system at 25° by Burrage, 1932, and Allmand and Burrage, 1933, gave the following results.

Gms. per 1000 gms. H_2O		Solid Phase	Gms. per 1000 gms. H_2O		Solid Phase
KCl	$PbCl_2$		KCl	$PbCl_2$	
0.0	10.94	$PbCl_2$	130	1.49	$2PbCl_2.KCl$
7.5	4.70	"	182	2.04	"
15.0	3.05	"	231	2.91	" + $PbCl_2.KCl 1/3H_2O$
30.0	2.31	"	265	3.41	$PbCl_2.KCl.1/3H_2O$
35.0	2.22	"	299	4.04	"
40.0	2,18	"	330	4.65	"
47.0	2.30	"	361	5.25	" + KCl
52.5	2.39	"	362.5	4.0	KCl
55.0	2.49	"	361	2.0	"
59.0	2.70	" + $2PbCl_2.KCl$	360	1.0	"
75.0	2.35	$2PbCl_2.KCl$	359	0.125	"

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT 25.2°. (von Ende, 1901.)

Normality of KCl.	Gm. Equiv. $PbCl_2$ per Liter.	Normality of KCl.	Gm. Equiv. $PbCl_2$ per Liter.
0	0.07760	0.0999	0.02380
0.001	0.07664	0.5006	0.01480
0.0025	0.07570	0.7018	0.01476
0.0049	0.07404	0.9991	0.00980
0.0099	0.07056	1.5018	0.00996
0.0200	0.06432	2.0024	0.01112
0.0599	0.04524	3.0036	0.01948

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT 20°. (Brönsted, 1912.)

Gm. Equivalents per 1000 Gms. Solution.		Solid Phase.	Gm. Equivalents per 1000 Gms. Solution.		Solid Phase.
KCl.	$PbCl_2$.		KCl.	$PbCl_2$.	
0.195	0.01900	$PbCl_2$	2.10	0.01022	$2PbCl_2.KCl$
0.299	0.01452	"	2.20	0.01060	"
0.375	0.01324	"	2.29	0.01184	"
0.483	0.01236	"	2.36	0.01300	$2PbCl_2.KCl+PbCl_2.KCl.\frac{1}{2}H_2O$
0.510	0.0125	" $+2PbCl_2.KCl$	2.45	0.01308	$PbCl_2.KCl.\frac{1}{2}H_2O$
0.575	0.01068	$2PbCl_2.KCl$	2.66	0.01396	"
0.639	0.00954	"	2.77	0.01476	"
0.930	0.00770	"	2.91	0.01550	"
1.224	0.00736	"	3.05	0.01656	"
1.575	0.00786	"	3.18	0.01780	"
1.884	0.00894	"	4.57*	0.0280*	" +KCl

* = Gm. equivalents per 1000 Gms. H_2O.

Data for the solubility of lead chloride in aqueous KCl and aqueous NaCl are given by Demassieux, 1914.

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT 25°. (Kendall and Sloan, 1925.)

Gms. equiv. per liter		Solid Phase.	Gms. equiv. per liter		Solid Phase.	Gms. equiv. per liter		Solid Phase.
[K Cl].	[$PbCl_2$].		[K Cl].	[$PbCl_2$].		[K Cl].	[$PbCl_2$].	
0.25	0.01850	$PbCl_2$	0.78	0.01063	1.2	2.07	0.01287	1.2
0.37	0.01600	»	0.97	0.00981	»	2.17	0.01388	»
0.46	0.01422	»	1.10	0.00960	»	2.26	0.01489	1.1
0.52	0.01362	»	1.20	0.00960	»	2.41	0.01480	»
0.54	0.01354	»	1.30	0.00965	»	2.65	0.01601	»
0.63	0.01277	1.2	1.55	0.01025	»	2.98	0.01943	»
0.74	0.01102	»	1.80	0.01134	»	3.00	0.01966	»
					»	3.20	0.02402	»

1.2 = $KCl.2PbCl_2$; 1.1 = $KCl.PbCl_2$.

Solubility of Lead Chloride in Aqueous Solutions of Mercuric Chloride at 25°. (Kendall and Sloan, 1925.)

Gm. equiv. per liter		Solid Phase.
[$HgCl_2$].	[$PbCl_2$].	
0.06	0.0885	$HgCl_2.PbCl_2$
0.10	0.0983	»
0.15	0.1074	»
0.50	0.1384	»

Solubility of Lead Chloride in Aqueous Solutions of Potassium Bromide at 25°. (Herz and Hellebrandt, 1923.)

Normality of KBr......	0.53	1.07	2.14	3.21	4.28
Mols. Pb per liter......	0.00789	0.00888	0.02577	0.06705	0.1774

Solubility of Lead Chloride in Aqueous Solutions of Potassium Chloride at 25°. (Burrage, 1926.)

Constant agitation in a thermostat was employed and great care exercised to insure that equilibrium had been attained. The solid phases were analyzed by the « rest method ».

Cl

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
KCl.	$PbCl_2$.	Solid Phase.	KCl.	$PbCl_2$	Solid Phase.
0.0	1.083	$PbCl_2$	7.048	0.128	$KCl.2PbCl_2$
0.037	1.008	»	9.787	0.127	»
0.075	0.961	»	12.93	0.142	»
0.152	0.877	»	18.74	0.236	»+$KCl.PbCl_2.1/_2H_2O$
0.296	0.747	»	22.54	0.303	$KCl.PbCl_2.1/_2H_2O$
0.735	0.462	»	26.43	0.386	»+KCl
1.469	0.301	»	26.52	0.267	KCl
3.022	0.205	»	26.44	0.122	»
4.969	0.227	» + $KCl.2PbCl_2$	26.53	0.00	»

Subsequent determinations upon this system at 25° by Burrage, 1932, and Allmand and Burrage, 1933, gave the following results.

Gms. per 1000 gms. H_2O		Solid Phase	Gms. per 1000 gms. H_2O		Solid Phase
KCl	$PbCl_2$		KCl	$PbCl_2$	
0.0	10.94	$PbCl_2$	130	1.49	$2PbCl_2.KCl$
7.5	4.70	"	182	2.04	"
15.0	3.05	"	231	2.91	" + $PbCl_2.KCl\,1/3H_2O$
30.0	2.31	"	265	3.41	$PbCl_2.KCl.1/3H_2O$
35.0	2.22	"	299	4.04	"
40.0	2,18	"	330	4.65	"
47.0	2.30	"	361	5.25	" + KCl
52.5	2.39	"	362.5	4.0	KCl
55.0	2.49	"	361	2.0	"
59.0	2.70	" + $2PbCl_2.KCl$	360	1.0	"
75.0	2.35	$2PbCl_2.KCl$	359	0.125	"

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT 25.2°. (von Ende, 1901.)

Normality of KCl.	Gm. Equiv. $PbCl_2$ per Liter.	Normality of KCl.	Gm. Equiv. $PbCl_2$ per Liter.
0	0.07760	0.0999	0.02380
0.001	0.07664	0.5006	0.01480
0.0025	0.07570	0.7018	0.01476
0.0049	0.07404	0.9991	0.00980
0.0099	0.07056	1.5018	0.00996
0.0200	0.06432	2.0024	0.01112
0.0599	0.04524	3.0036	0.01948

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT 20°. (Brönsted, 1912.)

Gm. Equivalents per 1000 Gms. Solution.		Solid Phase.	Gm. Equivalents per 1000 Gms. Solution.		Solid Phase.
KCl.	$PbCl_2$.		KCl.	$PbCl_2$.	
0.195	0.01900	$PbCl_2$	2.10	0.01022	$2PbCl_2.KCl$
0.299	0.01452	"	2.20	0.01060	"
0.375	0.01324	"	2.29	0.01184	"
0.483	0.01236	"	2.36	0.01300	$2PbCl_2.KCl+PbCl_2.KCl.\frac{1}{2}H_2O$
0.510	0.0125	" $+2PbCl_2.KCl$	2.45	0.01308	$PbCl_2.KCl.\frac{1}{2}H_2O$
0.575	0.01068	$2PbCl_2.KCl$	2.66	0.01396	"
0.639	0.00954	"	2.77	0.01476	"
0.930	0.00770	"	2.91	0.01550	"
1.224	0.00736	"	3.05	0.01656	"
1.575	0.00786	"	3.18	0.01780	"
1.884	0.00894	"	4.57*	0.0280*	" +KCl

* = Gm. equivalents per 1000 Gms. H_2O.

Cl

Data for the solubility of lead chloride in aqueous KCl and aqueous NaCl are given by Demassieux, 1914.

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT 25°. (Kendall and Sloan, 1925.)

Gms. equiv. per liter		Solid Phase.	Gms. equiv. per liter		Solid Phase.	Gms. equiv. per liter		Solid Phase.
[K Cl].	[Pb Cl_2].		[K Cl].	[Pb Cl_2].		[K Cl].	[Pb Cl_2].	
0.25	0.01850	PbCl_2	0.78	0.01063	1.2	2.07	0.01287	1.2
0.37	0.01600	»	0.97	0.00981	»	2.17	0.01388	»
0.46	0.01422	»	1.10	0.00960	»	2.26	0.01489	1.1
0.52	0.01362	»	1.20	0.00960	»	2.41	0.01480	»
0.54	0.01354	»	1.30	0.00965	»	2.65	0.01601	»
0.63	0.01277	1.2	1.55	0.01025	»	2.98	0.01943	»
0.74	0.01102	»	1.80	0.01134	»	3.00	0.01966	»
					»	3.20	0.02402	»

1.2 = K Cl.2 PbCl_2; 1.1 = K Cl.PbCl_2.

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE.

(Demassieux, 1923.)

Results at 14°. Gms. per 100 gms. sat. sol. KCl.	PbCl$_2$.	Results at 50°. Gms. per 100 gms. sat. sol. KCl.	PbCl$_2$.	Results at 100°. Gms. per 100 gms. sat. sol. KCl.	PbCl$_2$.	Solid Phase at each temp.
0.0	0.91	0.0	1.75	0.0	3.10	PbCl$_2$
1.37	0.18	2.0	0.65	2.0	2.00	»
2.44	0.14	4.0	0.5	4.0	1.75	»
3.43	0.13	6.0	0.57	6.0	1.78	»
-	-	-	-	8.0	2.00	»
-	-	-	-	10.0	2.38	»
3.79	0.15	6.4	0.62	10.6	2.57	» +2.1
4.0	0.13	12.0	0.50	12.0	2.42	2.1
4.7	0.08	14.0	0.52	14.0	2.32	»
12.75	0.08	16.0	0.55	16.0	2.35	»
15.65	0.10	18.0	0.62	18.0	2.50	»
15.87	0.11	20.0	0.70	20.0	2.75	»
16.26	0.11	22.0	0.85	22.0	3.10	»
-	-	-	-	24.0	3.50	»
-	-	-	-	26.0	4.25	»
16.83	0.12	22.8	0.97	27.2	5.00	» +1.1.$^1/_3$
17.57	0.13	28.0	1.10	28.0	4.90	1.1.$^1/_3$
18.64	0.14	30.0	1.27	30.0	5.10	»
18.97	0.15	-	-	32.0	5.45	»
22.45	0.17	-	-	34.0	5.80	»
24.61	0.20	31.24	1.5	35.3	6.05	» + KCl
-	-	31.0	1.0	35.0	3.5	KCl
-	-	31.0	0.5	35.2	1.25	»
24.52	0.0	31.07	0.0	35.5	0.0	»

2.1 = 2PbCl$_2$.KCl; 1.1.$^1/_3$ = PbCl$_2$.KCl.$^1/_3$H$_2$O.

The author's numerous determinations were plotted and the above values read from the average curve.

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF LITHIUM CHLORIDE

AT 25°. (Kendall and Sloan, 1925.)

Gm. equiv. per liter. [LiCl].	[PbCl$_2$].	Gm. equiv. per liter. [LiCl].	[PbCl$_2$].
0.28	0.02565	2.10	0.04300
0.32	0.02500	2.26	0.04729
0.52	0.02384	2.40	0.05144
0.74	0.02449	2.58	0.05723
0.91	0.02582	2.68	0.06086
1.28	0.02945	2.72	0.06317
1.55	0.03306	2.75	0.06507
1.81	0.03720	2.82	0.06930

Solid Phase; LiCl.2PbCl$_2$ in all cases.

AT 50°. (Demassieux, 1923.)

Gms. per 100 gms. sat. sol. LiCl.	PbCl$_2$.	Gms. per 100 gms. sat. sol. LiCl.	PbCl$_2$.
2.06	0.45	37.51	7.53
4.79	0.35	38.52	7.55
5.07	0.37	39.40	7.62
9.59	0.49	40.50	7.45
16.10	0.83	43.99	7.42
24.64	2.31	45.51	6.66
30.61	5.08	46.22	6.50
35.05	6.80	47.72	3.39
36.69	7.46	48.41	2.22

A double salt was not found.

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SALT SOLUTIONS AT 25°.

(Noyes; in $HgCl_2$ solutions at 20°, Formanek — Chem. Centralb. 270, '87.)

In Aqueous Solutions of:

HCl, KCl, $MgCl_2$, $CaCl_2$, $MnCl_2$ and $ZnCl_2$ Gram Equivalents per Liter of:		In $CdCl_2$ Gram Equiv. per Liter.		In $HgCl_2$ Gram Equiv. per Liter.		In $Pb(NO_3)_2$ Gram Equiv. per Liter.	
Salt	$PbCl_2$.	$CdCl_2$.	$PbCl_2$.	$HgCl_2$.	$PbCl_2$.	$Pb(NO_3)_2$.	$PbCl_2$.
0.0	0.0777	0.00	0.0777	0.0	0.0777	0.0	0.0777
0.05	0.050	0.05	0.0601	0.1	0.0992	0.2	0.0832
0.10	0.035	0.10	0.0481				
0.20	0.021	0.20	0.0355				

The above resuits were calculated to grams per liter plotted on cross-section paper, and the figures in the following table read from the curves.

Gms. Salt per Liter.	Grams $PbCl_2$ per Liter in Aqueous Solutions of:									
	HCl.	KCl.	$MgCl_2$.	$CaCl_2$.	$MnCl_2$.	$ZnCl_2$.	$CdCl_2$.	$HgCl_2$.		$Pb(NO_3)_2$
0	10.79	10.79	10.79	10.79	10.79	10.79	10.79	10.79(N)	9.71(F)	10.79
1	8.5	9.3	7.7	8.7	9.5	...	10.2	11.0	9.8	10.8
2	6.5	8.2	6.5	7.6	8.3	...	9.7	11.4	10.0	10.85
3	5.2	7.2	5.7	6.7	7.3	...	9.2	11.7	10.3	10.87
4	4.3	6.5	5.2	6.0	6.3	...	8.6	12.0	10.5	10.90
6	3.2	5.3	4.4	4.8	5.0	...	7.7	12.7	11.0	10 95
8	2.5	4.5	...	3.9	4.1	...	7.0	13.3	11.6	11.00
10	2.1	3.9	...	3.3	3.5	...	6.3	14.0	12.2	11.05
14	...	3.1	...	...	2.8	3.0	5.4	...	13.2	11.15
20	...	...	...	...	...	...	4.7	...	14.8	11.20
40	...	...	...	...	...	...	...	...	19.0	11.70

Cl

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF MAGNESIUM CHLORIDE AT 25°. (Kendall and Sloan, 1925.)

Gm. equiv. per liter		Gm. equiv. per liter		Gm. equiv. per liter		Gm. equiv. per liter	
$[MgCl_2]$.	$[PbCl_2]$.	$[MgCl_2]$.	$[PbCl_2]$.	$[MgCl_2]$.	$[PbCl_2]$.	$[MgCl_2]$.	$[PbCl_2]$.
0.12	0.01084	1.83	0.00723	4.86	0.01832	7.08	0.04844
0.27	0.00802	2.62	0.00915	5.42	0.02303	7.58	0.05944
0.60	0.00625	3.54	0.01205	5.94	0.02902	7.98	0.07000
0.85	0.00618	3.87	0.01329	6.36	0.03489	8.12	0.07360
1.58	0.00689	4.36	0.01564	6.78	0.04251		

Solid Phase $MgCl_2.PbCl_2.6H_2O$ in all cases.

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS AMMONIUM CHLORIDE AT 22°.

(Brönsted, 1911.)

Gm. Equivalents per Liter.		Solid Phase.	Gm. Equivalents per Liter.		Solid Phase.
NH_4Cl.	$PbCl_2$.		NH_4Cl.	$PbCl_2$.	
0	0.0749	$PbCl_2$	0.8	0.0087	$NH_4Cl.2PbCl_2$
0.1	0.0325	"	1	0.0080	"
0.2	0.0194	"	1.5	0.0073	"
0.4	0.0138	"	2.5	0.0092	"
0.5	0.0130	"	4	0.0182	"
0.52	0.0127	" $+NH_4Cl.2PbCl_2$	6	0.0473	"
0.55	0.0123	$NH_4Cl.2PbCl_2$	7.29	0.0898	" $+NH_4Cl$
0.65	0.0105	"	7.29	0	NH_4Cl

For additional results at 25.2° see von Ende, 1901.

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE.

(Demassieux, 1923.)

Results at 17°. Gms. per 100 gms. sat. sol.		Results at 30°. Gms. per 100 gms. sat. sol.		Results at 100°. Gms. per 100 gms. sat. sol.		Solid Phase at each temp.
$PbCl_2$.	NH_4Cl.	$PbCl_2$.	NH_4Cl.	$PbCl_2$.	NH_4Cl.	
0.89	0.0	1.09	0.50	3.10	0.0	$PbCl_2$
0.27	0.96	0.67	1.51	2.0	1.31	»
0.14	2.40	0.50	3.85	1.75	5.47	»
0.07	4.19	0.54	4.28	1.76	6.01	»
0.08	4.31	0.58	4.45	1.78	8.62	» +1.2
0.07	4.98	0.49	4.84	1.73	9.66	1.2
0.09	12.30	0.39	7.27	2.90	19.77	»
0.34	22.34	0.72	19.42	4.50	26.00	»
–	–	1.76	27.15	8.40	34.63	»
–	–	3.29	31.25	11.40	36.29	»
–	–	–	–	12.67	37.38	» +1.2
–	–	–	–	12.51	37.92	1.2
–	–	–	–	10.68	38.82	»
–	–	–	–	9.53	41.90	» $+NH_4Cl$
0.64	26.49	3.96	33.55	–	–	2.1 $+NH_4Cl$
0.33	27.23	1.60	33.90	4.21	42.96	NH_4Cl
0.0	27.35	0.32	34.14	3.06	43.40	»
–	–	0.0	34.25	0.71	43.88	»

2.1 = $2PbCl_2.NH_4Cl$; 1.2 = $PbCl_2.2NH_4Cl$.

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE AT 25°.

(Kendall and Sloan, 1925.)

Gm. equiv. per liter		Gm. equiv. per liter		Gm. equiv. per liter		Gm. equiv. per liter	
$[NH_4Cl]$.	$[PbCl_2]$.	$[NH_4Cl]$.	$[PbCl_2]$.	$[NH_4Cl]$.	$[PbCl_2]$.	$[NH_4Cl]$.	$[PbCl_2]$.
0.20	0.02207	1.96	0.00923	4.22	0.02220	5.46	0.03645
0.50	0.01305	2.57	0.01142	4.64	0.02620	5.66	0.04000
0.56	0.01224	3.18	0.01462	4.83	0.02836	6.00	0.04723
0.80	0.00878	3.47	0.01643	5.00	0.03030	6.28	0.05507
1.00	0.00765	3.60	0.01721	5.09	0.03142	6.30	0.05601
1.20	0.00769	3.90	0.01982	5.20	0.03264		

The solid phase at all concentrations above 0.6 *n* is $2\,PbCl_2.NH_4Cl$.

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM BROMIDE AT 25°.

(Herz and Hellebrandt, 1923.)

Normality of NaBr.....	0.48	0.97	1.94	2.82	3.78
Mol. Pb per liter......	0.00697	0.01210	0.05932	0.14310	0.31855

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AT 25°.

Results of Herz and Hellebrandt, 1923.		Results of Kendall and Sloan, 1923.					
Normality of NaCl.	Mol. Pb per liter.	Gm. equiv. per liter		Gm. equiv. per liter.		Gm. equiv. per liter	
		$[NaCl]$.	$[PbCl_2]$.	$[NaCl]$.	$[PbCl_2]$.	$[NaCl]$.	$[PbCl_2]$.
0.0	0.03895	0.25	0.01603	1.56	0.01468	3.06	0.03188
0.51	0.00648	0.40	0.01370	1.85	0.01725	3.29	0.03545
1.02	0.00631	0.50	0.01300	1.96	0.01807	3.54	0.03966
2.05	0.00961	0.70	0.01192	2.25	0.02100	3.78	0.04407
3.03	0.01279	0.86	0.01205	2.46	0.02370	4.04	0.05008
4.10	0.04377	1.14	0.01261	2.66	0.02606	4.18	0.05431
		1.46	0.01403	2.90	0.02944	4.39	0.06302
						4.50	0.07009

Solid phase above 0.5 *n* NaCl is $NaCl.2PbCl_2$.

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE

(Demassieux, 1923.)

Results at 13°. Gms. per 100 gms. sat. sol.		Results at 50°. Gms. per 100 gms. sat. sol.		Results at 100°. Gms. per 100 gms. sat. sol.		
NaCl.	$PbCl_2$.	NaCl.	$PbCl_2$.	NaCl.	$PbCl_2$.	Solid Phase at each temp.
0.0	0.82	2.07	0.57	2.01	1.65	$PbCl_2$
1.0	0.18	5.36	0.38	5.00	1.53	»
4.97	0.09	9.57	0.58	13.12	2.54	»
13.39	0.19	17.22	1.20	19.55	4.95	»
16.46	0.31	22.94	2.41	24.01	9.00	»
23.46	1.10	25.51	4.04	25.21	10.47	»
26.17	1.88	26.46	4.94	26.27	11.92	» + NaCl
26.29	0.75	26.48	3.88	27.05	6.86	NaCl
26.33	0.0	26.89	1.50	27.09	2.82	»

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF STRONTIUM BROMIDE AT 25°.

(Herz and Hellebrandt, 1923.)

Normality of $\frac{SrBr_2}{2}$ . . .	0.52	1.04	2.08	3.12	4.16
Mol. Pb per liter......	0.00629	0.01139	0.04875	0.1397	0.3993

Cl

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF STRONTIUM CHLORIDE AT 25°.

Results of Herz and Hellebrandt, 1923.		Results of Kendall and Sloan, 1925. Gm. equiv. per liter		Gm. equiv. per liter		Gm. equiv. per liter.	
Normality of $\frac{SrCl_2}{2}$.	Mol. Pb. per liter.	[$SrCl_2$].	[$PbCl_2$].	[$SrCl_2$].	[$PbCl_2$].	[$SrCl_2$].	[$PbCl_2$].
0.51	0.00678	0.20	0.02633	1.70	0.02985	2.96	0.04304
1.02	0.00640	0.32	0.02502	2.06	0.03260	3.32	0.05032
1.38	0.00824	0.60	0.02480	2.12	0.03303	3.36	0.05118
2.66	0.01418	0.80	0.02522	2.55	0.03705	3.47	0.05440
3.09	0.01578	1.12	0.02620	2.66	0.03869	3.64	0.06009
4.13	0.02698	1.46	0.02821	2.80	0.04027	3.78	0.06502
		Solid Phase $SrCl_2.PbCl_2$ in all cases.				3.88	0.06940

EQUILIBRIUM IN THE SYSTEM LEAD CHLORIDE, LEAD IODIDE AND WATER AT 30°.

(Sowerby, 1927.)

Gms. per 100 cc sat. sol.		Solid Phase	Gms. per 100 cc sat. sol.		Solid Phase
PbI_2	$PbCl_2$		PbI_2	$PbCl_2$	
0.0	1.171	$PbCl_2$	0.0520	0.550	PbICl
0.0081	1.171	"	0.0602	0.518	" + PbI_2
0.0168	1.171	"	0.0606	0.417	PbI_2
0.0235	1.171	" + PbICl	0.0620	0.352	"
0.0241	1.140	PbICl	0.0647	0.209	"
0.0278	0.958	"	0.0712	0.100	"
0.0390	0.717	"	0.0788	0.046	"
0.0432	0.631	"	0.0910	0.00	"

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF LEAD NITRATE AT 25°.

Results by Harkins, 1911.

Gms. per Liter Sat. Sol. $Pb(NO_3)_2$.	Gms. per Liter Sat. Sol. $PbCl_2$.	d_{25} of Sat. Sol.
0	10.81	1.0069
3.31	10.67	1.0095
8.28	10.65	1.0139
16.56	10.84	1.0210
33.12	11.57	...

Results by Armstrong and Eyre, 1913.

Aq. $Pb(NO_3)_2$ Sol., Gms. per 1000 Gms. H_2O.	Gms. $PbCl_2$ per 1000 Gms. Sat. Sol.
0	10.89
3.31	10.96
6.62	10.53
33.12	11.15
82.80	12.95

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF ACETIC ACID AT 25°. (Hill, 1917.)

Normality of Acetic Acid.	Dissolved $PbCl_2$. Gms. per Liter.	Dissolved $PbCl_2$. Equiv. per Liter.	Normality of Acetic Acid.	Dissolved $PbCl_2$. Gms. per Liter.	Dissolved $PbCl_2$. Equiv. per Liter.
0	10.77	0.07753	0.465	10.27	0.07392
0.05	10.82	0.07782	0.929	9.45	0.06803
0.10	10.85	0.07717	1.845	7.90	0.05686
0.20	10.70	0.07703	3.680	5.26	0.03788

Cl

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF ACETIC ACID AT 25°. (Herz and Martin, 1924.)

Titrametric Conc. of CH_3COOH.	Mols. Pb per liter.	Titrametric Conc. of CH_3COOH.	Mols. Pb per liter.	Titrametric Conc. of CH_3COOH.	Mols. Pb per liter.
0.0	0.03895	5.16	0.01446	10.17	0.00363
1.02	0.03365	5.87	0.01163	11.24	0.00258
2.05	0.02796	7.06	0.00887	12.20	0.00191
3.04	0.02266	7.93	0.00660	13.28	0.00138
3.94	0.01837	8.94	0.00505	14.44	0.00123
				14.90	0.00120

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF ACETIC ACID AT 25°.

(Sanved, 1929.)

Gms. per 100 gms. sat. sol. $PbCl_2$	Gms. per 100 gms. sat. sol. CH_3COOH	Solid Phase	Gms. per 100 gms. sat. sol. $PbCl_2$	Gms. per 100 gms. sat. sol. CH_3COOH	Solid Phase
1.060	0.0	$PbCl_2$	0.481	24.83	$PbCl_2$
1.024	1.28	"	0.372	30.32	"
0.983	2.33	"	0.213	42.20	"
0.883	6.01	"	0.147	51.72	"
0.793	9.58	"	0.084	60.40	"
0.627	17.27	"	0.047	78.30	"
0.547	21.31	"	0.013	96.60	"

The author also gives results at 25° for the quarternary system $PbCl_2 + Pb(CH_3COO)_2 + CH_3COOH + H_2O$.

Solubility of Lead Chloride in Aqueous Solutions of Alcohol and of Mannitol at 25°. (Kernot and Pomilio, 1912.)

Results for Aqueous Ethyl Alcohol. Gms. per Liter Solution. C_2H_5OH.	$PbCl_2$.	Results for Aqueous Mannitol. Gms. per Liter Solution. $(CH_2OH)_2(CHOH)_4$.	$PbCl_2$.
0	10.75	0	10.75
5.75	10.16	2.84	10.42
11.51	9.36	5.69	10.67
23.02	9.14	11.38	10.64
46.05	8.25	22.76	10.91
92.10	7.12	45.53	11.16
184.20	4.76	91.06	11.29

Solubility of Lead Chloride in Glycerol. (Presse, 1874.)

1 part glycerol + 7 parts H_2O dissolve 0.91 per cent $PbCl_2$.
1 part glycerol + 3 parts H_2O dissolve 1.04 per cent $PbCl_2$.
1 part glycerol + 1 part H_2O dissolves 1.32 per cent $PbCl_2$.
Pure glycerol dissolves 2 per cent $PbCl_2$.

Cl

Solubility of Lead Chloride in Aqueous Solutions of Several Compounds at 25°. (Armstrong and Eyre, 1913.)

Aqueous Solution of:	Gms. Cmpd. per 1000 Gms. H_2O.	Gms. $PbCl_2$ per 1000 Gms. Sat. Sol.	Aqueous Solution of:	Gms. Cmpd. per 1000 Gms. H_2O.	Gms. $PbCl_2$ per 1000 Gms. Sat. Sol.
Water alone	0	10.89	Ethyl Alcohol	11.51	10.43
Glycol	15.51	10.75	Glycerol	23.01	10.98
"	62.04	10.90	Propyl Alcohol	15.01	10.08
Acetaldehyde	11.01	10.54	" "	60.06	9.37
"	33.03	9.82	Methyl Acetanilide	29.82	10.25
Paraldehyde	11.01	10.50	Hydrochloric Acid	9.12	4.23
"	33.02	9.96	" "	18.23	3.60

100 cc. anhydrous hydrazine dissolve 3 gms. $PbCl_2$ at ord. temp. with decomposition. (Welsh and Broderson, 1915.)

Solubility of Lead Chloride in Pyridine. (Heise, 1912.)

t°.	Gms. $PbCl_2$ per 100 Gms. Pyridine.	Solid Phase.	t°.	Gms. $PbCl_2$ per 100 Gms. Pyridine.	Solid Phase.
−20	0.303	$PbCl_2.2C_5H_5N$	76	0.893	$PbCl_2.2C_5H_5N$
0	0.364	"	90	1.07	"
+22	0.459	"	94	1.12	"
44	0.559	"	102	1.31	"
65	0.758	"			

100 gms. Liquid Sulfur Dioxide (SO_2) dissolve 0.019 gm. $PbCl_2$ at 0°. (Jander and Ruppolt, 1937.)

Fusion-point data are given for:

$PbCl_2$	+ PbF_2	(Sandonnini, 1911; Pelabon and Lande, 1928.)
"	+ PbI_2	(Honkemeyer, 1906; Pelabon and Lande, 1928.)
"	+ PbO	(Ruer, 1906; Baroni, 1934; Pelabon and Lande, 1928.)
"	+ $Pb_3(PO_4)_2$	(Amadori, 1918; 1919.)
"	+ $Pb_3(VO_4)_2$	(Amadori, 1919.)
"	+ PbS	(Truthe, 1912.)
"	+ $AgCl$	(Tubaudt and Eggert, 1920.)
"	+ KCl	(Tries, 1914; Lorenz and Ruckstuhl, 1906.)
"	+ $NaCl$	(Tries, 1914; Demassieux, 1923.)
"	+ $RbCl$	(Tries, 1914.)
"	+ $SrCl$	(Sandonnini, 1911, 1914.)
"	+ $TlCl$	(Korreng, 1911; Sandonnini, 1911, 1914.)
Cl "	+ $SnCl_2$	(Hermann, 1911; Sandonnini, 1911, 1914.)
"	+ $ZnCl_2$	(Hermann, 1911.)

LEAD Fluoro**CHLORIDE** $PbFCl$.

SOLUBILITY OF LEAD FLUOROCHLORIDE IN WATER AND IN AQUEOUS SOLUTIONS.
(Stark, 1911.)

Solubility in Water.		Solubility in Aq. Solutions at 25°.			
t°.	Gms. PbFCl per 100 Gms. H_2O.	Aq. Solution of:	Gms PbFCl per 100 cc. Sat. Sol.	Aq. Solution of:	Gms. PbFCl per 100 cc. Sat. Sol.
0	0.0211	0.00996 *n* $PbCl_2$	0.0030	0.0535 *n* HCl	0.0758
18	0.0325	0.0195 *n* "	0.0008	0.1060 *n* "	0.1006
25	0.0370	0.0392 *n* "	0.0005	0.0518 *n* CH_3COOH	0.0512
100	0.1081			0.1055 *n* "	0.0561

LEAD CHLORITE $Pb(ClO_2)_2$.

SOLUBILITY OF LEAD CHLORITE IN WATER.
(Levi, 1923.)

t°	Gms. $Pb(ClO_2)_2$ per 100 gms. sat. sol.	Solid Phase
0	0.035	$Pb(ClO_2)_2$
25	0.12	"
50	0.19	"
75	0.32	"
100	0.41	"

ClO **LEAD CHLORATE** $Pb(ClO_3)_2.H_2O$.

100 grams H_2O dissolve 151.3 gms. $Pb(ClO_3)_2$, or 100 gms. sat. solution contain 60.2 gms. $Pb(ClO_3)_2$ at 18°. Density of solution, 1.947. (Mylius and Funk, 1897.)

100 gms. H_2O dissolve 440 gms. $Pb(ClO_3)_2$ at 18°, $d_{18} = 1.63$. (Carlson, 1910.)

LEAD per CHLORATE $Pb(ClO_4)_2.3H_2O$.

100 gms. sat. solution of lead perchlorate trihydrate in water contain 81.472 gms. Pb $(ClO_4)_2$ at 25° and the density of the solution is $d_{\frac{25}{4}} = 2.7753$. (Willard and Kassner, 1930.)

100 cc Furfural dissolve 25 gms. $Pb(ClO_4)_2$ at about 20°.

100 cc Cellosolve (mono ethyl ether of ethylene glycol) dissolve about 105 gms. $Pb(ClO_4)_2$ at about 20°. (Chaney and Mann, 1931.)

LEAD Hexa Antipyrine Per **CHLORATE** $[Pb(COC_{10}H_{12}N_2)_6](ClO_4)_2$.

100 cc sat. solution of Lead Hexa antipyrine per chlorate in water contain 5.44 gms. $[Pb(COC_{10}H_{12}N_2)_6](ClO_4)_2$ at 20°. (Wilke-Dörfurt and Schliephake, 1920.)

LEAD CHROMATE $PbCrO_4$.

SOLUBILITY OF LEAD CHROMATE IN WATER.

t°.	Mols. $PbCrO_4$ per Liter.	Gms. $PbCrO_4$ per Liter.	Method.	Authority.
18	$3.0 \cdot 10^{-7}$	0.00010	Solution equilibrium	(Beck and Stegmüller, 1910.)
..	$1.4 \cdot 10^{-7}$	0.00004	" "	(Auerbach and Pick.)
18	$3.2 \cdot 10^{-7}$	0.00010	Conductivity	(Kohlrausch, 1908.)
20	$2.1 \cdot 10^{-7}$	0.00007	Radio Indicators	(v. Hevesy and Rona, 1915.)

A more recent very careful direct determination of the solubility of lead chromate in water by Huybrechts and Degard, 1933, gave 0.00017 gm. $PbCrO_4$ per liter at 20°. The pH of the water was 6.27.

SOLUBILITY OF LEAD CHROMATE IN AQUEOUS SOLUTIONS OF ACETIC ACID AND OF AMMONIUM ACETATE AT 20°.

(Huybrechts and Degard, 1933.)

Results for Aqueous Solutions of:

Acetic Acid		Ammonium Acetate	
Normality of Aq. CH_3COOH	Gms. $PbCrO_4$ per liter sat. sol.	Normality of Aq. NH_4CH_3COO	Gms. $PbCrO_4$ per liter sat. sol.
0.025	0.00130	0.05	0.00097
0.05	0.00234	0.10	0.00136
0.10	0.00429	0.20	0.00210
0.20	0.00468	0.50	0.00936
0.50	0.00616		

CrO

The solubility of Lead Chromate is greatly reduced in presence of soluble chromates. In aqueous 0.0001 normal K_2CrO_4 only 0.00006 gms. $PbCrO_4$ per liter was present. Results are given showing the solubility of $PbCrO_4$ in aqueous solutions of mixtures of acetic acid and ammonium acetate and of the reduction of the solubility of $PbCrO_4$ in aqueous acetic acid, ammonium acetate and of their mixtures, caused by the simultaneous presence of calcium chromate. The application of these results to the titrametric determination of lead is discussed.

SOLUBILITY OF LEAD CHROMATE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC AND OF NITRIC ACIDS. (Beck and Stegmüller, 1910, 1911.)

	Solubility in Aq. HCl.			Solubility in Aq. HNO_3 at 18°.	
Normality of HCl.	Milligrams Pb per 100 cc. Sat. Sol. at:			Normality of HNO_3.	Milligrams Pb per 100 cc. Sat. Sol.
	18°.	25°.	37°.		
0.1	3.86	4.96	7.40	0.1	2.67
0.2	8.15	10.06	15.40	0.2	4.70
0.3	13.56	17.38	27.30	0.3	6.46
0.4	22.14	27.78	43.60	0.4	8.31
0.5	32.30	42.60	68	0.5	10.31
0.6	46.60	61.06	97.20	0.6	12.39

Results are also given for the solubility of mixtures of lead chromate and lead sulfate in aqueous hydrochloric acid at 25° and 37°.

SOLUBILITY OF LEAD CHROMATE IN AQUEOUS POTASSIUM HYDROXIDE SOLUTIONS.

(Lacland and Lepierre, 1891.)

t°.	Grams KOH per 100 cc.	Grams $PbCrO_4$ per 100 cc.
15	2.308	1.19
60	2.308	1.62
80	2.308	2.61
102	2.308	3.85

LEAD CHROMATE $PbCrO_4$.

SOLUBILITY OF LEAD CHROMATE IN AQUEOUS SOLUTIONS OF PERCHLORIC ACID AND OF MIXTURES OF PERCHLORIC ACID AND LEAD PERCHLORATE AT 25°. (Willard and Kassner, 1926.)

Solvent mols. per liter $HClO_4$.		Solvent mols. per liter $PbClO_4$.	Dissolved $PbCrO_4$ Gms. per 100 cc.	Dissolved $PbCrO_4$ Millimols. per 100 cc.	Solvent mols. per liter $HClO_4$.		Solvent mols. per liter $PbClO_4$.	Dissolved $PbCrO_4$ Gms. per 100 cc.	Dissolved $PbCrO_4$ Millimols. per 100 cc.
0.1	+	0.0	0.0041	0.0127	5.0	+	0.0	0.0191	0.0591
0.5	+	0.0	0.0120	0.0371	0.5	+	0.005	0.0005	0.0015
1.0	+	0.0	0.0140	0.0433	1.0	+	0.005	0.0013	0.0040
2.0	+	0.0	0.0199	0.0616	2.0	+	0.010	0.0012	0.0037
3.0	+	0.0	0.0211	0.0668	2.0	+	0.015	0.0006	0.0019
4.0	+	0.0	0.0213	0.0659	5.0	+	0.020	0.0001	0.0003

SOLUBILITY OF LEAD CHROMATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AND OF MIXTURES OF NITRIC ACID AND LEAD NITRATE AT 25°.

(Willard and Kassner, 1926.)

CrO

Mols. per liter solvent HNO_3.		Mols. per liter solvent $Pb(NO_3)_2$.	Dissolved $PbCrO_4$ Gms. per 100 cc.	Dissolved $PbCrO_4$ Millimols. per 100 cc.	Mols. per liter solvent HNO_3.		Mols. per liter solvent $Pb(NO_3)_2$.	Dissolved $PbCrO_4$ Gms. per 100 cc.	Dissolved $PbCrO_4$ Millimols. per 100 cc.
0.1	+	0.0	0.0063	0.0195	0.1	+	0.005	0.0001	0.0003
0.5	+	0.0	0.0177	0.0548	0.5	+	0.005	0.0018	0.0055
1.0	+	0.0	0.0385	0.1190	1.0	+	0.010	0.0038	0.0117
2.0	+	0.0	0.0889	0.2752	3.0	+	0.020	0.0381	0.1179
3.0	+	0.0	0.1701	0.5265	2.0	+	0.15	0.0012	0.0037
4.0	+	0.0	0.2810	0.8700	2.0	+	0.25	0.0002	0.0006
5.0	+	0.0	0.4367	1.3510	2.0	+	0.3*	0.0002	0.0006

* $Na_2Cr_2O_7$ instead of $Pb(NO_3)_2$.

The solubility of lead chromate in perchloric acid increases up to a molar concentration of the acid of about 4.0 and then begins to decrease, while in nitric acid the solubility continues to increase with increasing concentration of acid. It is also noted that lead chromate is much less soluble in perchloric than in nitric acid of the same concentration.

Fusion point data for mixtures of lead chromate and lead sulfate, lead chromate and lead molybdate, and lead chromate and lead tungstate are given by Jaeger and Germs, 1921.

LEAD FLUORIDE PbF_2.

F One liter of water dissolves 0.6 gm. PbF_2 at 9°, 0.64 gm. at 18°, and 0.68 gm. at 26.6° (conductivity method). (Kohlrausch, 1908.)

100 cc sat. solution of Lead Fluoride in Water contain 0.066 gm. PbF_2 at 25° and the pH of the solution is 5.3. (Carter, 1928.)

Experiments upon the influence of the size of grain upon the solubility of Lead Fluoride in water are given by Duncan, 1923.)

100 cc. anhydrous hydrazine dissolve 6 gms. PbF_2 at room temp. with decomposition. (Welsh and Broderson, 1915.)

LEAD FLUORIDE

100 gms. liquid Sulfur Dioxide (SO_2) dissolve 0.053 gm. PbF_2 at 0°. (Jander and Ruppolt, 1937.)

Fusion-point data are given for:

PbF	+ PbI_2	(Sandonnini, 1911.)
"	+ PbO	(Sandonnini, 1914.)
"	+ $Pb_3(PO_4)_2$	(Amadori, 1912, 1918, 1919.)
"	+ $Pb_3(VO_4)_2$	(Amadori, 1919.)
"	+ NaF	(Puchin and Baskow, 1913.)

LEAD Antipyrine Boro FLUORIDE $[Pb(COC_{10}H_{12}N_2)_6](BF_4)_2$.

100 cc sat. solution of Lead Antipyrine Boro Fluoride in water contain 15.1 gm $[Pb(COC_{10}H_{12}N_2)_6](BF_4)_2$ at 20°. (Wilke-Dörfurt and Mureck, 1929.)

LEAD TriPotassium Hydrogen Octa FLUORIDE. $3KF.HF.PbF_4$.

LEAD DiSodium Hexa FLUORIDE $2NaF.PbF_4$.

Data for the solubility of these two salts in water and in aqueous solutions of H_2F_2 at 25° are given by Clark, 1919.

LEAD Phospho FLUORIDE $PbPO_3F$.

F

One liter sat. solution of Lead Phospho Fluoride in Water contain 0.0099 gm. $PbPO_3F$ per liter. (Lang, 1929.)

LEAD Silico FLUORIDE $PbSiF_6.4H_2O$.

SOLUBILITY OF LEAD SILICO FLUORIDE IN WATER.
(Jatlov and Pinaevskaja, 1938.)

t°	Gms. $PbSiF_6$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $PbSiF_6$ per 100 gms. sat. sol.	Solid Phase
0	65.48	$PbSiF_6.4H_2O$	60	80.11	$PbSiF_6.2H_2O$
20	68.97	"	65	80.75	"
20(d = 2.4314)	67.90 (1)	"	80	81.06	"
50	74.16	"	100	82.85	"
57	77.70	"			

(1) Worthington and Haring, 1931.)

EQUILIBRIUM IN THE SYSTEM LEAD SILICO FLUORIDE SILICO FLUORIC ACID AND WATER AT 20°.
(Jatlov and Pinaevskaja, 1938.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
H_2SiF_6	$PbSiF_6$		H_2SiF_6	$PbSiF_6$	
0.0	68.97	$PbSiF_6.4H_2O$	13.93	43.10	$PbSiF_6.4H_2O$
0.98	67.96	"	25.82	23.95	"
7.34	56.50	"	39.65	10.38	"

SOLUBILITY OF TRIMETHYL, TRIETHYL, ETC. LEAD FLUORIDES IN SEVERAL SOLVENTS.

(Krause and Pohland, 1922.)

Compound.	Formula.	t°.	Gms. cmpd. per 100 gms. of H_2O.	CH_3OH.	C_2H_5OH.	C_6H_6.
Tri methyl lead fluoride...	$(CH_3)_3PbF$	30	5.51	8.24	6.89	0.028
» » ...	»	50	26.3	99.5	82.0	0.87
Tri ethyl » ...	$(C_2H_5)_3PbF$	30	1.3	7.24	6.11	0.185
» » ...	»	50	7.04	90.0	75.1	0.60
Tri *n* propyl » ...	$(nC_3H_7)_3PbF$	30.1	0.17	2.01	1.21	0.055
» » ...	»	50	0.23	4.94	3.53	0.082
Tri *iso* butyl » ...	$(iC_4H_9)_3PbF$	30	0.12	1.76	1.09	0.042
» » ...	»	50	0.18	2.96	2.13	0.071
Tri *iso* amyl » ...	$(iC_5H_{11})_3PbF$	30.1	0.019	2.34	1.73	0.063
» » ...	»	50	0.022	6.32	4.55	0.004
Tri phenyl » ...	$(C_6H_5)_3PbF$	30	0.031	0.36	0.15	0.080
» » ...	»	50	0.10	1.45	0.24	0.092
Tri cyclo hexyl » ...	$(C_6H_{11})_3PbF$	30	0.096	0.66	0.39	0.11

LEAD Sub IODIDE Pb I.

1000 cc. sat. solution of lead sub iodide in water contain 0.35 milliequivalents Pb I at 25° as determined by the conductivity method. (Denham, 1918.

LEAD IODIDE PbI_2.

SOLUBILITY IN WATER.

(Lichty, 1903.)

t°.	Density. (H_2O at o°.)	Grams PbI_2 per 100. cc. Solution.	Grams H_2O.	Millimols PbI_2 per 100. cc. Solution.	Grams H_2O
0	1.0006	0.0442	0.0442	0.096	0.096
15	0.9998	0.0613	0.0613	0.133	0.133
25	0.9980	0.0762	0.0764	0.165	0.166
35	0.9951	0.1035	0.1042	0.224	0.226
45	0.9915	0.1440	0.1453	0.312	0.315
55	0.9872	0.1726	0.1755	0.374	0.381
65	0.9827	0.2140	0.2183	0.464	0.473
80	0.9745	0.2937	0.3023	0.637	0.656
95	0 9671	0.3814	0.3960	0.828	0.859
100	...	0.420	0.436	0.895	0.927

I

Data for the solubility of lead iodide in water by the conductivity method are given by Böttger, 1903; Kohlrausch, 1904-05; Denham, 1917.

Later determinations of the Solubility of Lead Iodide in Water are as follows.

t°	Gms. PbI_2 per 100 gms. sat. sol.	Authority
13	0.05	Demassieux, 1923
20	0.06	" "
25	0.076	Burrage, 1926
30	0.09	Sowerby, 1927
50	0.17	Demassieux, 1923

SOLUBILITY OF LEAD IODIDE IN WATER AT TEMPERATURES ABOVE 100°.

(Benrath, Gjedebo, Schiffers and Wunderlich, 1937.)

t°	Gms. PbI_2 per 100 gms. sat. sol.	Solid Phase	t°	Gms. PbI_2 per 100 gms. sat. sol.	Solid Phase
175	1.42	PbI_2	291	8.43	PbI_2
234	3.65	"	334	12.0 - 82	" + solution + melt
280	6.37	"	338	87.5	"
281	6.44	"	360	95.3	"

SOLUBILITY OF LEAD IODIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AT 25°

(Burrage, 1926.)

Gms. per 100 gms. sat. sol. NaCl.	Gms. per 100 gms. sat. sol. PbI_2.	Solid Phase.	Gms. per 100 gms. sat. sol. NaCl.	Gms. per 100 gms. sat. sol. PbI_2.	Solid Phase.
0.00	0.0758	PbI_2	0.234	0.110	PbI_2
0.029	0.0778	»	0.586	0.141	»
0.059	0.0859	»	1.170	0.164	»
0.116	0.0951	»	2.980	0.179	»

SOLUBILITY OF MIXTURES OF LEAD IODIDE AND POTASSIUM IODIDE IN WATER.

(Ditte, 1881; Schreinemakers, 1891.)

t°.	Gms. per 1000 Gms. H_2O. PbI_2.	Gms. per 1000 Gms. H_2O. KI.	Solid Phase.	t°.	Gms. per 1000 Gms. H_2O. PbI_2.	Gms. per 1000 Gms. H_2O. KI.	Solid Phase.
5	. . .	163	Double Salt + PbI_2	50	526.7	1906	Double Salt + KI
20	9	260	"	64	789.3	2161	"
28	25	325	"	83.5	1,108.6	2434	"
39	45	449	"	92	1,273	2566	"
67	255	751	"	137	2,382	3278	"
80	731	1186	"	165	4,187	4227	"
80	569.9	976.4	"	218	10,303	. . .	"
104.5	1411	1521	"	241	12,803	7998	"
120	2151	1812	"	242	12,749	. . .	"
137	2874	2097	"	250	15,264	. . .	"
175	5603	2947	"	157	5,218	gms. $PbI_2.2KI$	$PbI_2.2KI.2\frac{1}{2}H_2O$
189	. . .	3339	"	172	6,489	" "	"
9	96.6	1352	" + KI	186	7,903	" "	"
13	114.3	1384	" "	194	9,266	" "	"
23	186.3	1510	" "	201	11,320	" "	"

Ordinary solubility method used for temperatures below boiling-point of the solution and sealed tube (with constriction in middle) method used for temperatures above boiling point.

One liter sat. aqueous solution of iodine dissolves 0.00216 gm. mols. PbI_2 (0.996 gms.) at 20°. (Fedotieff, 1911–12.)

SOLUBILITY OF LEAD IODIDE IN AQUEOUS SOLUTIONS OF AMMONIUM IODIDE.

(Demassieux, 1923.)

Results at 20°. Gms. per 100 gms. sat. sol. NH_4I.	Results at 20°. Gms. per 100 gms. sat. sol. PbI_2.	Results at 20°. Solid Phase.	Results at 50°. Gms. per 100 gms. sat. sol. NH_4I.	Results at 50°. Gms. per 100 gms. sat. sol. PbI_2.	Results at 50°. Solid Phase.
3.54	0.029	PbI_2	6.13	0.14	PbI_2
6.06	0.03	»	9.91	0.15	»
7.02	0.10	» + $PbI_2.NH_4I.2H_2O$	13.47	0.29	» + $PbI_2.NH_4I.2H_2O$
14.50	0.20	$PbI_2.NH_4I.2H_2O$	18.07	0.34	$PbI_2.NH_4I.2H_2O$
33.34	0.30	»	24.08	0.50	»
45.80	0.92	»	45.87	3.49	»
51.66	1.63	»	54.79	8.51	»
56.71	2.96	»	61.35	16.06	» + NH_4I
61.10	4.90	» + NH_4I	61.95	9.88	NH_4I
61.50	2.10	NH_4I	63.98	6.24	»
61.72	0.0	»	66.46	0.0	»

SOLUBILITY OF LEAD IODIDE IN ACETONE, ANILINE AND AMYL ALCOHOL.

(von Laszczynski, 1894.)

Solvent.	t°.	Gms. PbI_2 per 100 Gms. Solvent.
$(CH_3)_2CO$	59	0.02
$C_6H_5NH_2$	13	0.50
$C_6H_5NH_2$	184	1.10
$C_5H_{11}OH$	133.5	0.02

SOLUBILITY OF LEAD IODIDE IN PYRIDINE.

(Heise, 1912.)

I

t°.	Gms. PbI_2 per 100 Gms. Pyridine.	Solid Phase.	t°.	Gms. PbI_2 per 100 Gms. Pyridine.	Solid Phase.
−43.5 f.-pt.	...	$PbI_2.3C_5H_5N$	35	0.188	$PbI_2.2C_5H_5N$
−37	0.166	"	57	0.190	"
−20	0.175	"	77	0.228	"
− 9	0.186	"	92	0.290	"
0	0.200	"	98	0.340	"
+ 3	0.215	"	105	0.370	"
6 tr. pt.	0.225	$PbI_2.3C_5H_5N+PbI_2.2C_5H_5N$	108	0.410	"
15	0.208	$PbI_2.2C_5H_5N$	112	0.445	"

100 gms. 95% formic acid dissolve 0.25 gm. PbI_2 at 19.8°. (Aschan, 1913.)

100 cc. anhydrous hydrazine dissolve 2 gms. PbI_2 at room temp. with decomposition. (Welsh and Broderson, 1915.)

100 gms. liquid Sulfur Dioxide (SO_2) dissolve 0.009 gm. PbI_2 at 0°. (Jander and Ruppolt, 1937.)

Fusion-point data are given for:

PbI_2 + AgI (Matthes, 1911; Tubandt and Eggert, 1920.)
" + PbO (Barosi, 1934; Van Klooster and Owens, 1935.)

LEAD IODATE $Pb(IO_3)_2$.

One liter of water dissolves 0.0134 gm. $Pb(IO_3)_2$ at 9.2°, 0.019 gm. at 18° and 0.023 gm. at 25.8°. (Kohlrausch, 1908; Böttger, 1903.)

One liter H_2O dissolves 0.0307 gm. $Pb(IO_3)_2$ at 25°. (Harkins and Winninghoff, 1911.)

SOLUBILITY OF LEAD IODATE IN AQUEOUS SALT SOLUTIONS AT 25°.

(H. and W., 1911.)

10

Gms. per Liter.		Gms. per Liter.		Gms. per Liter.	
KNO_3.	$Pb(IO_3)_2$.	KIO_3.	$Pb(IO_3)_2$.	$Pb(NO_3)_2$.	$Pb(IO_3)_2$.
0.202	0.0318	0.0113	0.0199	1.656	0.0052
1.011	0.0363	0.0227	0.0122	16.561	0.0045
5.055	0.0567	$Pb(NO_3)_2$.		82.805	0.0078
20.220	0.0708	0.0165	0.0242	496.83	0.0418
		0.165	0.0115		

SOLUBILITY OF LEAD IODATE IN AQUEOUS SALT SOLUTIONS AT 25°.

(LaMer and Goldman, 1930.)

Aqueous Solvent			Gm. Mols. $Pb(IO_3)_2$ per liter
Water alone			0.0000361
0.1	normal	$NaNO_3$	0.0000699
0.1	"	KNO_3	0.0000694
0.1	"	KCl	0.0000829
0.1	"	NaCl	0.0000830

LEAD MOLYBDATE $PbMoO_4$.

Solubility of Lead Molybdate in Aqueous Solutions of Perchloric Acid and of Mixtures of Perchloric Acid and Salts at 25°.

(Willard and Kassner, 1930a)

Composition of solvent in mols. per liter.	Dissolved $PbMoO_4$. Gms. per 100 cc.	Dissolved $PbMoO_4$. Millimols. per 100 cc.
0.01 mol. $HClO_4$	0.0016	0.0043
0.5 » »	0.0136	0.0370
1.0 » »	0.0373	0.1016
2.0 » »	0.1176	0.3204
3.0 » »	0.2436	0.6639
0.01 » » + 0.01 mol. $Pb(ClO_4)_2$	0.0002	0.0005
0.5 » » + 0.01 » »	0.0005	0.0013
0.5 » » + 0.05 » »	0.0004	0.0011
0.5 » » + 0.10 » »	0.00006 (1)	0.0001 (1)
0.5 » » + 0.20 » »	0.00004 (1)	0.0001 (1)
0.5 » » + 0.02 » Na_2MoO_4	0.0004 (2)	0.0011 (2)
0.5 » » + 0.05 » »	0.00027 (2)	0.0007 (2)

Above 3.0 mol. $HClO_4$, $PbMoO_4$ decomposes to form solid MoO_3.

Solubility of Lead Molybdate in Aqueous Solutions of Nitric Acid and of Mixtures of Nitric Acid and Salts at 25°.

(Willard and Kassner, 1930a)

Composition of solvent in mols. per liter.	Dissolved $PbMoO_4$. Gms. per 100 cc.	Dissolved $PbMoO_4$. Millimols. per 100 cc.
0.1 mol. HNO_3	0.0020	0.0060
0.5 » »	0.0244	0.0665
1.0 » »	0.1086	0.2958
0.5 » » + 0.1 mol. $Pb(NO_3)_2$	0.00032 (1)	0.0009 (1)
0.5 » » + 0.2 » »	0.0002 (1)	0.0005 (1)
0.5 » » + 0.02 » Na_2MoO_4	0.00064 (2)	0.0017 (2)
0.5 » » + 0.05 » »	0.0007 (2)	0.0019 (2)

Above 1.0 mol. HNO_3, $PbMoO_4$ decomposes to form solid MoO_3.

(1) Molybdenum determined colorimetrically. (2) Lead determined colorimotrically.

Fusion-point data for mixtures of $PbMoO_4 + PbSO_4$ are given by Germs, 1907, and Jaeger and Germs, 1921.

LEAD NITRATE $Pb(NO_3)_2$.

Solubility in Water.

(Mulder; Kremers, 1854; at 15°, Michel and Kraft, 1854; at 17°, Euler, 1904.)

t°.	Grams $Pb(NO_3)_2$ per 100 Gms. Water.		Grams $Pb(NO_3)_2$ per 100 Gms. Solution.
0	36.5 (1)	38.8 (2)	27.33 (3)
10	44.4	48.3	31.6
17	50	54	34.2
20	52.3	56.5	35.2
25	56.4	60.6	36.9
30	60.7	66	38.8
40	69.4	75	41.9
50	78.7	85	45
60	88	95	47.8
80	107.6	115	52.7
100	127	138.8	57.1
17	52.76*		34.54*

* Euler.

(1) Mulder, (2) Kremers, (3) Average of M and K.

Density of saturated solution at 17° = 1.405. (Euler.)

100 gms. H_2O dissolve 55.8 gms. $Pb(NO_3)_2$ at 20°. (LeBlanc and Noyes, 1890.)

100 gms. H_2O sat. with $Pb(NO_3)_2 + KNO_3$ at 20° dissolve 95.39 gms. $Pb(NO_3)_2$. $+$61.05 gms. KNO_3. (LeBlanc and Noyes, 1890.)

100 gms. H_2O sat. with $Pb(NO_3)_2 + NaNO_3$ at 20° dissolve 38.42 gms. $Pb(NO_3)_2$ $+$84.59 gms. $NaNO_3$. (Le Blanc and Noyes, 1890.)

SOLUBILITY OF LEAD NITRATE IN AQUEOUS SOLUTIONS OF COPPER NITRATE AT 20°.

(Fedotieff, 1911–12.)

Gms. per 100 Gms. H_2O.		d_{20} of Sat. Sol.	Gms. per 100 Gms. H_2O.		d_{20} of Sat. Sol.
$Cu(NO_3)_2$.	$Pb(NO_3)_2$.		$Cu(NO_3)_2$.	$Pb(NO_3)_2$.	
0	55.11	1.419	37.96	13.08	1.360
7.7	39.34	1.354	60.32	8.19	1.451
15.04	27.80	1.322	83.11	5.37	1.546
24.63	19.05	1.321	100.29	3.53	1.622
33.25	14.70	1.343	127.70*	2.33*	1.700

* Solid phase in contact with this solution = $Pb(NO_3)_2 + Cu(NO_3)_2.6H_2O$.

SOLUBILITIES OF THE NITRATES OF LEAD ISOTOPES IN WATER AT 25°.02.

(Richards and Schumb, 1918.)

The two samples of nitrate were prepared, one from salt made from « test lead » free from silver and tin, and the other from pure Australian uranio-lead nitrate. Saturation was approached from above and below the selected temperature, by constant rotation of a large excess of the solid with distilled water. Saturation was reached with extreme slowness. At least 24 hours were required. Weighed portions of the saturated solution were evaporated with H_2SO_4 and the lead sulfate weighed after heating to constant weight at 350°.

NO

Sample of Lead Nitrate from:	Gms. $Pb(NO_3)_2$ per 100 gms	
	Sat. sol	Water.
Common Lead...............	37.342	59.597
Uranio Lead.................	37.280	59.439
Difference......	0.062	0.158

An experiment similar to the above is reported by Fajans, Fischler and Lembert, 1916. These authors prepared very pure nitrate from ordinary commercial lead of at. wt. 207.15 and from lead prepared from Colorado carnotite, and having an at. wt. of 206.59. Saturation was approached from above and below by constant agitation for at least two days at 24°.43. Very accurate specific gravity determinations of the saturated solutions were also made. The determination of the lead was made as sulfate.

Sample of Lead Nitrate from:	$d_{\frac{24.43}{4}}$ of sat sol.	$PbSO_4$ found in 3.0443 cc. of sat. sol.		Mol. Solubility.
Ordinary Lead..........	1.444499 ± 0.000013	1.4693	=	0.004855
Carnotite...............	1.443587 ± 0.000016	1.4740	=	0.004861
Joachimsthaler Pechblend.	1.443586 ± 0.0000015			
		Difference.....		0.000006

The authors conclude from the density experiment that a difference exists in the sp. gr. of the saturated solutions of the nitrates of lead isotopes which is slightly greater than that calculated. The difference in the molecular solubility is less than 1 %, while the difference in atomic weight is 2.7 %.

EQUILIBRIUM IN THE SYSTEM LEAD NITRATE, SODIUM NITRATE AND WATER

(Glasstone and Saunders, 1923))

Results at 0°. Gms. per 100 gms. sat. sol. $NaNO_3$.	Results at 0°. Gms. per 100 gms. sat. sol. $Pb(NO_3)_2$.	Results at 25°. Gms. per 100 gms. sat. sol $NaNO_3$.	Results at 25°. Gms. per 100 gms. sat. sol $Pb(NO_3)_2$.	Results at 50°. Gms. per 100 gms. sat. sol. $NaNO_3$.	Results at 50°. Gms. per 100 gms. sat. sol. $Pb(NO_3)_2$.	Solid Phase at each temp.
0.0	28.70	6.02	30.89	0.0	44.79	$Pb(NO_3)_2$
2.91	25.80	10.04	27.86	4.32	40.27	"
		20.94	22.33	8.75	35.77	"
		30.08	18.99	17.55	29.22	"
		36.43	16.86	29.87	22.88	"
		40.32	15.47	43.84	17.25	" + $NaNO_3$
		41.32	13.17	47.09	11.35	$NaNO_3$
		45.71	4.30	49.80	6.35	"
		47.86	0.00	53.29	0.00	"

Results at 100°.

$NaNO_3$.	$Pb(NO_3)_2$.
0.00	55.65
4.24	50.78

100 gms. pyridine dissolve 4.39 gms. Pb $(NO_3)_2$ at 0° and 5.46 gms. at 25°.

(Muller, R., 1924.)

SOLUBILITY OF LEAD NITRATE IN CONCENTRATED AQUEOUS SOLUTIONS OF SODIUM NITRATE AND VICE VERSA, DETERMINED BY SYNTHETIC METHOD.

(Isaac, 1908.)

(The several mixtures were enclosed in sealed tubes and heated until only one or two very small crystals remained undissolved. The temperature was then determined at which the edges of these crystals just showed a change from sharp to round or vice versa.)

Results for Lead Nitrate as Solid Phase. t° of Saturation.	Gms. per 100 Gms. Sat Sol. $NaNO_3$.	Gms. per 100 Gms. Sat Sol. $Pb(NO_3)_2$.	Results for Sodium Nitrate as Solid Phase. t° of Saturation.	Gms. per 100 Gms Sat. Sol. $NaNO_3$.	Gms. per 100 Gms Sat. Sol. $Pb(NO_3)_2$.
32	34.42	19.69	21	40.97	13.62
35.5	34.15	20.33	26.5	42.04	13.38
39.5	33.71	21.35	31	43.18	12.88
44	33.35	22.19	38.8	44.63	12.78
49.1	32.94	23.15	41	45.11	12.94
55	32.60	23.93	44.25	46.03	12.45
58	32.47	24.24	51	47.28	12.50
62	32.33	24.57	58	49.03	11.76
65	32.19	24.89	64	49.92	11.56

NO

SOLUBILITY OF MIXED CRYSTALS OF LEAD NITRATE AND STRONTIUM NITRATE IN WATER AT 25°.

(Fock, 1897.)

Mol. per cent in Solution. $Pb(NO_3)_2$.	Mol. per cent in Solution. $Sr(NO_3)_2$.	Gms. per 100 cc. Solution. $Pb(NO_3)_2$.	Gms. per 100 cc. Solution. $Sr(NO_3)_2$.	Sp. Gr. of Solutions.	Mol. per cent in Solid Phase. $Pb(NO_3)_2$.	Mol. per cent in Solid Phase. $Sr(NO_3)_2$.
100	0	46.31	0	1.4472	100	0
87.41	12.39	50.47	4.56	1.4336	99.05	0.95
78.68	21.32	53.92	8.14	1.4288	98.11	1.89
56.39	43.61	45.34	17.81	1.4263	97.02	2.98
60.29	39.71	44.48	18.74	1.4245	96.06	3.94
33.70	36.30	25.23	35.03	1.4468	83.84	16.16
24.58	75.42	19.13	37.54	1.4867	32.88	67.12
0	100	0	71.04	1.5141	0	100

SOLUBILITY OF LEAD NITRATE-NITRITE, $Pb(NO_3)_2.Pb(NO_2)_2.2Pb(OH)_2.2H_2O$, IN AQUEOUS SOLUTIONS OF ACETIC ACID AT 13.3°.

(Chilesotti, 1908.)

Normality of Acetic Acid	Gms. PbO per 100 cc. Sat. Sol.	Normality of Acetic Acid.	Gms. PbO per 100 cc. Sat. Sol.
0	0.601	0.25	5.450
0.05	1.323	0.50	9.690
0.10	2.185	0.75	15.874

SOLUBILITY OF LEAD NITRATE IN AQUEOUS SOLUTIONS OF METHYL ALCOHOL AT 25°.

(Akerlof and Turck, 1935.)

Wt. Percent CH_3OH in solvent	Gm. Mols. $Pb(NO_3)_2$ per 1000 gms. sat. sol.	Wt. Percent CH_3OH in solvent	Gm. Mols. $Pb(NO_3)_2$ per 1000 gms. sat. sol.
0.0	1.799	60.0	0.2800
20.08	0.8768	70.0	0.1905
30.0	0.6730	80.1	0.1237
40.0	0.5151	90.02	0.0752
50.05	0.3820	100.00	0.0423

SOLUBILITY OF LEAD NITRATE IN ETHYL AND METHYL ALCOHOL.

Solvent.	Gms. $Pb(NO_3)_2$ per 100 Gms. Solvent at: 4°.	8°.	22°.	40°.	50°.	
Aq. C_2H_5OH (Sp. Gr. 0.9282)	4.96	5.82	8.77	12.8	14.9	(G)
Abs. C_2H_5OH	...	...	0.04 (20.5°)	...	...	(de B)
Abs. CH_3OH	...	...	1.37 “	...	...	“

(Gerardin, 1865; de Bruyn, 1892.)

100 cc. anhydrous hydrazine dissolve 52 gms. lead nitrate at room temperature with formation of a yellow precipitate. (Welsh and Broderson, 1915.)

SOLUBILITY OF LEAD NITRATE IN PYRIDINE.

(Walton and Judd, 1911.)

NO

t°.	Gms. $Pb(NO_3)_2$ per 100 Gms. Pyridine.	Solid Phase.	t°.	Gms. $Pb(NO_3)_2$ per 100 Gms. Pyridine.	Solid Phase.
−19.4	2.93	$Pb(NO_3)_2.4C_5H_5N$	45	22.03	$Pb(NO_3)_2.4C_5H_5N$
−14.5	2.14	“	49.97	29.37	“
−10	1.90	“	51 tr. pt.	...	“ $+Pb(NO_3)_2.3C_5H_5N$
0	3.54	“	59.52	36.70	$Pb(NO_3)_2.3C_5H_5N$
5.4	3.93	“	70	47.29	“
8.7	5.39	“	80	61.60	“
14.72	6.13	“	89.93	90.21	“
19.97	6.78	“	94.94	128.06	“
24.75	8.56	“	96 tr. pt.	...	“ $+3Pb(NO_3)_2.2C_5H_5N$
30.03	10.98	“	99.89	143.36	$3Pb(NO_3)_2.2C_5H_5N$
34.97	13.20	“	104.90	152	“
40.03	16.94	“	109.90	163.80	“

Fusion-point data are given for mixtures of $Pb(NO_3)_2$ + $TlNO_3$ by Glass, Laybourne and Madgin, 1932.)

EQUILIBRIUM IN THE SYSTEM LEAD OXIDE, NITROGEN PENTOXIDE AND WATER.

(Denham and Kidson, 1931.)

d. of sat. sol.	Gms. per 100 gms. sat. solution N_2O_5	PbO	Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. solution N_2O_5	PbO	Solid Phase
Results at 25°				Results at 50°			
1.022	0.71	2.09	2.1.2½	1.022	0.60	2.69	2.1.2½
1.134	4.67	9.77	"	1.117	4.39	8.99	"
1.223	7.68	15.03	"	1.229	7.24	15.81	"
1.287	8.80	18.39	"	1.322	9.55	20.47	"
1.452	12.27	26.38	" $+Pb(NO_3)_2$	1.436	11.60	25.45	"
1.408	11.54	23.61	$Pb(NO_3)_2$	1.590	14.47	31.00	" $+Pb(NO_3)_2$
1.328	11.83	18.88	"	1.511	14.22	26.05	$Pb(NO_3)_2$
1.257	12.06	14.09	"	1.420	14.33	23.42	"
1.194	14.30	8.16	"	1.957	14.22	19.77	"
1.192	14.60	7.40	"	1.279	15.08	15.64	"
1.236	30.59	1.59	"	1.234	17.92	10.08	"
1.243	30.70	1.98	"	1.211	23.75	4.27	"
1.290	40.05	0.49	"	1.244	32.32	1.74	"
				1.308	45.33	0.04	"

2.1.2½ = $2PbO.N_2O_5.2\frac{1}{2}H_2O$.

LEAD HYDROXIDE $Pb(OH)_2$.

SOLUBILITY OF LEAD HYDROXIDE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE.

(Moist Lead Hydroxide used, temperature not given.)

(Rubenbauer, 1902.)

Amount of Na in 20 cc.	Amt. of Pb in 20 cc.	Mol. Dilution of NaOH.	Grams per 100 cc. Solution. NaOH.	$Pb(OH)_2$.
0.2024	0.1012	2.27	1.759	0.590
0.3196	0.1736	1.44	2.778	1.010
0.5866	0.3532	0.785	5.10	2.056
0.9476	0.4071	0.485	8.235	2.370
1.7802	0.5170	0.258	15.470	3.010

LEAD OXIDES.

SOLUBILITY IN WATER.

(Böttger; Ruer — Z. anorg. Chem. 50, 273, '06.)

No.	Description of Oxide.	Gm. Equiv. per Liter.	Gms. per Liter.
1.	Yellow Oxide, by boiling Pb hydroxide with 10% NaOH	1.03×10^{-4}	0.023
2.	Red Oxide, by boiling Pb hydroxide with conc. NaOH	0.56×10^{-4}	0.012
3.	Yellow Oxide, by heating No. 1 to 630°	1.05×10^{-4}	0.023
4.	Yellow Oxide, by heating No. 2 to 740°	1.00×10^{-4}	0.022
5.	Yellow Oxide, by heating com. yellow brown oxide to 620°	1.09×10^{-4}	0.024
6.	Yellow Brown Oxide commercially pure	1.10×10^{-4}	0.024
7.	Yellow Brown Oxide, by long rubbing of No. 5.	1.12×10^{-4}	0.025

Böttger gives for three samples of lead oxide, 0.017, 0.021, and 0.013 gm. per liter respectively.

One liter H_2O dissolves 0.068 gm. PbO at 18°, solid phase PbO and 0.1005 gm. PbO at 18°, solid phase $Pb_3O_2(OH)_2$. (Pleissner, 1907.)

Results for the solubility of hydrated lead oxide in water and dilute H_2SO_4 solutions are given by Sehnal (1909). The results are considerably higher than the above, viz. 0.1385 gm. Pb per 1000 cc. H_2O at 20°; with increase of H_2SO_4 the solubility decreases rapidly.

100 cc. anhydrous hydrazine dissolve 1 gm. lead oxide (red) at room temp. (Welsh and Broderson, 1915.)

SOLUBILITY OF LEAD OXIDE (Pb O) IN WATER.

(Remy and Kuhlmann, 1924; Remy, 1925.)

Millimols. PbO per liter at 18°.	Milligrams. PbO per liter at 20°.	Method.
0.055	12.34	Calc. from electrolytic conductivity.
0.055	12.39	Conducto titrametric determination of used amt. of acid for saturation.

The SOLUBILITY PRODUCT of red lead monoxide in water at 25° is 1.17×10^{-15} and the solubility is 0.26×10^{-3} gm. mol. per liter (Glasstone, 1921). The author states that this rough comparison emphazises the uncertainty of the ionization of lead monoxide in water and the futility of determining the solubility of lead monoxide or hydroxide in water by the conductivity method.

SOLUBILITY OF DIFFERENT FORMS OF LEAD HYDROXIDE IN AQUEOUS NORMAL SOLUTIONS OF SODIUM HYDROXIDE.

Form of PbO used.	Manner of attaining saturation.	t°.	Gm. mol. PbO per liter sat. sol.	Authority.
Ordinary	Gentle shaking (14 days).	20	0.045 (aver of 8 det.)	Glasstone, 1921
»	Vigorous shaking (14 d.)..	20	0.047 (» »)	»
Redish-brown-yellow	Stirring gently with air bubbles.	20	0.039	»
Red	» » .	20	0.035	»
Yellow	» » .	20	0.0237*	Appleby and Reid, 1922
Red	» » .	20	0.0140*	

*Mean values obtained after stirring with slow stream of air up to 5 months. According to Glasstone the differences are explainable on the grounds of the varying size of the particles. Appleby and Reid consider that the results indicate that the yellow and red forms are polymorphic modifications of lead monoxide.

SOLUBILITY OF HYDRATED LEAD MONOXIDE AT 25° IN AQUEOUS SOLUTIONS OF:

(Glasstone, 1922.)

Sodium Hydroxide

Normality of Aq. NaOH.	Gm. mols. per liter sat. sol. $PbO.xH_2O$.	Na plumbite.	Residual NaOH.
0.0499	0.00392	0.00347	0.0464
0.1177	0.00881	0.00836	0.1093
0.2496	0.0178	0.01735	0.2323
0.4993	0.0345	0.03405	0.4653
0.7489	0.0484	0.04795	0.7010
0.9985	0.0620	0.06155	0.9370

Potassium Hydroxide.

Normality of Aq. KOH.	Gm. mols. $Pb.O.xH_2O$ per liter sat. sol.
0.1177	0.00892
0 9985	0.0631

The above repetition of Herz, 1901, experiments fail to confirm his results. Pleissner's (1907) hydrated oxide was used.

Results similar to the above for the solubility of the several polymorphic forms of lead oxide in aqueous NaOH solutions up to 20 normal and at both 20° and 84° are given by Applebey and Powell, 1931. The black modification was shown to owe its color to metallic lead.

More recent very careful determinations of the solubility of lead oxides in water and in aqueous solutions of sodium hydroxide at 25°, are given by Garrett, Vellenger and Fontana, 1939. The numerous determinations as plotted by the authors show that most of those made with red lead oxide fall in one curve and the determinations made with yellow, white, and black lead oxide fall more or less close to another curve. The approximate values read from these curves are as follows.

NaOH	Gm. Mols. per 1000 gms. H_2O Red PbO	yellow, white and black PbO	NaOH	Gm. Mols. per 1000 gms. H_2O Red PbO	yellow, white and black PbO
0.000	0.000226	0.000477	0.004	0.00022	0.0004
0.0005	0.0001	0.0003	0.005	0.00027	0.0005
0.0010	0.0001	0.00022	0.006	0.00032	0.00057
0.002	0.00013	0.00026	0.008	0.0004	0.0007
0.003	0.00017	0.00036	0.010	0.0005	0.00085

The data were used by the authors for various theoretical calculations.

SOLUBILITY OF LEAD SESQUIOXIDE (Pb_2O_3) IN AQUEOUS SODIUM HYDROXIDE SOLUTIONS. (Glasstone, 1922*a*.)

Solution of plumbite, plumbate and dilute alkali or water were mixed in various proportions and kept 4 or 5 weeks at room temperature. The supernatant solution above the precipitated sesquioxide was removed and analyzed. Equilibrium was reached very slowly.

NaOH.	Gram mols. per liter sat. sol. Plumbite × 10^3.	Plumbate × 10^3.	$\frac{[HPbO_2'][PbO_3'']}{[OH']^3} \times 10^4$.
1.20	8.75	0.412	2.09
1.26	12.12	0.35	2.08
1.79	1.60	11.50	3.20
2.41	20.0	1.20	1.72
2.63	21.5	2.65	3.12

Data for the equilibrium in the system lead oxide + lead hydroxide + plumbite + Na OH + H_2O are given by Erich Muller, 1924 *a*.

Fusion-point data are given for:

$PbO + MoO_3$ (Jaeger and Germs, 1921.)
" $+ SO_3$ " "
" $+ WO_3$ " "
" $+ P_2O_5$ (Amadori, 1916-17.)
" $+ V_2O_5$ " "
" $+ Pb_3(PO_4)_2$ (Amadori, 1914.)
" $+ Pb_3(VO_4)_2$ " "
" $+ PbSO_4$ (Schenck and Albers, 1919; Shenck and Rossbach, 1908.)
" $+ SiO_2$ (Weiller, 1911; Cooper, Shaw and Loomis, 1909; Geller, Creamer and Bunting, 1934.)

LEAD Per**OXIDE** PbO_2.

The two forms of lead superoxide, (*a*) amorphous and (*b*) crystalline, differ in their solubilities in sulphuric acid. One liter of very concentrated H_2SO dissolves about 0.010 mol. PbO_2 (*b*) at 22°. One liter of conc. H_2SO_4 containing 1720 gms. per liter, dissolves 0.0995 mol. PbO_2 (*a*) at 22°. The solid phase is slowly converted to $Pb(SO_4)_2$. One liter of H_2SO_4 containing 1097 gms. H_2SO_4 per liter dissolves 0.004 mol. PbO_2 at 22°. The solid phase is converted more quickly to $Pb(SO_4)_2$. In more dilute H_2SO_4 solutions no solubility can be detected. (Dolezalek and Finckli, 1906.)

LEAD PHOSPHATE (Ortho) $Pb_3(PO_4)_2$.

One liter water dissolves 0.000135 gm. lead phosphate at 20° by conductivity method. (Böttger, 1903.) PO

One liter of 4.97 per cent aqueous acetic acid solution dissolves 1.27 gms. $Pb_3(PO_4)_2$. (Bertrand, 1888.)

More recent studies of the Solubility of Lead Phosphates in Water, using electrometric methods, are described by Hillett and Jowett, 1929, and Jowett and Price, 1932. Their earlier results were found to be in error. Their final determinations for primary lead phosphate, $Pb_3(PO_4)_2$ secondary lead phosphate, $PbHPO_4$, and lead pyromorphite, $Pb_5(PO_4)_3Cl$, the stable salt in presence of chloride ion, have been used for calculating the solubility products of each compound.

LEAD PHOSPHATES, Primary, $PbH_4(PO_4)_2$; Secondary, $PbHPO_4$.

EQUILIBRIUM IN THE SYSTEM LEAD OXIDE, PHOSPHORIC ANHYDRIDE AND WATER AT 25°. (Fairhall, 1924.)

The mixtures were rotated in a thermostat for several weeks, and the solutions analyzed from time to time uptill equilibrium was reached. The composition of the solid phases was determined by the Schreinemaker residue method,

d_{4}^{25} of sat. sol.	Gms. per 100 cc sat. sol.		Solid Phase.	d_{4}^{25} of sat. sol.	Gms. per 100 cc. sat. sol.		Solid Phase.
	P_2O_5.	PbO.			P_2O_5.	PbO.	
1.036	5.273	0.138	$PbHPO_4$	1.302	45.335	1.175	$PbHPO_4$
1.074	10.675	0.245	»	1.375	54.944	1.495	»
1.113	16.060	0.366	»	1.448	66.231	2.142	»
1.151	21.684	0.587	»	1.516	76.906	1.971	$PbH_4(PO_4)_2$
1.190	27.263	0.821	»	1.549	82.190	1.547	»
1.227	32 809	0 954	»	1.576	86.406	1.190	»
1.264	39.184	1.001	»	1.635	95.696	0.774	»

LEAD SULFIDE PbS.

SOLUBILITY OF LEAD SULFIDE IN WATER.

t°	Gm. Mols. PbS per liter	Authority
18	3.6×10^{-6}	(Weigel, 1907.)
25	0.94×10^{-6}	(Nims and Bonner, 1929.)
25	4.3×10^{-4} (1)	(Karaoglanov and Sagortschev, 1929.)
25	5.7×10^{-4} (2)	" " " "
25	3.62×10^{-11}(3)	(Ravitz, 1936.)
25	6.8×10^{-4} (4)	(Micwitz, 1928.)

S

(1) Solid Phase amorphous PbS; (2) Solid Phase Cryst. PbO; (3) Value recommended on the basis of a study of the published determinations of others (4) Gms. PbS per 1000 gms. sat. solution.

Fusion-point data are given for:

$PbS + Ag_2S$ (Friedrich, 1908.)
" $+ ZnS$ " "
" $+ Sb_2S_3$ (Wagemann, 1912.)
" $+ Tl_2S$ (Canneri and Fernandes, 1925.)
" $+ SiS_2$ (Cambi, 1912.)

LEAD SULFITE $PbSO_3.H_2O$.

EQUILIBRIUM IN THE SYSTEM LEAD OXIDE, SULFUR DIOXIDE AND WATER.

(Terres and Ruhl, 1934.)

The determinations were made by the synthetic method. The results are given in the present paper only in the form of a small diagram from which the following approximate values were read.

SO

Results at 15°

Mol. Percent in sat. sol.		Solid Phase
PbO	SO_2	
0.005	1.0	$PbSO_3.H_2O$
0.02	3.0	"
0.04	5.0	"
0.07	7.0	"
0.09	8.0	"
0.115	9.0	"
0.12	9.2	" + $Pb(HSO_3)_2$(?)
0.09	10.0	$Pb(HSO_3)_2$(?)
0.12	11.0*	"

Results at 25°

Mol. Percent in sat. sol.		Solid Phase
PbO	SO_2	
0.005	2.0	$PbSO_3.H_2O$
0.01	3.0	"
0.02	5.0	"
0.04	7.0	"
0.05	8.0	"
0.06	9.0	"
0.07	9.6	" + $Pb(HSO_3)_2$(?)
0.06	10.0	$Pb(HSO_3)_2$(?)
0.065	11.0*	"

* Between 11 and 95 Mol. Percent SO_2 the mixtures separate into liquid layers.

LEAD SULFATE $PbSO_4$.

SOLUBILITY IN WATER.

(Average curve from gravimetric results of Dibbits (1874), Beck and Stegmüller (1910) and Pleissner (1907) and conductivity results of Böttger (1903) and Kohlrausch (1904–05).

t°.	Gms. $PbSO_4$ per Liter.	t°.	Gms. $PbSO_4$ per Liter.
0	0.028	20	0.041
5	0.031	25	0.045
10	0.035	30	0.049
15	0.038	35	0.052
18	0.040	40	0.056

Results considerably higher than the above are reported by Sehnal (1909). This author finds 0.082 gm. $PbSO_4$ per liter at 18° and claims that the presence of H_2SO_4 in the $PbSO_4$ reduces the solubility very greatly. His results for the solubility in presence of small amounts of H_2SO_4 are:

Gms. H_2SO_4 per 1000 cc. solution	0	0.0098	0.0196	0.0980	0.4900	0.9800
Gms. dissolved $PbSO_4$ per 1000 cc. solution at 20°	0.082	0.051	0.038	0.013	0.006	0.0

Sehnal also gives results showing that the solubility in water and dilute H_2SO_4 solutions is exactly the same at 100° as at 20°.

Data for the solubility of $PbSO_4$ precipitates are given by deKoninck, 1907.

Later determinations of the Solubility of Lead Sulfate in Water by Crockford and Brawley, 1934; Purdum and Rutherford, 1933; Kolthoff and Rosenblum, 1933; and Huybrechts and de Langeron, 1930, gave an average curve from which the following values were taken.

SO

t°	Gms. $PbSO_4$ per liter	t°	Gms. $PbSO_4$ per liter
0	0.0330	25	0.0452
5	0.0354	30	0.0476
10	0.0380	35	0.0500
15	0.0403	40	0.0526
20	0.0427	50	0.0574

1000 cc. H_2O dissolve 0.032 gm. Pb SO_4 at 15° as determined by a new optical method using an interferometer of the type described by Janin (*Ann. chim. phys.*, 52, 171, 1858). (Mitchell, 1926)

SOLUBILITY OF LEAD SULFATE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC AND OF NITRIC ACIDS AND OF SODIUM CHLORIDE.

(Beck and Stegmüller, 1910.)

In Aqueous HCl.				In Aq. HNO_3 at 18°.		In Aq. NaCl at 18°.	
Normality of HCl.	Milligrams Pb per 100 cc. Solution. At 18°.	At 25°.	At 37°.	Normality of HNO_3.	Mgm. Pb per 100 cc. Sol.	Normality of NaCl.	Mgm. Pb per 100 cc. Sol.
0(= pure H_2O)	2.60	3	3.80	0.1	10.48	0.1	11.19
0.1	19	22.18	28.04	0.2	17.48	0.2	18.73
0.2	35.70	42.88	54.50	0.3	23.41	0.3	26.51
0.3	55.37	65.15	84.04	0.4	29.84	0.4	33.76
0.4	75.27	88.80	111.90				

SOLUBILITY OF LEAD SULFATE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID.

(Huybrechts and Ramelot, 1926.)

Results at 18°

Gms. per liter	
HCl	$PbSO_4$
0.1	0.0516
0.5	0.0966
1.0	0.133
2.5	0.244

Gms. per liter	
HCl	$PbSO_4$
4.88	0.384
7.5	0.573
9.75	0.748
25.0	1.020
50.0	0.983

Results at 30°

Gms. per liter	
HCl	$PbSO_4$
9.75	0.984
24.40	1.767
48.80	1.583

SOLUBILITY OF LEAD SULFATE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID CONTAINING INCREASING AMOUNTS OF SULPURIC ACID AT 18°.

(Huybrechts, and Ramelot, 1926.)

Results for:

Aq. 0.134 normal HCl		Aq. 0.275 normal HCl		Aq. 0.687 normal HCl		Aq. 1.372 normal HCl	
Gms. per liter		Gms. per liter		Gms. per liter		Gms. per liter	
H_2SO_4	$PbSO_4$	H_2SO_4	$PbSO_4$	H_2SO_4	$PbSO_4$	H_2SO_4	$PbSO_4$
0.0	0.384	0.0	0.730	0.0	1.020	0.0	0.983
0.16	0.179	0.16	0.522	0.16	1.030	0.18	0.974
0.48	0.124	0.48	0.292	0.48	1.026	1.0	0.950
0.96	0.055	0.96	0.1655	0.96	1.024	5.0	0.922
4.8	0.0157	4.8	0.0505	2.5	0.711	10	0.924
9.6	0.0101	9.6	0.0314	4.8	0.382	23.6	0.911
24.0	0.0109	24.0	0.0202	9.6	0.187	47.2	0.818
49.0	0.0101	48.0	0.0168	48.0	0.066		

SOLUBILITY OF LEAD SULFATE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID CONTAINING INCREASING AMOUNTS OF AMMONIUM SULFATE AT 18°.

(Huybrechts and Ramelot, 1926.)

Results for:

Aq. 0.134 normal HCl		Aq. 0.267 normal HCl		Aq. 0.687 normal HCl		Aq. 1.372 normal HCl	
Gms. per liter		Gms. per liter		Gms. per liter		Gms. per liter	
$(NH_4)_2SO_4$	$PbSO_4$	$(NH_4)_2SO_4$	$PbSO_4$	$(NH_4)_2SO_4$	$PbSO_4$	$(NH_4)_2SO_4$	$PbSO_4$
0.0	0.384	0.0	0.748	0.0	1.020	0.0	0.982
0.2	0.213	0.12	0.616	0.5	1.033	1.0	0.925
1.0	0.069	1.0	0.217	1.0	1.059	2.5	0.882
2.0	0.038	2.0	0.145	2.5	1.071	5.0	0.870
2.5	0.027	5.0	0.047	5.0	0.435	7.5	0.905
5.0	0.015	10.0	0.027	7.5	0.265	10.0	0.748
10.0	0.010	100.0	0.015	10.0	0.206	50.0	0.591
		300.0	0.007	50.0	0.049	100	0.425
				100.0	0.028	200	0.282
				300.0	0.014		

SOLUBILITY OF LEAD SULFATE IN AQUEOUS SOLUTIONS OF PERCHLORIC ACID AND OF MIXTURES OF PERCHLORIC ACID AND SULFURIC ACID AT 25°.

(Willard and Kassner, 1930)

	Dissolved $PbSO_4$.			Dissolved $PbSO_4$.	
Composition of solvent in mols. per liter.	Gms. per 100 cc.	Millimols. per 100 cc.	Composition of solvent in mols. per liter.	Gms. per 100 cc.	Millimols. per 100 cc.
0.1 Mol. $HClO$	0.0278	0.0917	0.5 Mol. $HClO_4$ + 0.01 Mol. H_2SO_4..	0.0137	0.0451
0.5 "	0.0528	0.1742	0.1 " + 0.02 " ..	0.0024	0.0079
1.0 "	0.0714	0.2301	0.5 " + 0.02 " ..	0.0067	0.0220
2.0 "	0.0787	0.2596	0.1 " + 0.05 " ..	0.0013	0.0043
3.0 "	0.0687	0.2266	0.5 " + 0.05 " ..	0.0030	0.0099
4.2 "	0.0490	0.1616	0.1 " + 0.10 " ..	0.0010*	0.0033*
0.1 " + 0.005 Mol. H_2SO_4..	0.0070	0.0230	0.1 " + 0.25 " ..	0.0008*	0.0026*
0.5 " + " ..	0.0206	0.0679	0.1 " + 0.50 " ..	0.0003*	0.0010*
1.0 " + " ..	0.0367	0.1211	0.1 " + 0.50 Mol. $Pb(ClO_4)_2$.	0.0002	0.0007

* Lead determined colorimetrically.

SOLUBILITY OF LEAD SULFATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AND OF MIXTURES OF NITRIC ACID AND SULFURIC ACID AT 25°.

(Willard, and Kassner, 1930)

	Dissolved $PbSO_4$.			Dissolved $PbSO_4$.	
Composition of solvent in mols. per liter.	Gms. per 100 cc.	Millimols. per 100 cc.	Composition of solvent in mols. per liter.	Gms. per 100 cc.	Millimols. per 100 cc.
0.1 Mol. HNO_3	0.0426	0.1405	1.0 Mol. HNO_3 + 0.005 Mol. H_2SO_4..	0.1007	0.3322
0.5 "	0.0992	0.3272	0.5 " + 0.01 " ..	0.0328	0.1082
1.0 "	0 2031	0.6667	0.5 " + 0.02 " ..	0.0159	0.0524
2.0 "	0.3605	1.1890	0.1 " + 0.05 " ..	0.0015	0.0049
3.0 "	0.5389	1.7770	0.5 " + 0.05 " ..	0.0089	0.0293
4.2 "	0.7263	2.3960	0.1 " + 0.25 " ..	0.0011	0.0036
0.1 " + 0.005 Mol. H_2SO ..	0.0078	0.0257	0.1 " + 0.5 " ..	0.0009	0.0030
0.5 " + 0.005 " ..	0.0398	0.1313	0.1 " + 0.5 Mol. $Pb(NO_3)_2$.	0.0008	0 0026

SO

SOLUBILITY OF LEAD SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID.

(Frisak, 1922.)

Aqueous lead nitrate solution was added, by means of a buret, to aqueous sulfuric acid solutions at definite temperature untill a permanent cloud remained. The results were plotted and the following values read from the curve.

	Gms. Pb dissolved per 100 gms. sat. solution in Aq. H_2SO_4 containing							
t°.	60% H_2SO_4.	65% H_2SO_4.	70% H_2SO_4.	75% H_2SO_4.	80% H_2SO_4.	85% H_2SO_4.	90% H_2SO_4.	95% H_2SO_4.
16...	0.002	0.002	0.002	0.0021	0.0025	0.004	0.008	0.024
127...	0.0035	0.0042	0.005	0.007	0.009	0.014	0.024	0.060
149...	0.006	0.0075	0.009	0.013	0.018	0.030	0.055	–
166...	–	0.010	0.014	0.021	0.032	0.048	–	–

SOLUBILITY OF LEAD SULFATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AND OF MIXTURES OF NITRIC AND SULFURIC ACID AT 18°.

(Huybrechts and Ramelot, 1926.)

Results for:

Aqueous HNO_3

Gms. per liter HNO_3	Gms. per liter $PbSO_4$
5.65'	0.2195
11.32	0.348
28.30	0.784
56.60	1.437

Aqueous 0.18 normal HNO_3

Gms. per liter H_2SO_4.	Gms. per liter $PbSO_4$
0.0	0.348
0.5	0.0819
1.0	0.0483
2.5	0.0202
5.0	0.0183
10.0	0.0082
20.0	0.0078
50.0	0.0065

Aqueous 0.89 normal HNO_3

Gms. per liter H_2SO_4.	Gms. per liter $PbSO_4$
0.0	1.437
0.5	0.777
1.0	0.537
5.0	0.146
10.0	0.084
20.0	0.045
25.0	0.047
50.0	0.020

SOLUBILITY OF LEAD SULFATE IN AQUEOUS SOLUTIONS OF NITRIC ACID CONTAINING INCREASING AMOUNTS OF AMMONIUM SULFATE AT 18°.

(Huybrechts and Ramelot, 1926.)

Results for:

Aqueous 0.18 normal HNO_3

SO

Gms. per liter $(NH_4)_2SO_4$	Gms. per liter $PbSO_4$	Gms. per liter $(NH_4)_2SO_4$	Gms. per liter $PbSO_4$
0.0	0.348	5.0	0.0146
0.5	0.097	10.0	0.0090
1.0	0.0512	25.0	0.0052
2.5	0.0249	50.0	0.0079

Aqueous 0.89 normal HNO_3

Gms. per liter $(NH_4)_2SO_4$	Gms. per liter $PbSO_4$	Gms. per liter $(NH_4)_2SO_4$	Gms. per liter $PbSO_4$
0.0	1.437	5.0	0.196
0.5	0.926	10.0	0.091
1.0	0.722	25.0	0.036
2.5	0.405	50.0	0.020

SOLUBILITY OF LEAD SULFATE IN DILUTE AQUEOUS SOLUTIONS OF SULFURIC ACID AT 20°.

The only fairly closely agreeing results of Pleissner, 1907; Sehnal, 1909; Dawkins and Weldon, 1922; Huybrechts and Ramelot, 1926 and Purdum and Rutherford, 1933, were plotted and the following values were read from the average curve.

Gms. per liter H_2SO_4	Gms. per liter $PbSO_4$	Gms. per liter H_2SO_4	Gms. per liter $PbSO_4$	Gms. per liter H_2SO_4	Gms. per liter $PbSO_4$
0.0	0.042	0.5	0.0055	10.0	0.0050
0.05	0.013	1.0	0.0040	20.0	0.0060
0.10	0.010	2.5	0.0040	50.0	0.0075
0.25	0.007	5.0	0.0045	100.0	0.0100

The available results at 30° are approximately one unit in the third place higher than the above values for the flat portion of the curve corresponding to concentrations of sulfuric acid above 0.25 gms. per liter.

SOLUBILITY OF LEAD SULFATE IN CONCENTRATED AQUEOUS SOLUTIONS OF ACIDS.

(Schultz, 1861; Rodwell, 1862.)

In Aq. H_2SO_4.			In Aq. HCl.			In Aq. HNO_3.		
(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)
1.540	63.4	0.003	1.05	10.6	0.14	1.08	11.6	0.33
1.793	85.7	0.011	1.08	16.3	0.35	1.12	17.5	0.59
1.841	97	0.039	1.11	22	0.95	1.25	34	0.78
			1.14	27.5	2.11	1.42	60	1.01
			1.16	31.6	2.86			

(a) Sp. Gr. of Aq. Acid. (b) Gms. Acid per 100 Gms. Solution. (c) Gms. $PbSO_4$ per 100 Gms. Solvent.

SOLUBILITY OF LEAD SULFATE IN CONC. SOLUTIONS OF SULFURIC ACID.

(Donk, 1916.)

t°.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.	t°.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
	H_2SO_4.	$PbSO_4$.			H_2SO_4.	$PbSO_4$.	
0	51.2	0	$PbSO_4$	100	61.2	0	$PbSO_4$
0	89.4	0	" $+H_2SO_4.H_2O$	100	72.5	0.1	"
0	97	0	H_2SO_4	100	96.3	0.2	"
0	97.2	0.3	" $+PbSO_4$	100	99.1	0.9	"
50	50.4	0	$PbSO_4$	200	79	0	"
50	86.7	0.1	"	200	88.8	0.1	"
50	95.1	0.2	"	200	95.5	0.3	"
50	99.3	0.6	"	200	98.9	1.1	"

Additional data for highly concentrated solutions of H_2SO_4 are given by Ditz and Kanhaüser (1916).

SO

SOLUBILITY OF LEAD SULFATE IN CONCENTRATED AND FUMING SULFURIC ACID AT ABOUT 18°.

(Ditz and Kanhäuser, 1916.)

The solutions were analyzed after being shaken from time to time during three days, and the analyses repeated after an additional two days.

Per cent concentration of sulfuric Acid		Gms. Pb SO_4 per 100 gms. sat. sol.	Per cent concentration of sulfuric Acid		Gms. Pb SO_4 per 100 gms. sat. sol.	Per cent concentration of sulfuric Acid		Gms. Pb SO_4 per 100 gms. sat. sol.
H_2SO_4.	free SO_3.		H_2SO_4.	free SO_3.		H_2SO_4.	free SO_3.	
91.27	–	0.047	98.63	–	1.29	101.13	5.02	3.54
93.78	–	0.063	98.94	–	1.34	101.45	6.4	3.78
96.04	–	0.147	99.52	–	2.51	102.5	11.1	6.00
97.01	–	0.210	100.01	0.044	4.21	103.4	15.1	7.22
98.11	–	0.54	100.2	0.89	3.97	105.05	22.4	8.23
98.37	–	0.70	100.5	2.22	3.62			

Fusion-point data for mixtures of Pb SO_4 and Pb WO_4 are given by Jaeger and Germs, 1921.

SOLUBILITY OF LEAD SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID.

(Crockford and Brawley, 1936; Crockford and Addlestone, 1936.)

Gms. H_2SO_4 per 1000 gms. aq. solvent	Gms. $PbSO_4$ per 1000 gms. sat. solution at: 0°	25°	50°	80°
0.0	0.033	0.0445	0.0497	0.0577
0.05	0.008	0.0100	0.0110	0.0240
0.1	0.007	0.0080	0.0100	0.0210
0.2	0.0064	0.0070	0.0080	0.0180
0.5	0.0052	0.0060	0.0066	0.0150
1.0	0.0046	0.0052	0.0051	0.0130
2.0	0.0034	0.0038	0.0045	0.0120
5.0	0.0020	0.0025	0.0043	0.0115
10.0	0.0018	0.0022	0.0042	0.0113
50.0	0.0016	0.0020	0.0040	0.0103
100.0	0.0012	0.0016	0.0038	0.0096
200.0	0.0005	0.0012	0.0028	0.0080
300.0	0.0004	0.0012	0.0020	0.0046
600.0	0.0004	0.0012	0.0020	0.0028
700.0	0.0012	0.0018	0.0024	0.0030
750.0	0.0028	0.0030	0.0038	0.0066
800.0	0.0065	0.0115	0.0240	0.0420
850.0	—	0.0600	0.1000	0.130
900	0.0420	0.200	0.318	0.380
950	0.680(940)	0.800	1.060	1.260
970	3.000	—	—	—
1000	—	18.000	22.000	27.600
1010	—	31.000	36.000	42.000
1020	—	47.000	52.000	56.000
1030	—	63.000	68.000	72.000

SO

In agreement with Donk, 1916, analyses of the solid phases showed that $PbSO_4$ is the only one at these temperatures. The eutectic temperature for $PbSO_4 + H_2SO_4$ was found to be 5.4°. The acid concentration of 104 percent H_2SO_4 corresponds to 80.5 percent SO_3.

SOLUBILITY OF LEAD SULFATE IN AQUEOUS SOLUTIONS OF POTASSIUM ACETATE AND OF SODIUM ACETATE AT 25°. (Fox, 1909.)

In Aq. Potassium Acetate. Gms. per 100 Gms. Sat. Sol. CH_3COOK.	$(CH_3COO)_2Pb$.	Solid Phase.	In Aq. Sodium Acetate. Gms. per 100 Gms. Sat. Sol. CH_3COONa.	$(CH_3COO)_2Pb$.	Na_2SO_4.	Solid Phase.
4.33	2.54	$PbSO_4+PbK_2(SO_4)_2$	6.69	0.78	0.34	$PbSO_4$
9.03	3.55	"	6.95	0.81	0.35	"
17.81	5.43	"	11.76	2.73	1.26	"
26.58	9.83	"	16.90	5.70	2.49	"
28.82	11.40	"	19.92	8.24	3.60	"
28.93	19.41	"	21.51	10.75	4.68	"

In the case of the CH_3COOK solutions, the double salt $PbK_2(SO_4)_2$ is formed and no SO_4 ions enter the solution.

SOLUBILITY OF LEAD SULFATE IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE.

(Huybrechts and Ramelot, 1928.)

Results at 18°				Results at 30°			
Gms. per liter		Gms. per liter		Gms. per liter		Gms. per liter	
K_2SO_4	$PbSO_4$	K_2SO_4	$PbSO_4$	K_2SO_4	$PbSO_4$	K_2SO_4	$PbSO_4$
0.1	0.0125	5.0	0.0037	0.1	0.0128	5.0	0.0036
0.5	0.0047	10.0	0.0007	0.5	0.0064	7.5	0.0047
1.0	0.0053	30.0	0.0002	0.75	0.0060	10.0	0.0007
2.5	0.0042	100.0	0.0002	1.5	0.0055	20.0	0.0011

SOLUBILITY OF LEAD SULFATE IN AQUEOUS SOLUTIONS OF AMMONIUM ACETATE AND OF SODIUM ACETATE.

(Noyes and Whitcomb, 1905; Dunnington and Long, 1899; Dibbits, 1874.)

In Ammonium Acetate. At 25° (N. and W.).				In Sodium Acetate. At 100° (D. and L.).		In Sodium Acetate. (D.).	
Millimols per Liter.		Gms. per Liter.		G. $NH_4C_2H_3O_2$ per 100 cc. Solution.	G. $PbSO_4$ per 100 g. Solution.	Gms. per 100 Gms. H_2O.	
$NH_4C_2H_3O_2$.	$PbSO_4$.	$NH_4C_2H_3O_2$.	$PbSO_4$.			$NaC_2H_3O_2$.	$PbSO_4$.
0	0.134	0	0.041	28	7.12	2.05	0.054
103.5	2.10	7.98	0.636	32	9.88	8.2	0.853
207.1	4.55	15.96	1.38	37	10.58	41	11.23
414.1	10.10	31.92	3.02	45	11.10		

SO

SOLUBILITY OF LEAD SULFATE IN AQUEOUS SOLUTIONS OF AMMONIUM ACETATE AT 25°.

(Marden, 1916.)

Gms. per 1000 Gms. Sat. Sol.		Gms. per 1000 Gms. Sat. Sol.		d_{25} of Sat. Sol.
$NH_4C_2H_3O_2$.	$PbSO_4$.	$NH_4C_2H_3O_2$.	$PbSO_4$.	
7.96	0.636	53.4	5.60	1.012
15.91	1.370	106.8	16.8	1.024
31.70	3.04	213.7	38.9	1.045

SOLUBILITY OF LEAD SULFATE IN AQUEOUS SOLUTIONS OF AMMONIUM SULFATE.

(Huybrechts and Ramelot, 1928.)

Results at 18°				Results at 30°	
Gms. per liter		Gms. per liter		Gms. per liter	
$(NH_4)_2SO_4$	$PbSO_4$	$(NH_4)_2SO_4$	$PbSO_4$	$(NH_4)_2SO_4$	$PbSO_4$
0.1	0.0107	30.0	0.0049	0.1	0.0105
0.5	0.0056	50.0	0.0079	1.0	0.0046
0.75	0.0042	70.0	0.0093	2.5	0.0042
1.00	0.0034	100.	0.0123	5.0	0.0044
5.00	0.0040	150	0.0157	7.5	0.0048
10.0	0.0047	200	0.0107	25.0	0.0060

SOLUBILITY OF LEAD SULFATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE.

(Huybrechts and de Langeron, 1930.)

Gms. H_2SO_4 per liter aq. solvent	Gms. $PbSO_4$ per liter sat. sol. at 15°	Gms. $PbSO_4$ per liter sat. sol. at 50°	Gms. H_2SO_4 per liter aq. solvent	Gms. $PbSO_4$ per liter sat. sol. at 15°	Gms. $PbSO_4$ per liter sat. sol. at 50°
0.1	0.0079	0.0117	7.5	0.0023	0.0044
0.25	0.0057	0.0083	10.0	0.0027	0.0049
0.50	0.0049	0.0060	25.0	0.0038	0.0057
0.75	0.0045	0.0057	50.0	0.0060	0.0079
1.00	0.0045	0.0057	75.0	0.0083	0.0102
2.50	0.0034	0.0049	100.0	0.0105	0.0124
5.00	0.0023	0.0044	132.0	0.0123	0.0147
			400.0		0.0284

SOLUBILITY OF LEAD SULFATE IN AQUEOUS SOLUTIONS OF:

(Kolthoff and Rosenblum, 1933.)

Sodium Sulfate at 26.5°		Lead Sulfate at 29°	
Normality of aq. Na_2SO_4	Normality of dissolved $PbSO_4$	Normality of aq. $Pb(NO_3)_2$	Normality of dissolved $PbSO_4$
0.000505	0.000145	0.000501	0.000148
0.000745	0.000115	0.000750	0.000119
0.001011	0.00010	0.0010	0.000088
0.001505	0.00008	0.0015	0.000076
		0.0025	0.000047

SO

SOLUBILITY OF LEAD SULFATE IN AQUEOUS SOLUTIONS OF THORIUM CHLORIDE.

(Balcar and Stegmann, 1929.)

To solutions of varying concentrations of thorium chloride, illuminated by a converging beam of light, equivalent solutions of lead chloride and sulfuric acid were added dropwise and the point determined at which the Tyndall cone became permanent. This was taken as the point representing saturation of the solution at 25°.(?)

Gram mols. per liter $ThCl_4$	Gram mols. per liter $PbSO_4$
0.0044	0.00323
0.0105	0.00574
0.0233	0.00959
0.0495	0.01760
0.0817	0.01970

Fusion-point data are given for

PbSO + K_2SO_4 (Calcagni and Mariotta, 1912; Grahmann, 1913.)
" + Na_2SO_4 (Calcagni and Mariotta, 1912.)

Solubility of Basic Lead Sulfates in Water at 18°.

(Pleissner, 1907.)

Compound.	Formula.	One Liter Sat. Solution Contains: Mg. Lead Salt	= Mg. Pb	= Millimols Pb.
½ Basic Lead Sulfate	$PbSO_4.PbO$	13.4	10.6	0.050
¾ Basic Lead Sulfate	$PbSO_4.3PbO.H_2O$	26.2	22	0.106

LEAD Per**SULFATE** $Pb(SO_4)_2$.

Solubility in Aqueous Sulfuric Acid at 22°.

(Dolezalek and Finckli, 1906.)

Gms. per Liter. H_2SO_4.	Gms. per Liter. $Pb(SO_4)_2$.	Solid Phase.	Gms. per Liter. H_2SO_4.	Gms. per Liter. $Pb(SO_4)_2$.	Solid Phase.
948	0	$PbOSO_4.H_2O$	1253	14.85	$PbOSO_4.H_2O$
1014	0.719	"	1352	16.17	"
1081	1.198	"	1470	9.30	$Pb(SO_4)_2$
1098	1.557	"	1532	9.46	"
1130	2.115	"	1631	19.80	"
1180	5.749	"	1698	33.34	"
1217	9.303	"	1703	35.22	"

The solid phase at concentrations of acid up to 1352 gms. per liter is the white basic salt of the composition $PbOSO_4.H_2O$. In the concentration limits of about 1470-1703 gms. H_2SO_4 per liter the original yellow color of the solid phase remains unchanged.

LEAD (Hypo)**SULFATE.**

Solubility of Mixtures of Lead Hyposulphate and Strontium Hyposulphate at 25°.

(Fock — Z. Kryst. Min. 28, 389, '97.)

Mol. per cent in Solution. $PbS_2O_6.4H_2O$.	Mol. per cent in Solution. $SrS_2O_6.4H_2O$.	Grams per Liter. PbS_2O_6.	Grams per Liter. SrS_2O_6.	Sp. Gr. of Solutions.	Mol. per cent in Solid Phase. $PbS_2O_6.4H_2O$.	Mol. per cent in Solid Phase. $SrS_2O_6.4H_2O$.
0.0	100.0	0.0	145.6	1.1126	0.0	100.0
1.05	98.95	2.97	151.2	1.1184	0.30	99.7
15.31	84.69	40.82	152.5	1.1503	3.87	96.13
46.80	53.20	149.2	114.5	1.2147	9.84	90.16
62.30	37.70	256.1	85.0	1.2889	19.26	80.74
75.75	24.25	310.3	67.0	1.3252	23.73	76.27
78.09	21.91	373.7	70.8	1.3726	32.24	67.76
88.29	11.71	509.5	45.6	1.4671	49.97	50.13
100.0	0.00	374.3	0.0	1.6817	0.00	0.00

PHOSPHORUS (White) P_4.

Solubility of White Phosphorus in Several Solvents.

(Hildebrand and Buehrer, 1920.)

Results for Solubility in:

Carbon Disulfide. t°.	Carbon Disulfide. Mol % P4.	p Dibrom Benzene. t°.	p Dibrom Benzene. Mol. % P4.	Ethylene Bromide. t°.	Ethylene Bromide. Mol. % P4.	Naphthalene. t°.	Naphthalene. Mol % P4.	Phenanthrene. t°.	Phenanthrene. Mol % P4.
—7.8..	6	154.3..	41	169.6..	41	132.8..	26	199.2..	55
—6.7..	34	159.4..	49	165.0..	44	201.4..	49	199.5..	57
—5.9..	43	162.0..	54	163.0..	47	195.5..	56	199.1..	73
—6.4..	50	163.0..	61	165.5..	56	202.7..	60	198.0..	80
—6.4..	59	159.0..	70	162.2..	63	201.6..	74	200 crit. t.	
—6.6..	74	163 crit. t.		151.7..	81	200.2..	75		
—6.5 crit. t.				165 crit. t.		190.4..	80		
						202 crit. t.			

The critical temperatures of solution given above were obtained by plotting the preceding results and reading from the curve. Single determinations in decane and chlorobenzene gave as critical temperatures, > 390° and 264° respectively.

PALLADIUM CHLORIDE $PdCl_2$.

When 1 gm. of palladium, as chloride, is dissolved in 100 cc. of H_2O and shaken with 100 cc. of ether, 0.02 per cent of the metal enters the ethereal layer at ord. temp. When aq. 10% HCl is used, 0.01 per cent of the metal enters the ethereal layer. (Mylius, 1911)

100 cc. anhydrous hydrazine dissolve 1 gm. $PdCl_2$, with evolution of gas and formation of a black precipitate, at room temperature. (Welsh and Broderson, 1915.)

PRASEODYMIUM BROMATE $Pr(BrO_3)_3.9H_2O$.

SOLUBILITY OF PRASEODYMIUM BROMATE IN WATER.

(James, Fogg, McIntire, Evans & Donovan, 1927.)

BrO

t°	Gms. per 100 gms. sat. sol.		t°	Gms. per 100 gms. sat. sol.	
	$Pr(BrO_3)_3.9H_2O$	$Pr(BrO_3)_3$		$Pr(BrO_3)_3.9H_2O$	$Pr(BrO_3)_3$
0	46.96	35.87	25	66.23	50.59
5	51.42	39.28	30	69.83	53.34
10	55.25	42.20	35	73.58	56.21
15	59.03	45.09	40	77.23	59.00
20	62.66	47.87	45	81.29	62.10

PRASEODYMIUM ACETATE $Pr(CH_3COO)_2.H_2O$.

100 gms. sat. solution of praseodymium acetate in water contain 21.48 gms. $Pr(CH_3COO)_2$ at 25°. Saturation was obtained by constant shaking. (Meyer and Muller, 1920.)

PRASEODYMIUM GLYCOLATE $Pr_2(C_2H_3O_3)_3$.

One liter water dissolves 3.578 gms. $Pr_2(C_2H_3O_3)_3$ at 20°. (Jantsch & Grünkraut, '12–13.)

PRASEODYMIUM LACTATE $Pr(C_3H_5O_3)_3.2\frac{1}{2}H_2O$.

CH

1000 cc. sat. solution of praseodymium lactate in water contain 24.84 gms. $Pr(C_3H_5O_3)_3.2\frac{1}{2}H_2O$ at 20°. Saturation was obtained by constant shaking. (Jantsch, 1926.)

PRASEODYMIUM SULFONATES

SOLUBILITY IN WATER.

Praseodymium Salt of:	Formula.	Gms. Anhydrous Salt per 100 Gms. H_2O.	Authority.
Bromonitrobenzene Sulfonic Acid	$Pr(C_6H_3.Br.NO_2.SO_3,1,4,2)_3.8H_2O$	6.08	(Katz & James, '13.)
Benzene Sulfonic Acid	$Pr(C_6H_5SO_3)_3.9H_2O$	55 6	(Holmberg, 1907.)
m Nitrobenzene Sulfonic Acid	$Pr[C_6H_4(NO_2)SO_3]_3.6H_2O$	33.9	"
m Chlorobenzene Sulfonic Acid	$Pr[C_6H_4Cl.SO_3]_3.9H_2O$	12.6	"
Chloronitrobenzene Sulfonic Acid	$Pr(C_6H_3.SO_3.NO_2.Cl,1,3,6)_3.14H_2O$	25.9	"
α Naphthalene Sulfonic Acid	$Pr[C_{10}H_7SO_3]_3.6H_2O$	6 1	"
1.5 Nitronaphthalene Sulfonic Acid	$Pr[C_{10}H_6(NO_2)SO_3]_3.6H_2O$	0.47	"
1.6 " "	" $9H_2O$	0.18	"
1.7 " "	" $.11H_2O$	1.3	"

PRASEODYMIUM OXALATE $Pr_2(C_2O_4)_3.10H_2O$.

One liter H_2O dissolves 0.00074 gm. $Pr_2(C_2O_4)_3$ at 25°. (Rimbach and Schubert, 1909.)

100 gms. aq. 19.4% HNO_3 ($d = 1.116$) dissolve 1.16 gms. $Pr_2(C_2O_4)_3$ at 15°. (v. Scheele, 1899.)

100 gms. aq. 10.2% HNO_3 ($d = 1.063$) dissolve 0.50 gm. $Pr_2(C_2O_4)_3$ at 15°. (v. Scheele, 1899.)

PRASEODYMIUM OXALATE

One liter sat. solution of Praseodymium Oxalate in Water, contains 0.00149 gm. $Pr_2(C_2O_4)_3$ at 25°, determined by the gravimetric method and 0.00215 determined by conductivity. (Sarver and Brinton, 1927.)

SOLUBILITY OF PRASEODYMIUM OXALATE IN AQUEOUS SOLUTIONS OF ACIDS AT 25°.

(Sarver and Brinton, 1927.)

Composition of Aq. Solvent in Normality	Gms. $Pr_2(C_2O_4)_3$ per 100 gms. sat. sol.	Composition of Aq. Solvent in Normality	Gms. $Pr_2(C_2O_4)_3$ per 100 gms. sat. sol.
0.1008 HCl	0.0098	6.0 HCl + sat. $(COOH)_2$	0.1492
0.2576 "	0.0279	6.2 " + " "	0.1338
0.5004 "	0.0625	0.2482 HNO_3	0.0238
1.018 "	0.1603	1.992 "	0.5102
1.484 "	0.2658	4.054 "	1.656
2.000 "	0.4108	2.000 " + 0.1 $(COOH)_2$	0.1295
2.865 "	0.6799	3.03 " + 0.1 "	0.5712
0.978 " + 0.1 $(COOH)_2$	0.0128	4.00 " + 0.1 "	1.057
2.000 " + 0.1 "	0.1163	2.00 " + 0.5 "	0.0292
2.865 " + 0.1 "	0.3255	3.03 " + 0.5 "	0.1323
3.965 " + 0.1 "	0.7021	4.00 " + 0.5 "	0.3987
0.978 " + 0.5 "	0.0026	4.00 " + sat. "	0.0663
2.000 " + 0.5 "	0.0173	6.00 " + " "	0.912
2.865 " + 0.5 "	0.0548	0.086 H_2SO_4	0.0103
3.965 " + 0.5 "	0.1833	0.419 "	0.0512
1.484 " + sat. "	0.0046	0.958 "	0.1294
4.0 " + " "	0.0986	1.846 "	0.2808
		2.612 "	0.4213

COO

SOLUBILITY OF PRASEODYMIUM OXALATE IN AQUEOUS SOLUTIONS OF NITRIC ACID ALONE AND CONTAINING OXALIC ACID AT 90°.

(Neckers and Kremers, 1928.)

Normality of aq. HNO_3	Gms. Pr_2O_3 per 100 cc sat. sol.	Normality of aq. HNO_3	Gms. $(COOH)_2$ per 100 gms. solvent	Gms. Pr_2O_3 per 100 cc sat. sol.
0.779	0.3871	0.779	5.0	0.0275
1.558	1.0764	1.558	5.0	0.1639
2.337	1.8467	2.337	5.0	0.6932
5.000	0.8825	5.000	5.0	5.2339

PRASEODYMIUM CHLORIDE $PrCl_3$.

Cl

SOLUBILITY IN WATER, AQ. HYDROCHLORIC ACID AND IN PYRIDINE.

(Matignon, 1906, 1909.)

Solvent.	t°.	Sp. Gr. Sat. Sol.	Gms. per 100 Gms. Sat. Sol.
Water	13	1.687	50.96 $PrCl_3$
Aq. HCl	13	1.574	41.05 $PrCl_3$+7.25HCl
Pyridine	room temp.	...	2.1 $PrCl_3$

PRASEODYMIUM TriCHLORIDE and OXIDE $PrCl_3$, Pr_2O_3.

SOLUBILITY OF PRASEODYMIUM TRICHLORIDE AND OF PRASEODYMIUM OXIDE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE AT SEVERAL TEMPERATURES.
(Prandtl and Rauchenberger, 1920; See Note Neodymium Trichloride, p. 1311.)

The basic chlorides which were obtained were as follows. At 15°, $Pr_4Cl_2O_5.9H_2O$ at 30°, $Pr_2ClO_4.6H_2O$; at 50°, $Pr_4Cl_2O_5 20H_2O$.

PRASEODYMIUM CHROMATE $Pr_2(CrO_4)_3.8H_2O$.

100 gms. sat. solution of Praseodymium Chromate in water contain 0.021 gm. $Pr_2(CrO_4)_3$ at 25°. (Britton, 1924.)

PRASEODYMIUM MOLYBDATE $Pr_2(MoO_4)_3$.

One liter water dissolves 0.0152 gm. $Pr_2(MoO_4)_3$ at 23° and 0.0143 gms. at 75°. (Hitchcock, 1895.

NO

PRASEODYMIUM NITRATE $Pr(NO_3)_3.6H_2O$.

SOLUBILITY OF PRASEODYMIUM NITRATE IN WATER.
(Friend, 1935.)

t°	Gms. $Pr(NO_3)_3$ per 100 gms. sat. sol.	Solid Phase
15.8	59.32	$Pr(NO_3)_3.6H_2O$
22.0	60.18	"
30.4	61.94	"
43.0	65.00	"
56.0(m.pt.)	75.15	"

A sat. solution of $Pr(NO_3)_3.6H_2O$ in ethyl ether, prepared by frequent agitation and allowing to stand over night at about 20°, contained 0.004 gm. Pr_2O_3 per 100cc. (Wells, 1930.)

PRASEODYMIUM Magnesium NITRATE $2Pr(NO_3)_3.3Mg(NO_3)_2.24H_2O$.

SOLUBILITY OF PRASEODYMIUM MAGNESIUM NITRATE IN WATER.
(Friend and Wheat, 1935.)

t°	Gms. $2Pr(NO_3)_3.3Mg(NO_3)_2.24H_2O$ per 100 gms. sat. sol.	t°	Gms. $2Pr(NO_3)_3.3Mg(NO_3)_2.24H_2O$ per 100 gms. sat. sol.
15	63.0 (1)	61.8	74.25
17.8	63.1	70.0	77.5 (1)
30.0	66.4 (1)	74.6	78.39
37.4	67.74	111.2 (m.pt.)	100.0
50.0	71.0 (1)		

(1) Prandtl and Ducrue, 1926.

PRASEODYMIUM Double NITRATES

SOLUBILITY AT 16° IN CONC. HNO_3 OF $d_{15} = 1.325$. (Jantsch, 1912.)

Salt.			Formula.			Gms. Hydrated Salt per 100 cc. Sat. Solution.
Praseodymium	Magnesium	Nitrate	$[Pr(NO_3)_6]_2Mg_3.24H_2O$			7.70
"	Nickel	"	"	Ni_3	"	9.28
"	Cobalt	"	"	Co_3	"	12.99
"	Zinc	"	"	Zn_3	"	14.69
"	Manganese	"	"	Mn_3	"	23.40

PRASEODYMIUM Double NITRATES.

SOLUBILITY OF EACH SEPARATELY IN WATER. (Prandtl and Ducrue, 1926.)

Saturation was obtained by constant agitation.

Salt.			Compostion.	t°.	d of sat. sol.	Gms. per 100 gms. sat. sol.			Double salt.
						P_2O_3.			
Praseodymium	Cobalt	Nitrate.	$2Pr(NO_3)_3.3Co(NO_3)_2.24H_2O$	15	1.62	13.64	9.30	CoO	67.6
»	»	» .	»	30	1.65	14.28	9.75	»	70.8
»	»	» .	»	45	1.69	14.98	10.13	»	74.3
»	»	» .	»	60	1.72	15.89	10.79	»	78.8
»	Magnesium	» .	$2Pr(NO_3)_3.3Mg(NO_3)_2.24H_2O$	15	1.49	13.55	4.91	MgO	63.0
»	»	» .	»	30	1.52	14.29	5.24	»	66.4
»	»	» .	»	50	1.55	15.27	5.55	»	71.4
»	»	» .	»	70	1.61	16.65	6.14	»	77.5
»	Manganese	» .	$2Pr(NO_3)_3.3Mn(NO_3)_2.24H_2O$	15	1.63	14.60	9.44	MnO.	71.8
»	»	» .	»	30	1.68	15.42	9.75	»	75.9
»	»	» .	»	45	1.72	16.24	10.40	»	79.9
»	»	» .	»	60	1.79	17.43	11.15	»	85.8
»	Nickel	» .	$2Pr(NO_3)_3.3Ni(NO_3)_2.24H_2O$	15	1.60	12.99	8.83	NiO	64.4
»	»	» .	»	30	1.63	13.83	9.41	»	68.5
»	»	» .	»	45	1.66	14.50	9.87	»	71.8
»	»	» .	»	60	1.70	15.27	10.47	»	75.7
»	Zinc	» .	$2Pr(NO_3)_3.3Zn(NO_3)_2.24H_2O$	15	1.63	13.22	9.87	ZnO	66.3
»	»	» .	»	30	1.67	14.08	10.45	»	70.6
»	»	» .	»	45	1.71	15.02	11.01	»	75.4
»	»	» .	»	60	1.76	15.97	11.98	«	80.1

NO

PRASEODYMIUM OXIDE Pr_2O_3.

One liter sat. solution of Praseodymium Oxide in Water contains 0.00000061 gm. mol. Pr_2O_3 at 29°, as determined by electrometric titration. The corresponding value for Pr_6O_{11} is 0.0000039 at 29°. (Busch, 1927.)

PRASEODYMIUM Dimethyl PHOSPHATE $Pr_2[(CH_3)_2PO_4]_3$.

100 gms. H_2O dissolve 64.1 gm. $Pr_2[(CH_3)_2PO_4]_3$ at 25°. (Morgan and James, 1914.)

PRASEODYMIUM SULFATE $Pr_2(SO_4)_3.8H_2O$.

SOLUBILITY OF PRASEODYMIUM SULFATE IN WATER.

The somewhat irregular results of Muthmann and Rölig, 1898; Meyer, ----; and Jackson and Rienacker, 1930, were plotted and the following values taken from the average curve drawn through them.

t°	Gms. $Pr_2(SO_4)_3$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Pr_2(SO_4)_3$ per 100 gms. sat. sol.	Solid Phase
0	16.5	$Pr_2(SO_4)_3.8H_2O$	50	6.0	$Pr_2(SO_4)_3.8H_2O$
10	13.5	"	60	4.8	"
20	11.2	"	70	4.0	"
25	10.0	"	80	3.4	"
30	9.0	"	90	1.1(?)	$Pr_2(SO_4)_3.5H_2O$
40	7.2	"	100	0.9(?)	"

EQUILIBRIUM IN THE SYSTEM PRASEODYMIUM SULFATE, RUBIDIUM SULFATE AND WATER AT 25°.

(Restanio, 1934.)

SO

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$Pr_2(SO_4)_3$	Rb_2SO_4		$Pr_2(SO_4)_3$	Rb_2SO_4	
4.82	0.30	$Pr_2(SO_4)_3.8H_2O$	0.06	6.72	1.1.8
3.67	0.33	"	0.0	15.22	"
1.98	0.38	—	0.0	17.59	"
1.28	0.41	—	0.0	19.43	"
1.08	0.58	—	0.0	20.84	—

1.1.8 = $Pr_2(SO_4)_3.Rb_2SO_4.8H_2O$.

EQUILIBRIUM IN THE SYSTEM PRASEODYMIUM SULFATE, THALLIUM SULFATE AND WATER AT 25°.

(Zambonini and Restanio, 1931.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$Pr_2(SO_4)_3$	Tl_2SO_4		$Pr_2(SO_4)_3$	Tl_2SO_4	
8.43	0.03	$Pr_2(SO_4)_3.8H_2O$+1.1.4	0.10	3.42	1.3.1+1.4½
6.18	0.13	1.1.4	0.0	4.98	1.4½
0.52	0.73	"	0.0	5.27	1.5
0.18	2.80	"	0.0	5.83	"
0.15	2.98	"	0.0	5.91	" + $TlSO_4$

1.1.4 = $Pr_2(SO_4)_3Tl_2SO_4.4H_2O$; 1.3.1 = $Pr_2(SO_4)_3.3Tl_2SO_4.H_2O$; 1.4½ = $Pr_2(SO_4)_3.4\frac{1}{2}Tl_2SO_4$; 1.5 = $Pr_2(SO_4)_3.5Tl_2SO_4$.

PRASEODYMIUM SELENATE $Pr_2(SeO_4)_3.?H_2O$.

Solubility of Praseodymium Selenate in Water.

(Friend, 1932.)

t°	Gms. $Pr_2(SeO_4)_3$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Pr_2(SeO_4)_3$ per 100 gms. sat. sol.	Solid Phase
0.5	26.59	$Pr_2(SeO_4)_3.?H_2O$	55.5	23.99	$Pr_2(SeO_4)_3.?H_2O$
17.4	23.88	"	59.5	23.33	$Pr_2(SeO_4)_3.12H_2O$
24.6	24.29	"	63.6	14.00	"
30.0	24.50	"	67.0	9.96	"
40.2	23.67	"	75.0	6.89	"
48.6	24.00	"	81.0	5.64	"
52.0	23.89	"	92.0	2.99	"

Owing to hydrolysis, especially at the higher temperatures, the saturated solutions were usually slightly acid. Difficulties were experienced in obtaining concordant results. Determinations were also made of the influence of small amounts of free selenic acid upon the solubility of the salt.

PRASEODYMIUM TUNGSTATE $Pr_2(WO_4)_3$.

One liter water dissolves 0.0438 gm. $Pr_2(WO_4)_3$ at 75°. (Hitchcock, 1895.) WO

PLATINUM ALLOYS.

Solubility of Platinum Alloys in Nitric Acid.

(Winkler — Z. anal. Ch. 13, 369, '74.)

Alloy.	Approx. per cent Pt in Alloy.	Grams Alloy Dissolved per 100 Grams HNO_3 Solution of 1.398 Sp. Gr.	1.298 Sp. Gr.	1.190 Sp Gr.	1.298 Sp. Gr.:
Pt and Silver	10	57	44	69	37
"	5	69	57	51	35
"	2.5	62	61	69	..
"	1	75	70	76	..
Pt and Copper	10	46	27	11	51
"	5	36	34	14	41
"	2.5	51	40	30	..
"	1	52	41	37	..
Pt and Lead	10	7	9	8	..
"	5	8	9	10	..
"	2.5	22	17	11	..
"	1+	21	18	23	..
Pt and Bismuth	10	14	19	4	3
"	5	21	20	6	18
"	2.5	25	42	8	..
"	1	49	64	10	..
Pt and Zinc	10	10	11	19	5
"	5	16	12	6	11
"	2.5	16	24	19	..
"	1	20	32	37	..

PLATINUM BROMIDE $PtBr_4$.

100 grams sat. aqueous solution contain 0.41 gram $PtBr_4$ at 20°.
(Halberstadt — Ber. 17, 2962, '84.)

PLATINUM CHLORIDE $PtCl_4 \cdot 5H_2O$.

100 gms. sat. solution of Platinum Chloride in Water contain 58.7 gms. $PtCl_4$ at 25°. (Geake, 1926.)

PLATINUM Potassium BROMIDE PtK_2Br_6.

100 gms. sat. solution in Water contain 2.02 gms. PtK_2Br_6 at 20°. (Halberstadt)

PLATINIC DOUBLE CHLORIDES of Ammonium, Caesium, Potassium, Rubidium and Thallium. (Data for each separately.)

SOLUBILITY IN WATER.

(Crookes — Chem. News 9, 37, 205, '64; Bunsen — Pogg. Ann. 113, 337, '61.)

Cl

t°.	Grams per 100 Grams Water.				
	$(NH_4)_2PtCl_6$.	Cs_2PtCl_6.	K_2PtCl_6.	Rb_2PtCl_6.	Tl_2PtCl_6.
0	...	0.024	0.74	0.184	...
10	0.666 (15°)	0.050	0.90	0.154	0.0064 (15°)
20	...	0.079	1.12	0.141	...
25	...	0.095	1.26	0.143	...
30	...	0.110	1.41	0.145	...
40	...	0.142	1.76	0.166	...
50	...	0.177	2.17	0.203	...
60	...	0.213	2.64	0.253	...
70	...	0.251	3.19	0.329	...
80	...	0.291	3.79	0.417	...
90	...	0.332	4.45	0.521	...
100	1.25	0.377	5.18	0.634	0.050

SOLUBILITY OF POTASSIUM CHLOROPLATINATE IN WATER AND IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AND OF SODIUM CHLORIDE.

(Archibald, Wilcox and Buckley, 1908.)

Solubility in Water.		In Aq. KCl at 20°.		In Aq. NaCl at 16°.	
t°.	Gms. K_2PtCl_6 per 100 Gms. H_2O.	Gm. Mols. KCl per Liter.	Gms. K_2PtCl_6 per 100 Gms. Solvent.	Gm. Mols. NaCl per Liter.	Gms. K_2PtCl_6 per 100 Gms. Solvent.
0	0.4784	0.20	0.0236	0	0.672
10	0.5992	0.25	0.0207	0.05	0.700
20	0.7742	0.50	0.0109	0.10	0.729
30	1	1	0.0046	0.25	0.758
40	1.355	2	0.0045	0.50	0.775
60	2.444	3	0.0043	0.75	0.791
80	3.711	4	0.0042	1	0.805
100	5.030	sat.	0.0034	2	0.834

SOLUBILITY OF POTASSIUM CHLOROPLATINATE IN AQUEOUS SOLUTIONS OF METHYL ALCOHOL AND OF ETHYL ALCOHOL AT 20°.

(Archibald, Wilcox and Buckley, 1908.)

Wt. Per cent Alcohol in Solvent.	Gms. K_2PtCl_6 per 100 Gms.: Aq. CH_3OH.	Aq. C_2H_5OH.	Wt. Per cent Alcohol in Solvent.	Gms. K_2PtCl_6 per 100 Gms.: Aq. CH_3OH.	Aq. C_2H_5OH.
0	0.7742	0.7742	50	0.0625	0.0491
5	0.535	0.491	60	0.0325	0.0265
10	0.412	0.372	70	0.0182	0.0128
20	0.264	0.218	80	0.0124	0.0085
30	0.1831	0.134	90	0.0038	0.0025
40	0.1165	0.076	100	0.0027	0.0009

100 gms. aq. 8.2% isobutyl alcohol dissolve 0.625 gm. K_2PtCl_6 at 20°.
100 gms. aq. sat. isobutyl alcohol dissolve 0.318 gm. K_2PtCl_6 at 20°.
(Archibald, Wilcox and Buckley, 1908.)

One liter of 55% alcohol dissolves 0.150 gm. $(NH_4)_2PtCl_6$ at 15–20°. (Fresenius, 1846.)
" 76% " " 0.067 " " " "
" 95% " " 0.0037 " " " "

PLATINUM Potassium CHLORIDE

100 gms. of aqueous 2.0 normal KCl solution dissolve 5.03 gms. PtK_2Cl_6 at 100°. (Archibald and Kern, 1917.)

SOLUBILITY OF PLATINUM POTASSIUM CHLORIDE IN AQUEOUS ETHYL ALCOHOL AT 14°.

Cl

(Pierrat, 1921.)

Constant agitation for several hours was employed for securing saturation.

Wt. per cent C_2H_5OH in solvent.	Gms. K_2PtCl_6 per liter sat. sol.	Wt. per cent C_2H_5OH in solvent.	Gms. K_2PtCl_6 per liter sat. sol.
0.0	9.3	42.4	0.5
8.7	4.2	58.5	0.2
15.9	2.6	94.7	0.02
27.3	1.4		

DISTRIBUTION OF PLATINUM CHLORIDE BETWEEN WATER AND ETHER AT ORD. TEMP. (Mylius, 1911.)

When 1 gm. of platinum as chloride is dissolved in 100 cc. of aq. 10% HCl and shaken with 100 cc. of ether, 0.01 per cent of the platinum enters the etheral layer. If water is used instead of 10% HCl, approximately the same per cent of Pt enters the ether layer.

100 cc. anhydrous hydrazine dissolve 1 gm. platinic chloride, with formation of a black precipitate at room temp. (Welsh and Broderson, 1915.)

Chloro**PLATINATES** of Hydrocarbon Sulfines.

SOLUBILITY OF EACH IN WATER AT 16°. (Strömholm, 1900.)

Chloroplatinate. Name.	Formula.	Gms. Salt per 100 Gms. Sat. Solution.
Trimethyl Sulfine Chloroplatinate	$[(CH_3)_3S]_2PtCl_6$	0.47
Dimethyl Ethyl Sulfine Chloroplatinate	$[(CH_3)_2(C_2H_5)S]_2PtCl_6$	3.43
Methyl Diethyl Sulfine Chloroplatinate	$[CH_3(C_2H_5)_2S]_2PtCl_6$	2.42
Triethyl Sulfine Chloroplatinate	$[(C_2H_5)_3S]_2PtCl_6$	1.98

Similar results for more complex sulfines are also given.

PLATINO AMINES.

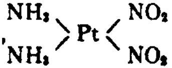
SOLUBILITY IN WATER. (Cleve, 1866?)

Amine.	Formula.	Gms. per 100 Gms. H_2O.
Platino Semi Diamine Chloride	$Pt<\substack{(NH_3)_2.Cl \\ Cl}$	0.26 at 0°, 3.4 at 100°
Chloro Platino Amine Chloride	$Cl_2Pt<\substack{NH_3Cl \\ NH_3Cl}$	0.14 at 0°, 3 at 100°
Chloro Platino Semi Diamine Chloride	$Cl_3Pt(NH_3)_2Cl$	0.33 at 0°, 1.54 at 100°

PLATINOUS NITRITE AMMONIUM COMPOUNDS.

SOLUBILITY IN WATER. (Tschugaev and Kiltinovie, 1916.)

When ammonia is added to a cold solution of potassium platinonitrite a copious precipitate of the composition $Pt2NH_3(NO_2)_2$, is obtained. By comparison of the solubility of this precipitate with that of each of three hitherto described ammonioplatinum compounds, it was found that the precipitate obtained as described, corresponds to the *cis* form of dinitrodiammonio platinum,



$\begin{matrix} NH_3 \\ NH_3 \end{matrix} > Pt < \begin{matrix} NO_2 \\ NO_2 \end{matrix}$

The results for the solubility of *cis* and *trans* dinitro diammonio platinum and of tetra ammonia platinous platinonitrite in water, are as follows:

t°.	Gms. Each Compound per 100 Gms. H_2O. *cis* $Pt2NH_3(NO_2)_2$.	*trans* $Pt2NH_3(NO_2)_2$.	$[Pt4NH_3][Pt(NO_2)_4]$.
25	0.083	0.063	0.011
63	0.66	0.49	...
74.4	...	0.81	...
95	2.32	1.85	...

Determinations of the solubility of several mixtures of the *cis* and *trans* compounds in water are also given.

Cl

PLATINUM CHLORIDE and NITRATE COMPLEX COMPOUNDS

SOLUBILITY OF EACH SEPARATELY IN WATER.

(Tschugajew, 1926.)

t°	Compound	Gms. Cm'p'd. per 100 gms. sat. sol.
0	$[Pt5NH_3Cl]Cl_3$	14.79
0	$[Pt6NH_3]Cl_4$	2.83
0	$[Pt5NH_3OH]Cl_3$	2.74
0	$[Pt5NH_3Cl](NO_3)_3$	0.98
21	"	2.11

RADIUM EMANATIONS

SOLUBILITY IN WATER. (Boyle, 1911; Kofler, 1913.)

t°.	Solubility. *l* (Boyle).	Solubility. α (Kofler).	t°.	Solubility. *l* (Boyle).	Solubility. α (Kofler).
0	0.508	0.54	30	0.195	0.205
5	0.41	0.442	40	0.16	0.165
10	0.34	0.37	50	...	0.14
15	0.29	0.31	60	...	0.12
20	0.245	0.265	70	...	0.11
25	0.215	0.232	90	...	0.108

The results of Boyle are in terms of *l*, the Ostwald Solubility Expression (see p. 1136). Those of Kofler are in terms of the expression $\alpha = \frac{V - v}{v} \cdot \frac{E'}{E}$, where *V* and *v* are the volumes involved and *E'* and *E* the total amount of emanation contained respectively in the air and in the liquid.

RADIUM EMANATIONS.

SOLUBILITY OF RADIUM EMANATIONS IN WATER. (Von Antropoff, 1919.)

A highly refined apparatus was used. The results are given in terms of the Ostwald solubility expression *l* which gives the distribution relation of the gas between the liquid and the gas phase, and in terms of the Bunsen absorption coefficient, β, as modified by Kuenen. This latter is the volume of gas, reduced to normal conditions, dissolved by unit weight of solvent. The author also gives a detailed description of the principles of gas solubility.

t°.	*l*.	β.	t°.	*l*.	β.
0	0.510	0.510	40	0.145	0.126
10	0.337	0.326	50	0.119	0.100
20	0.238	0.222	60	0.106	0.085
30	0.180	0.162			

SOLUBILITY OF RADIUM EMANATIONS IN ORGANIC SOLVENTS. (Schulze, 1920.)

The results are given in terms of the Ostwald solubility expression *l*, which is the relation of the concentration of the gas in the liquid to that in the gas space.

t°.	Solubility of Radium Emanations, *l* in : Toluene.	Ether.	$CHCl_3$.	Acetone.	CS_2.	$CH_3COOC_2H_5$.	C_2H_5OH.	Hexane.
−18	27.0	29.1	28.4	10.7	50.3	13.6	11.4	35.2
−10	22.5	–	23.8	9.3	41.5	–	–	28.5
− 5	20.6	21.9	21.6	8.5	37.0	–	–	25.7
0	18.4	19.9	19.6	8.0	33.4	9.41	8.28	23.4
+ 5	17.0	18.2	18.1	7.4	–	–	–	21.4
10	15.7	16.9	16.7	6.9	27.2	8.0	6.93	19.6
15	13.9	15.8	15.6	6.5	–	–	–	17.9
18	13.2	15.1	15.0	6.3	23.1	7.16	6.17	16.6
20	–	14.8	14.6	6.1	–	–	6.03	–
25	11.4	14.0	13.8	5.8	21.5	6.57	–	14.7
30	10.5	13.3	13.1	5.6	20.1	–	5.30	13.3
40	8.87	–	11.9	5.2	18.1	5.64	4.72	–
50	7.6	–	11.2	–	–	5.22	4.26	–
60	6.42	–	–	–	–	4.9	–	–

The solubility *l* in aniline is 4.43 at 0° and 3.8 at 18°.

The solubility *l* in benzene is 12.82 at 18°.

The author also quotes data for the densities of the solvents at the several temperatures.

SOLUBILITY OF RADIUM EMANATIONS IN SEVERAL SOLVENTS.

(Ramstedt, 1911; Swinne, 1913.)

Solvent.	Results at 0°. l_0.	Results at 0°. Sp. Gr. of Sol.	Results at 18°. l_{18}.	Results at 18°. Sp. Gr. of Sol.	Results at 14°. (Boyle, 1911.) l_{14}
Water	0.52	0.9999	0.285	0.9986	0.30
Sea Water	...	...	...	...	0.255
Ethyl Alcohol	8.28	0.8065	6.17	0.7911	7.34
Amyl Alcohol	...	...	...	...	9.31
Acetone	7.99	0.8186	6.30	0.7972	...
Aniline	4.43	1.0379	3.80	1.0210	...
Benzene	...	...	12.82	0.8811	...
Carbon Disulfide	33.4	1.2921	23.14	1.2640	...
Chloroform	20.5	1.5264	15.08	1.4907	...
Cyclohexane	...	...	18.04	0.7306	...
Ethyl Acetate	9.41	0.9244	7.34	0.9029	...
Ethyl Ether	20.9	0.7362	15.08	0.7158	...
Glycerol	...	...	0.21	1.262	...
Hexane	23.4	0.6769	16.56	0.6612	...
Toluene	18.4	0.8842	13.24	0.8666	13.7

The above results are in terms of the Ostwald Solubility Expression (see p. 1136).

RADIUM BROMIDE, CHLORIDE and NITRATE.

SOLUBILITY OF EACH SEPARATELY IN WATER AT 20°.

(Erbacher, 1930.)

The experiments were made on a scale about one-two hundredth that ordinarily employed for solubility determinations. The results are of special interest in connection with the separation of radium from barium by fractional crystallization of their salts. The results are compared in the following table with those for the corresponding bromides, chlorides and nitrates of calcium, strontium and barium.

Cl

Salt	Gms. per 100 gms. sat. solution of the salts of:			
	Ca	Sr	Ba	Ra
Bromide	58.8	50.0	51.0	41.4
Chloride	42.7	35.0	26.3	19.7
Nitrate	54.8	41.5	7.9	12.2

The distribution of $Ra(NO_3)_2$ between solutions saturated with $Ba(NO_3)_2$ and $Pb(NO_3)_2$ and the solid salts and mixed crystals of these salts has been extensively studied by Chlopin and his students; Chlopin and Polessitsky, 1928; Chlopin, Polessitsky and Tolmatcheff, 1929; Polessitsky, 1932.

Results for the coefficient of distribution of radium and barium in the fractional crystallization of solutions of their bromides, are given by Walter and Schlundt, 1928.

RADIUM SULFATE $RaSO_4$.

SOLUBILITY IN WATER AND IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°.

(Lind, Underwood and Whittemore, 1918.)

Constant agitation was employed and equilibrium was approached from above and from below. The dissolved radium sulfate was determined by the « emanation » method.

SO

Conc. of H_2SO_4.	Gm.×10^{-6} $RaSO_4$ per 25 cc. sat. sol.	Conc. of H_2SO_4.	Gm.×10^{-6} $RaSO_4$ per 25 cc. sat. sol.	Conc. of H_2SO_4.	Gm.×10^{-6} $RaSO_4$ per 25 cc. sat. sol.
0.0 (= H_2O)	2.1	10 Per cent	2.4	50 Per cent	2.1
0.01 normal	2.0 (3.0 at 35°)	15 »	2.4	55 »	3.4
0.10 »	2.2	25 »	2.3 (3.3 at 35° and 5.0 at 45°)	60 »	6.3
1.0 »	2.2	30 »	2.3	65 »	6.4
		45 »	1.9	70 »	>79.0 (not. sat).

Subsequent determinations of the solubility of radium sulfate in water by Erbacher and Nikitin, 1931, made with special reference to the sources of error in the method, resulting from the adsorption of radium by the filtering medium, gave 0.00014 gm. $RaSO_4$ per 100cc H_2O at 20°. This value is about 67 times greater than the above result by Lind and co-workers. In a later paper Nikitin and Tolmatscheff, 1933, revised this value to 0.00021 gm. $RaSO_4$ per 100cc H_2O at 20° They also found that the solubility of radium sulfate in solutions which contain sulfate ions follows the mass action law, taking into conconsideration the activity coefficient of both ions. The activity product at 20° is equal to $4.25\ 10^{-11}$.

RUBIDIUM Penta BORATE $Rb_2O.5B_2O_3.8H_2O$.

SOLUBILITY OF RUBIDIUM PENTA BORATE IN WATER.

(Rollet and Andres, 1930, 1931.)

t°	Gms. $Rb_2O.5B_2O_3$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Rb_2O.5B_2O_3$ per 100 gms. sat. sol.	Solid Phase
−0.43 Eutec.	1.57	Ice+$Rb_2O.5B_2O_3.8H_2O$	45	5.75	$Rb_2O.5B_2O_3.8H_2O$
+0.2	1.58	$Rb_2O.5B_2O_3.8H_2O$	60	8.69	"
5	1.72	"	70.4	11.5	"
13.4	2.21	"	82.4	15.2	"
18	2.57	"	88.15	17.75	"
30	3.58	"	102 (b.pt.)	23.75	"

RUBIDIUM Fluo BORATE $RbBF_4$.

One liter sat. solution of Rubidium Fluo Borate in water contains 0.035 gm. mol. $RbBF_4$ at about 20°. (van Liempt, 1927.)

RUBIDIUM BROMIDE RbBr.

Br

SOLUBILITY IN WATER.

(Rimbach, 1905.)

t°.	Gms. RbBr per 100 Gms. Water.	Gms. RbBr per 100 Gms. Solution.	t°.	Gms. RbBr per 100 Gms. Water.	Gms. RbBr per 100 Gms. Solution.
0.5	89.6	47.26	39.7	131.85	56.87
5	98	49.50	57.5	152.47	60.39
16	104.8	51.17	113.5	205.21	67.24

Freezing-point data for RbBr + AgBr are given by Sandonnini (1912a).

100 gms. sat. solution of Rubidium Bromide in Water contain 50.02 gms. RbBr at 18°. (Lannung, 1934.) and 53.69 gms. at 25°. (Fajans and Karagunis, 1931.)

100 gms. sat. solution of Rubidium Bromide in Liquid Ammonia contain 18.23 gms. RbBr at 0°. (Linhard and Stephan, 1934.)

1000 gms. pure Acetone dissolve 0.0505 gm. RbBr at 18° and 0.047 gm. at 37°. (Lannung, 1932.)

100 cc sat. solution of Rubidium Bromide in Ethyl Urethan ($NH_2COOC_2H_5$) contain 0.566 gm. RbBr at 60°. (Stuckgold, 1917.)

RUBIDIUM Iodo BROMIDE $RbIBr_2$.

100 gms. sat. solution of Rubidium Iodo Bromide in Water contain about 44 gms. $RbIBr_2$ and the solution has d.= 3.84 at about 20° (?). (Wells and Wheeler, 1892.)

One liter sat. solution of Rubidium Iodo Bromide in Carbon Tetra Chloride contains 0.001 gm. mol. $RbIBr_2$ at 25°. (Cremer and Duncan, 1931.)

RUBIDIUM BROMATE $RbBrO_3$.

100 gms. H_2O dissolve 2.93 gms. $RbBrO_3$ at 25°, 3.55 gms. at 30°, 4.28 gms. at 35° and 5.08 gms. at 40°. (Buell and Mc Crosky, 1921.)

RUBIDIUM METHIONATE and Chlor Methionate.

SOLUBILITY OF EACH IN WATER AT 25°

Compound	Formula	Gms. Compound per 100 gms. H_2O	Authority
Rubidium Methionate	$Rb_2[CH_2(SO_3)_2]$	4.93	(Backer and Terpstra, 1929.)
Rubidium Chlor Methionate	$Rb_2[CHCl(SO_3)_2]$	30.4	(Backer, 1930.)

RUBIDIUM FORMATE $HCOORb.{}^1/_2H_2O$.

SOLUBILITY OF RUBIDIUM FORMATE IN WATER. (Sidgwick and Gentle, 1922.)

t°.	Gms. HCOORb per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. HCOORb per 100 gms. sat. sol.	Solid Phase.
− 1.82	6.23	Ice	16.3	84.61	$HCOORb.H_2O$
− 5.62	15.93	»	16.5 tr. pt.	−	» $+HCOORb.{}^1/_2H_2O$
− 7.82	20.62	»	28.3	83.60	$HCOORb.{}^1/_2H_2O$
−10.62	25.79	»	43.6	87.77	»
−13.88	30.62	»	49.9	89.23	»
+ 3.3	78.86	$HCOORb.H_2O$	46.9	80.23 (unstable)	»
7.8	80.71	»	51.0 tr. pt.	−	» +HCOORb
9.5	81.37	»	60.8	90.06	HCOORb
14.0	83.59	»	101.7	93.89	»
			170.0 m. pt.	100.0	»

CH

RUBIDIUM ACETATE CH_3COORb.

SOLUBILITY OF RUBIDIUM ACETATE IN WATER.
(Sidgwick and Gentle, 1922.)

t°.	Gms. CH_3COORb per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. CH_3COORb per 100 gms. sat. sol.	Solid Phase.
− 2.79	9.59	Ice	− 9.5	82.92	CH_3COORb
− 5.27	16.11	»	+44.7	86.23	»
− 6.82	19.64	»	99.4	89.30	»
−10.27	25.57	»	125.2	91.35	»
			246.0 m. pt.	100.00	»

RUBIDIUM Phenyl ACETATE $RbCH_2C_6H_5COO$.

Fusion-point data for $RbCH_2C_6H_5COO + CH_2C_6H_5COOH$ are given by BaKunin and Vitale, 1935.)

RUBIDIUM Dihydroxy TARTARIC ACID $Rb_2C_4H_4O_8.3H_2O$.

100 gms. H_2O dissolve 6.51 gms. $Rb_2C_4H_4O_8.3H_2O$ at 0°. (Fenton, 1898.)

On account of the unstable character of the compound, only ½ hour was allowed for saturation of the solution.

RUBIDIUM BENZOATE C_6H_5COORb.

SOLUBILITY OF RUBIDIUM BENZOATE IN WATER. (Sidgwick and Ewbank, 1922.)

t°.	Gms. C_6H_5COORb per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. C_6H_5COORb per 100 gms. sat. sol.	Solid Phase.
− 1.56	9.41	Ice	+15.0	56.06	C_6H_5COORb
− 4.71	21.15	»	51.5	59.70	»
− 9.64	33.32	»	82.0	63.23	»
−14.75	45.75	»	147.0	70.32	»

RUBIDIUM HydroxyBENZOATES *o*, *m* and *p* $C_6H_4OH.COORb$.

SOLUBILITY OF EACH SEPARATELY IN WATER. (Sidgwick and Ewbank, 1922.)

Results for Rubidium Ortho Hydroxy Benzoate (= Rb Salicylate).

t°.	Gms. (*o*) $C_6H_4OHCOORb$ per 100 gms. sat. sol	Solid Phase.
− 1.62...	12.34	Ice
− 3.69...	23.48	»
− 6.34...	33.81	»
− 8.82...	42.77	»
−13.17...	53.40	»
+ 8.0....	64.85	(*o*) $C_6H_4OHCOORb.H_2O$
21.5...	68.15	(*o*) $C_6H_4OH.COORb.H_2O$
27.0...	69.84	»
49.0...	74.97	(*o*) $C_6H_4OH.COORb$
73.0...	77.96	»
88.0...	79.89	»
134.0...	86.36	»

Results for Rubidium Meta Hydroxy Benzoate.

t°.	Gms. (*m*) $C_6H_4OHCOORb$ per 100 gms. sat. sol.	Solid Phase.
− 2.23	14.92	Ice
− 6.41	32.13	»
−13.69	48.88	» + (*m*) $C_6H_4OHCOORb.H_2O$
+14.0	50.61	(*m*) $C_6H_4OHCOORb.H_2O$
32.5	54.94	»
45.0	60.02	»
64.0	65.04	(*m*) $C_6H_4OH.COORb$
88.0	70.45	»
105.0	74.49	»
130.0	79.91	»

Results for Rubidium Para Hydroxy Benzoate.

t°.	Gms. (*p*) $C_6H_4OH.COORb$ per 100 gms. sat. sol.	Solid Phase.
− 1.17	9.92	Ice
− 2.47	17.47	»
− 4.22	26.22	»
+17.5	35.66	•(*p*) $C_6H_4OHCOORb.H_2O$
45.0	45.95	»
68.0	55.73	»
94.0	64.95	(*p*) $C_6H_4OH.COORb$
120.5	74.00	»
127.0	75.92	»

CH

RUBIDIUM MANDELATE (Racemic and Laevo) $RbC_8H_7O_3$.

EQUILIBRIUM IN THE SYSTEM RACEMIC RUBIDIUM MANDELATE, RACEMIC MANDELIC ACID AND WATER AT 35°.

(Ross and Morrison, 1936.)

Gms. per 100 gms. sat. sol.		Solid Phase
$C_8H_8O_3$	$RbC_8H_7O_3$	
3.9	73.2	1.1
6.5	55.1	"
8.4	48.9	"
12.5	43.7	"
14.3	42.1	"
20.7	41.0	"
21.0	40.1	1.3
20.0	36.0	"
19.7	33.7	"
18.3	27.5	"
20.1	22.8	1.3
23.2	20.1	"
30.8	15.8	"
43.5	13.9	"
40.3	13.4	" + $C_8H_8O_3$
28.9	7.8	$C_8H_8O_3$
21.1	3.7	"
19.5	2.6	"
17.8	1.0	"
16.95	0.0	"

1.1 = $RbC_8H_7O_3.C_8H_8O_3$; 1.3 = $RbC_8H_7O_3.3C_8H_8O_3$.

EQUILIBRIUM IN THE SYSTEM LAEVO RUBIDIUM MANDELATE LAEVO MANDELIC ACID AND WATER AT 25°.

(Ross, Morrison and Johnstone, 1937.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$C_8H_8O_3$	$RbC_8H_7O_3$		$C_8H_8O_3$	$RbC_8H_7O_3$	
10.1	0.0	$C_8H_8O_3$	34.2	31.4	$C_8H_8O_3$
10.0	3.1	"	39.0	33.8	"
10.5	6.1	"	41.2	34.3	"
11.3	8.7	"	45.3	40.8	"
13.0	13.7	"	45.8	41.7	"
20.7	21.8	"	45.8	41.7	"
26.9	27.9	"	45.5	44.9	"

Owing to viscosity of the solutions other points on the curve could not be obtained and no acid salt was isolated.

RUBIDIUM Benzene **SULFONATES**

CH

SOLUBILITY OF EACH SEPARATELY IN WATER AT 25°.

(Elgersma, 1929.)

Compound	Formula	Gms. Compound per 100 gms. H_2O
Rb -2- Nitro Benzene Sulfonate	$Rb[C_6H_4(NO_2)SO_3]$	16.08
" -3- " " "	"	6.09
" -4- " " "	"	5.80
" -2,4- Dinitro" "	$Rb[C_6H_3(NO_2)_2SO_3]$	3.90
" -2- Nitro-4-Chlor Benzene Sulfonate	$Rb[C_6H_3(NO_2)Cl.SO_3]$	1.93
" -2- " -5- " " "	"	1.07
" -3- " -6- " " "	"	1.32
" -2- " -4- Brom " "	$Rb[C_6H_3(NO_2)BrSO_3]$	1.80

RUBIDIUM BiCARBONATE $RbHCO_3$.

100 gms. sat. solution in H_2O contain 53.73 gms. $RbHCO_3$ at about 20°. (de Forcrand, 1909.)

RUBIDIUM CARBONATE Rb_2CO_3.

100 gms. absolute alcohol dissolve 0.74 gm. Rb_2CO_3. (Bunsen.)

RUBIDIUM OXALATE $Rb_2C_2O_4$.

EQUILIBRIUM IN THE SYSTEM RUBIDIUM OXALATE, ZIRCONIUM OXALATE AND WATER AT 19°.

(Boulanger, 1936.)

Gms. per 100 gms. sat. sol. $Rb_2C_2O_4$	Gms. per 100 gms. sat. sol. $ZrOC_2O_4$	Solid Phase	Gms. per 100 gms. sat. sol. $Rb_2C_2O_4$	Gms. per 100 gms. sat. sol. $ZrOC_2O_4$	Solid Phase
26.68	0.0	$Rb_2C_2O_4$	11.0	1.2	2.1.1.2
22.5	trace	"	10.76	1.76	"
22.45	0.2	1.1.1.3	10.67	3.22	"
22.4	0.65	"	9.0	3.0	$ZrO.C_2O_4.xH_2O$(?)
17.4	0.74	"	8.63	2.63	"
14.5	0.77	"	6.5	2.0	"
12.7	0.91	"	3.50	0.55	"

COO

1.1.1.3 = $Rb_2C_2O_4.ZrOC_2O_4.(COOH)_2.3H_2O$.
2.1.1.2 = $2Rb_2C_2O_4.ZrOC_2O_4.(COOH)_2.2H_2O$.

These double salts obtained only upon evaporation of the solutions.

RUBIDIUM Telluric Acid OXALATE $Rb_2[H_6TeO_6.C_2O_4]$.

SOLUBILITY IN WATER.

(Rosenheim and Weinheber, 1910–11.)

t°.	0°	20°	30°	40°	50°
Gms. $Rb_2[H_6TeO_6.C_2O_4]$ per 100 gms. H_2O	3.85	7.26	9.40	12.76	16.90

RUBIDIUM CHLORIDE RbCl.

SOLUBILITY IN WATER.

(Rimbach, 1902; Berkeley, 1904.)

t°.	Mols. RbCl per Liter.	Gms. RbCl per 100 Gms. Water.	Gms. RbCl per 100 Gms. Solution.	t°.	Mols. RbCl per Liter.	Gms. RbCl per 100 Gms. Water.	Gms. RbCl per 100 Gms. Solution.
0	5.17	77.0	43.5	60	6.90	115.5	53.6
10	5.55	84.4	45.8	70	7.12	121.4	54.8
20	5.88	91.1	47.7	80	7.33	127.2	56.0
30	6.17	97.6	49.4	90	7.52	133.1	57.1
40	6.43	103.5	50.9	100	7.71	138.9	58.9
50	6.67	109.3	52.2	112.9	7.95	146.6	59.5

Cl

The following determinations of the Sp. Gr. of the sat. solutions are given by Berkeley.

t°.	0.55	18.7	31.5	44.7	60.25	75.15	89.35	114*
Sp. Gr.	1.4409	1.4865	1.5118	1.5348	1.5558	1.5746	1.5905	1.6148

* Boiling-point.

100 gms. sat. solution of Rubidium Chloride in Water contain 45.98 gms. RbCl at 18° (Lannung, 1934.) and 48.54 gms. at 25°. (Fajans and Karanganis, 1931.)

100 gms. methyl alcohol dissolve	1.41	gms. RbCl at 25°.	(Turner and Bissett, 1913.)
" ethyl " "	0.078	gm. " " "	" "
" propyl " "	0.015	" " " "	" "
" amyl " "	0.0025	" " " "	" "

100 cc. anhydrous hydrazine dissolve 5 gms RbCl at room temp. (Welsh and Broderson, 1915.)

1000 gms. Acetone, $(CH_3)_2CO$, dissolve 0.0021 gm. RbCl at 18° and 0.0024 gm. at 37°. (Lannung, 1932.)

RUBIDIUM CHLORIDE

100 gms. sat. solution of Rubidium Chloride in Liquid Ammonia contain 0.289 gm. RbCl at 0°. (Linhard and Stephan, 1934.)

100 gms. liquid Sulfur Dioxide dissolve 0.329 gm. RbCl at 0°. (Jander and Ruppolt, 1937.)

100 gms. sat. solution of Rubidium Chloride in Selenium Oxy Chloride ($SeOCl_2$) contain 3.56 gms. RbCl at 25°. (Wise, 1922.)

Fusion-point data are given for:

Rb_2Cl_2	+ Rb_2SO_4	(Dombrovskaya, 1933.)
RbCl	+ $RbNO_3$	(Rostkowski, 1930.)
"	+ $SrCl_2$	(Hofmann, 1927.)
"	+ AgCl	(Sandonini, 1911, 1914.)
"	+ TlCl	" " "
"	+ NaCl	(Zemczuzny and Rimbach, 1910.)

RUBIDIUM Iridium CHLORIDES.

Solubilities in Water.

(Delépine, 1908.)

Salt.	Formula.	t°.	Gms. Salt per 100 Gms. H_2O.
Rubidium Chloroiridate	Rb_2IrCl_6	19	0.0555
Trirubidium Hexachloroiridite	$Rb_3IrCl_6.H_2O$	19	0.91
Dirubidium Aquopentachloroiridite	$Rb_2IrCl_5(H_2O)$	19	1.05

RUBIDIUM Platinum CHLORIDE Rb_2PtCl_6.

Solubility of Rubidium Chloroplatinate in Water.

(Archibald and Hallett, 1925.)

Saturation obtained by constant agitation for long periods. A weighed amoun of the salt was agitated with 100 gms. H_2O and the undissolved portion was determined and the amount dissolved estimated by difference.

t°.	Gms. Rb_2PtCl_6 per 100 gms. H_2O.	t°.	Gms. Rb_2PtCl_6 per 100 gms. H_2O.	t°.	Gms Rb_2PtCl_6 per 100 gms. H_2O.
0.....	0.0137	40.....	0.0565	80.....	0.1824
10.....	0.0200	50.....	0.0737	90.....	0.2472
20.....	0.0283	60.....	0.0997	100.....	0.3340
30.....	0.0397	70.....	0.1324		

RUBIDIUM Tellurium CHLORIDE Rb_2TeCl_6

100 gms. aq. HCl of 1.2 Sp. Gr. dissolve 0.34 gm. Rb_2TeCl_6 at 23°.
100 gms. aq. HCl of 1.05 Sp. Gr. dissolve 13.09 gms. Rb_2TeCl_6 at 23°.
(Wheeler, 1893.)

RUBIDIUM Thallium CHLORIDE $3RbCl \cdot TlCl_3 . 2H_2O$.

100 gms. H_2O dissolve 13.3 gms. at 18°, and 62.5 gms. at 100°. (Godeffroy, 1886.)

RUBIDIUM CHLORATE $RbClO_3$.

SOLUBILITY IN WATER.

(Calzolari, 1912.)

t°.	Gms. $RbClO_3$ per 100 Gms. H_2O.	t°.	Gms. $RbClO_3$ per 100 Gms. H_2O.
0	2.138	42.2	12.48
8	3.07	50	15.98
19.8	5.36	76	34.12
30	8	99	62.8

There is some uncertainty as to whether the results of Calzolari refer to 100 gms. of H_2O or 100 gms. of saturated solution.

100 gms. H_2O dissolve 3.1 gms. $RbClO_3$ at 15° (d_{15} of the sat. sol. = 1.07). (Carlson, '10.)

For earlier data see Reissig, 1863.

RUBIDIUM PerCHLORATE $RbClO_4$.

SOLUBILITY IN WATER.

(Carlson, 1910; Calzolari, 1912.)

t°.	Gms. $RbClO_4$ per 100 Gms. H_2O.		t°.	Gms. $RbClO_4$ per 100 Gms. H_2O	
	(Calzolari.)	(Carlson.)		(Calzolari.)	(Carlson.)
0	0.5	1.1 (1.007)	50	3.5	4.6
10	0.6	1.2	60	4.85	6.27 (1.028)
20	1	1.56 (1.010)	70	6.72	8.2
25	1.2	1.8	80	9.2	11.04 (1.050)
30	1.5	2.2	90	12.7	15.5
40	2.3	3.26 (1.017)	100	18	22 (?) (1.070)

C10

The figures in parentheses are densities of sat. solutions.

100 gms. H_2O dissolve 1.08 gm. $RbClO_4$ at 21.3°. (Longuinine, 1862.)

SOLUBILITY OF RUBIDIUM PERCHLORATE IN SEVERAL SOLVENTS, AT 25°.

(Willard and Smith, 1923.)

Solvent.	$d_{\frac{25}{4}}$ of sat. sol.	Gms. $RbClO_4$ per 100 gms. sat. sol.	Solvent.	$d_{\frac{25}{4}}$ of sat. sol.	Gms. $RbClO_4$ per 100 gms. sat. sol.
Water	1.0060	1.320	*n* Butyl alcohol	0.8059	0.002
Methyl alcohol	0.7875	0.060	*iso* »	0.7982	0.004
Ethyl alcohol	0.7851	0.009	Acetone	0.7865	0.095
n Propyl alcohol	0.7989	0.006	Ethyl acetate	0.8945	0.0016

100 cc. sat. solution of rubidium perchlorate in water contain 1.004 gm. Rb Cl O_4 at 20°. (Moser and Ritchel, 1925.)

SOLUBILITY OF RUBIDIUM PERCHLORATE IN WATER AND IN AQUEOUS ETHYL ALCOHOL.

(Flatt and Jordan, 1930, 1933.)

t°	Vol. Percent C_2H_5OH in Aq. solvent	Gms. $RbClO_4$ per 100 gms. solvent
25	0.0	1.276
"	50.0	0.520
"	75.0	0.204
40	50.0	0.954
"	75.0	0.370

SOLUBILITY OF RUBIDIUM PERCHLORATE IN MIXTURES OF ETHYL ACETATE AND ALCOHOLS AT 25°. (Smith, 1925.)

Composition of solvent.	Gms. $RbClO_4$ per 100 gms sat. sol.
90 vol. % $CH_3COOC_2H_5$ + 10 vol. % CH_3OH	0.24
80 » » + 20 » »	0.43
90 » » + 10 » C_2H_5OH	0.16
80 » » + 20 » »	0.10
80 » » + 20 » 93 % Alcohol	0.27
90 » » + 10 » *n* Butyl Alcohol	0.11
80 » » + 20 » » »	0.13

RUBIDIUM Potassium Per**CHLORATE** $Rb_2K(ClO_4)_3$.

100 gms. sat. solution in H_2O contain 1.55 gms. $Rb_2K(ClO_4)_3$ at 20° (d_{20} of the sat. solution = 1.013). (Carlson, 1910.)

CrO

RUBIDIUM CHROMATE (Mono) Rb_2CrO_4.

SOLUBILITY IN WATER.
(Schreinemakers and Filippo, Jr., 1906.)

t°.	Gms. $RbCrO_4$ per 100 Gms. Solution.	t°.	Gms. $RbCrO_4$ per 100 Gms. Solution.	t°.	Gms. $RbCrO_4$ per 100 Gms. Solution.
−7	36.65	50	47.44	−2.40	15.58
0	38.27	60.4	48.90	−3.25	20.03
10	40.23	Solid Phase, Ice		−4.14	24.28
20	42.42	−0.6	0.95	−5.55	30.15
30	44.11	−1.1	7.22	−6.71	34.31
40	46.13	−1.57	9.87	about −7	36.65

EQUILIBRIUM IN THE SYSTEM RUBIDIUM OXIDE, CHROMIUM TRIOXIDE AND WATER AT 30°.
(Schreinemakers and Filippo, Jr., 1906.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
CrO_3.	Rb_2O.		CrO_3.	Rb_2O.	
0	60.56	RbOH	13.91	3.38	$Rb_2Cr_2O_7$
0	56.82	Rb_2CrO_4	15.05	3.45	" $+Rb_2Cr_3O_{10}$
0.776	37.88	"	15.31	3.59	$Rb_2Cr_2O_7$
2.89	34.89	"	15.19	3.19	$Rb_2Cr_3O_{10}$
4.96	30.20	"	18.96	2.37	"
8.54	28.17	"	24.92	1.66	"
11.98	27.99	"	37.34	1.61	"
15.38	28.73	"	48.20	1.54	"
15.54	28.55	" $+Rb_2Cr_2O_7$	53.87	1.67	"
13.69	23.87	$Rb_2Cr_2O_7$	54.29	1.28	" $+Rb_2Cr_4O_{13}$
9.98	17.56	"	58.69	1.07	$Rb_2Cr_4O_{13}$
5.72	8.47	"	62.38	0.93	"
4.58	7.98	"	62.74	0.93	"
4.87	4.60	"	63.07	0.92	" $+CrO_3$
8.16	3.57	"	62.28	0	CrO_3

RUBIDIUM DICHROMATE $Rb_2Cr_2O_7$.

SOLUBILITY OF THE POLYMORPHIC FORMS IN WATER.
(Stortenbecker, 1907; see also Wyrouboff, 1901.)

t°.	Gms. $Rb_2Cr_2O_7$ per 100 Gms. Sat. Sol. Monoclinic Form.	Triclinic Form.
18	5.42	4.96
24	6.94	6.55
30	9.08	8.70
40	13.22	12.90
50	18.94	18.77
65	28.10	27.30

100 gms. sat. aq. solution contain 9.47 gms. $Rb_2Cr_2O_7$, at 30°. (Schreinemakers and Filippo, Jr., 1906.)

RUBIDIUM FLUORIDE $RbF.1\frac{1}{2}H_2O$.

100 gms. H_2O dissolve 130.6 gms. RbF at 18°. (de Forcrand, 1911.)

100 gms. sat. solutions of Rubidium Fluoride in Water contain 75.06 gm. RbF at 18°. (Lannung, 1934.) F

1000 gms. Acetone, $(CH_3)_2CO$, dissolve 0.0036 gm. RbF at 18° and 0.0039 at 37°. (Lannung, 1932.)

Freezing-point data for the system RbF + HF are given by Webb and Prideaux, 1938.

RUBIDIUM Phospho FLUORIDE $RbPF_6$.

One liter sat. solution of Rubidium Phospho Fluoride in Water contain 0.0758 gm. mol. $RbPF_6$ at 25°. (Lange and Müller, 1930.)

RUBIDIUM Silico FLUORIDE Rb SiF_6.

100 gms. H_2O dissolve 0.16 gm. Rb_2SiF_6 at 20°, and 1.36 gms. at 100°. (Stolba, 1867.)

RUBIDIUM Titano FLUORIDE Rb_2TiF_6.

100 cc sat. solution of Rubidium Titano Fluoride in Water contain 0.8 gm. Rb_2TiF_6 at 20-22°. (Ginsberg, 1932.)

RUBIDIUM IODIDE RbI.

SOLUBILITY OF RUBIDIUM IODIDE IN WATER. I

t°	Gms. RbI per 100 gms. sat. sol.	Authority
6.9	57.9	(Reissig, 1863.)
17.4	60.3	" "
18.0	58.98	(Lannung, 1934.)
25.0	62.05	(Fajans and Karagunis, 1931.)

The system RbI + SbI_3 + H_2O at 12° was studied by Francois, 1937 the author gives his results only in the form of a small diagram f which numerical values can not be obtained. The double salt 3RbI. was identified and the existance of another probably of the composition $3RbI.SbI_3$ was indicated.

The temperature-composition data for the system RbI + I for the range 60° to 238° are given by Briggs and Patterson, 1932. The solid phases in contact with the melt are I, RbI_3 and RbI.

SOLUBILITY OF RUBIDIUM IODIDE IN ORGANIC SOLVENTS.

(Walden, 1906.)

Solvent.	Formula.	Gms. RbI per 100 cc. Solution.	
Acetonitrile	CH_3CN	1.478 at 0°	1.350 at 25°
Propionitrile	C_2H_5CN	0.274 "	0.305 "
Nitromethane	CH_3NO_2	0.567 "	0.518 "
Acetone	$(CH_3)_2CO$	0.960 "	0.674 "
Furfurol	$C_4H_3O.COH$	...	4.930 "

Fusion-point data for RbI + AgI are given by Sandonnini (1912a).

1000 gms. Acetone, $(CH_3)_2CO$, dissolve 6.52 gms. RbI at 18° and 4.95 gms. at 25°. (Laanung, 1932.)

100 cc sat. solution of Rubidium Iodide in ethyl urethan $(NH_2COOC_2H_5)$ contain 4.079 gms. RbI at 60°. (Stuckgold, 1917.)

100 gms. sat. solution of Rubidium Iodide in Liquid ammonia contain 65.15 gm. RbI at -0°. (Linhard and Stephan, 1934.)

Results for the vapor-pressure, temperature relations of the system RbI + SO_2 are given by Foote and Fleischer, 1931.

I

RUBIDIUM Per**IODIDES**

SOLUBILITY IN WATER AT 25°.

(Foote and Chalker, 1908.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
RbI.	I.		RbI.	I.	
61.93	0	RbI	28.01	64.85	RbI_3+I
59.94	5.90	" $+RbI_3$	27.85	65.12	"
57.24	8.02	RbI_3	27.83	65.13	"
33.89	38.08	"	27.99	64.98	"

The results show that RbI_7 and RbI_9 are not formed.

RUBIDIUM IODATE $RbIO_3$.

100 gms. H_2O dissolve 2.1 gms. $RbIO_3$ at 23°. (Wheeler, 1892.)

RUBIDIUM Per**IODATE** $RbIO_4$.

100 gms. H_2O dissolve 0.65 gm. $RbIO_4$ at 13°, $d_{\frac{13}{4}}$ of sat. solution = 1.0052. (Barker, 1908.)

RUBIDIUM PERMANGANATE $RbMnO_4$.

One liter of aqueous solution contains 6.03 gms. $RbMnO_4$ at 7°. (Muthmann and Kuntze, 1894.)

100 cc. sat. aq. solution contain 0.46 gm. $RbMnO_4$ at 2°, 1.06 gms. at 19° and 4.68 gms. at 60°. (Patterson, 1906.)

RUBIDIUM Para**MOLYBDATE** $5Rb_2O.12MoO_3.H_2O$.

100 cc. sat. aq. solution contain 1.941 gms. of the salt at 24°. (Wempe, 1912.)

RUBIDIUM Silico **MOLYBDATE** and Other Salts.

SOLUBILITY OF EACH SEPARATELY IN WATER AT 20°.

(Moser and Ritschel, 1925.)

Salt.	Formula.	Gms. salt. per 1000 cc. sat. sol.
Rubidium Silico Molybdate		

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
RbI.	I.		RbI.	I.	
61.93	0	RbI	28.01	64.85	RbI_3+I

RUBIDIUM AZIDE RbN_3.

100 gms. sat. solution of Rubidium Azide in Water contain 51.7 gms. RbN_3 at 16° and 53.3 gms. at 17°. (Curtius and Rissom, 1898.)

RUBIDIUM NITRATE $RbNO_3$.

SOLUBILITY IN WATER.

(Berkeley, 1904.)

t°.	Mols. $RbNO_3$ Per Liter.	Grams $RbNO_3$ per 100 Gms. Water.	Grams $RbNO_3$ per 100 Gms. Solution.	t°.	Mols. $RbNO_3$ Per Liter.	Gms. $RbNO_3$ per 100 Gms. Water	Gms. $RbNO_3$ per 100 Gms. Solution.
0	1.27	19.5	16.3	60	7.99	200	66.7
10	2.04	33.0	24.8	70	9.02	251	71.5
20	3.10	53.3	34.6	80	9.93	309	75.6
30	4.34	81.3	44.8	90	10.77	375	78.9
40	5.68	116.7	53.9	100	11.54	452	81.9
50	6.88	155.6	60.9	118.3	12.76	617	86.1

NO

The following Sp. Gr. determinations are also given by Berkeley.

t°.	0.6	15.85	31.55	45.85	63.4	75.60	90.95	118.3*
Sp. Gr. Sat. Sol.	0.1389	1.2665	1.4483	1.6216	1.8006	1.9055	2.0178	2.1867

* Boiling-point.

THE SOLUBILITY AND SUPERSOLUBILITY ICE CURVES FOR RUBIDIUM NITRATE AND WATER.

(Jones, 1908.)

t°. of Cryst. of Ice.	Gms. $RbNO_3$ per 100 Gms. H_2O. Solubility Curve.	Gms. $RbNO_3$ per 100 Gms. H_2O. Supersolubility Curve.	t° of Cryst. of Ice.	Gms. $RbNO_3$ per 100 Gms. H_2O. Solubility Curve.	Gms. $RbNO_3$ per 100 Gms. H_2O. Supersolubility Curve.
−0.4	1.16	...	−3.5	...	9.94
−1.8	...	1.24	−2.3	13.97	...
−2.1	...	5.39	−4.2	...	13.97
−1.7	9.94	...	−2.7 Cryohydrate	17.11	...

RUBIDIUM HYDROXIDE RbOH.

100 gms. sat. aqueous solution contain 63.39 gms. RbOH at 30°. (Schreinemakers and Filippo, 1906.)

100 gms. sat. aqueous solution contain 64.17 gms. RbOH at 15°. (de Forcrand, 1909a.)

Fusion-point data for mixtures of RbOH + NaOH are given by (v. Hevesy, 1900).

RUBIDIUM Per RHENATE $RbReO_4$.

One liter sat. solution of Rubidium Per Rhenate in Water contain 10.5 gm. $RbReO_4$ at 19.2° and 14.6 gms. at 24.6°. (Noddak and Noddak, 1931.) ReO

RUBIDIUM Penta SULFIDE Rb_2S_5.

Fusion-point data for the system Rb_2S_5 + S are given by Biltz and Wilke-Dörfurt, 1906.

RUBIDIUM Di SULFITE $Rb_2S_2O_5$.

100 gms. Liquid Sulfur Dioxide dissolve 0.040 gm. $Rb_2S_2O_4$ at 0°. (Jander and Wickert, 1936; Jander and Ruppolt, 1937.)

RUBIDIUM SULFATE Rb_2SO_4.

SOLUBILITY IN WATER.

(Etard, 1894; Berkeley, 1904.)

t°.	Mols. Rb_2SO_4 per Liter.	Gms. Rb_2SO_4 per 100 Gms. Water.	Gms. Rb_2SO_4 per 100 Gms. Solution.	t°.	Mols. Rb_2SO_4 per Liter.	Gms. Rb_2SO_4 per 100 Gms. Water.	Gms. Rb_2SO_4 per 100 Gms. Solution.
0	1.27	36.4	27.3	60	2.15	67.4	40.3
10	1.46	42.6	29.9	70	2.25	71.4	41.7
20	1.64	48.2	32.5	80	2.34	75.0	42.9
30	1.79	53.5	34.9	90	2.42	78.7	44.0
40	1.92	58.5	36.9	100	2.49	81.8	45.0
50	2.04	63.1	38.7	102.4	2.50	82.6	45.2

The following Sp. Gr. determinations are also given by Berkeley.

t°.	0.5	15.80	31.6	44.2	57.90	74.75	89.45	102.4*
Sp.Gr.Sat.Sol.	1.2740	1.3287	1.3704	1.3998	1.4232	1.4480	1.4649	1.4753

* b. pt.

100 cc. sat. solution in absolute H_2SO_4 contain 58.81 gms. Rb_2SO_4. (Bergius, 1910.)

SO

SOLUBILITY OF RUBIDIUM DOUBLE SULFATES IN WATER AT 25°

(Locke, 1902.)

Formula.	Per 100 cc. H_2O. Gms. Anh. Salt.	Per 100 cc. H_2O. Mols. Salt.	Formula.	Per 100 cc. H_2O. Gms. Anh. Salt.	Per 100 cc. H_2O. Mols. Salt.
$Rb_2Cd(SO_4)_2.6H_2O$	76.7	0.1615	$Rb_2Mn(SO_4)_2.6H_2O$	35.7	0.0857
$Rb_2Co(SO_4)_2.6H_2O$	9.28	0.022	$Rb_2Mg(SO_4)_2.6H_2O$	20.2	0.0521
$Rb_2Cu(SO_4)_2.6H_2O$	10.28	0.0241	$Rb_2Ni(SO_4)_2.6H_2O$	5.98	0.0142
$Rb_2Fe(SO_4)_2.6H_2O$	24.28	0.0579	$Rb_2Zn(SO_4)_2.6H_2O$	10.10	0.0236

RUBIDIUM ALUMS.

SOLUBILITY IN WATER.

(Locke, 1901.)

Alum.	Formula.	t°.	Gms. Alum per 100 Gms. H_2O. Anhydrous.	Gms. Alum per 100 Gms. H_2O. Hydrated.	Gms. Alum per 100 Gms. H_2O. G. Mols.
Rb. Aluminum Alum	$RbAl(SO_4)_2.12H_2O$	25	1.81	3.15	0.0059
"	"	30	2.19	...	0.0072
"	"	35	2.66	...	0.0087
"	"	40	3.22	...	0.0106
Rb. Chromium Alum	$RbCr(SO_4)_2.12H_2O$	25	2.57	4.34	0.0079
"	"	30	3.17	...	0.0096
"	"	35	4.11	...	0.0128
"	"	40	5.97	...	0.0181
Rb. Vanadium Alum	$RbV(SO_4)_2.12H_2O$	25	5.79	9.93	0.0177
Rb. Iron Alum	$RbFe(SO_4)_2.12H_2O$	25	9.74	16.98	0.0294
"	"	30	20.24	...	0.0617

Biltz and Wilke, 1906, find for the solubility of rubidium iron alum in water, at 6.6°, 4.55 gms. per 100 cc. solution; at 25°, 29 gms; and at 40°, 52.6 gms.

Fusion-point data for mixtures of Rb_2SO_4 + K_2Cl_2 are given by Dombrovskaya, 1933.

RUBIDIUM SELENATE Rb_2SeO_4.

100 gms. H_2O dissolve 158.9 gms. Rb_2SeO_4 at 12°. (Tutton, 1897.)

SOLUBILITY OF MIXED CRYSTALS OF RUBIDIUM ACID SELENATE AND RUBIDIUM ACID TELLURATE AND OF RUBIDIUM ACID SULFATE AND RUBIDIUM ACID TELLURATE IN WATER AT 25°. (Pellini, 1909.)

Results for $RbHSeO_4$ + $RbHTeO_4$.			Results for $RbHSO_4$ + $RbHTeSO_4$.		
Gms. per 1000 cc. Sat. Sol.		Mol. % Selenate in Solid Phase.	Gms. per 1000 cc. Sat. Sol.		Mol. % Sulfate in Solid Phase.
$RbHSeO_4$.	$RbHTeO_4$.		$RbHSO_4$.	$RbHTeO_4$.	
76.46	39.51	51.55	26.675	38.403	47.91
95.82	35.30	52.22	32.117	31.58	50.33
171.70	22.98	53.95	42.917	26.764	50.74
462.80	5	56.33	59.074	20.182	50.99
859.30	3.40	67.46	498.25	0.02887	52.52

RUBIDIUM SILICOTUNGSTATE $Rb_4SiW_{12}O_{42}$.

100 gms. H_2O dissolye 0.65 gm. $Rb_4SiW_{12}O_{42}$ at 20°, and 5.1 gms. at 100°. (Godeffroy, 1876.)

RHODIUM SALTS. SOLUBILITY IN WATER.

(Jorgensen — J. pr. Ch. [2] 27, 433, '83; 34, 394, '86; 44, 51, '91.)

Salt.	Formula.	t°.	Gms. per 100 Gms. H_2O.
Chloro Purpureo Rhodium Chloride	$ClRh(NH_3)_5Cl_2$	17	0.56
Luteo Rhodium Chloride	$Rh(NH_3)_6Cl_3$	8	13.3
Luteo Rhodium Nitrate	$Rh(NH_3)_6(NO_3)_3$	ord. t.	2.1
Luteo Rhodium Sulphate	$[Rh(NH_3)_6]_2(SO_4)_3.5H_2O$	20	2.3

C1

RHODIUM Pentammin Chloro **CHLORIDE** $[Rh(NH_3)_5Cl]Cl_2$.

100 gms. sat. solution of the salt in water contain 0.828 gm. $[Rh(NH_3)_5Cl.Cl_2$ at 25°. (Semzusni, 1927.)

RHODIUM dextro and racemic Di amino Cyclo **PENTANES.**

Data for the solubility of these complex compounds in water are given by Jaeger and Blumendal, 1928.

RUTHENIUM SALTS

SOLUBILITIES IN WATER.

(Howe, 1894.)

Salt.	Formula.	t°.	Gms. Salt per 100 Gms. H_2O.
Ruthenium Potassium Nitrosochloride	K_2RuCl_5NO	25	12
" " "	"	60	80
" Ammonium Nitrosochloride	$(NH_4)_2RuCl_5NO$	25	5
" " "	"	60	22
" Rubidium Nitrosochloride	Rb_2RuCl_5NO	25	0.57
" " "	"	60	2.13
" " " (hydrated)	$Rb_2RuCl_5NO.2H_2O$	25	114.3
" Caesium Nitrosochloride	Cs_2RuCl_5NO	25	0.20
" " "	"	60	0.56
" " " (hydrated)	$Cs_2RuCl_5.NO.2H_2O$	25	105.8

SULFUR S.

In a series of papers by Aten (1905–06, 1912, 1912–13, 1913, 1914 and 1914a), the preparation and properties of the four known modifications of sulfur are described. These are designated by the symbols, S_λ, S_μ, S_π and S_ρ.

S_λ is ordinary rhombic sulfur and its molecule is considered to be composed of eight atoms of sulfur, S_8.

S_μ is the insoluble, so-called amorphous sulfur.

S_π is obtained when ordinary sulfur is heated above its melting-point and quickly cooled; it is especially easily prepared by warming S_λ in sulfur chloride. Its molecule is probably represented by S_4.

S_ρ was discovered by Engel and is prepared by mixing concentrated HCl, cooled to 0°, with saturated sodium thiosulfate solution. The precipitated NaCl is removed by filtration and the solution extracted with toluene. The aqueous layer soon yields a cloudy precipitate of S_ρ. The molecule of this sulfur is considered to have the composition S_6.

SOLUBILITY OF SULFUR (S_λ) IN SULFUR MONOCHLORIDE (S_2Cl_2) DETERMINED BY THE MELTING-POINT METHOD.

(Aten, 1905–06.)

t° of Melting.	Mol. % S_8 in Mixture.	Solid Phase.	t° of Melting.	Mol. % S_8 in Mixture.	Solid Phase.
−16	4.3	Rhombic S	83.5	67	Rhombic S
0	6	"	95.6	81.8	"
+17.9	9.9	"	86	81.8	Monoclinic S
36.8	17.1	"	103.2	88.4	"
55.2	28.5	"	110.4	95	"
65.6	40.3	"	118.8	100	"
77.7	55.4	"			

More recent determinations of freezing-points in the above system are given by Lowry, McHatton and Jones, 1927.

Results for the solubility of sulfur in sulfur chloride.determined by the synthetic method upon mixtures as such and after preheating to various temperatures, are given by Hammick and Zvegintzof, 1928. These authors point out that the conclusions of Lowry,McHatton and Jones are incorrect in certain respects.

SOLUBILITY OF SULFUR (S_π) IN SULFUR MONOCHLORIDE (S_2Cl_2)

(Aten, 1912–13.)

A preliminary experiment showed that if a solution of S_λ in sulfur monochloride, saturated at 20°, is heated to 170° and cooled, it will then dissolve as much S_λ as already required to saturate it. The following determinations were made by sealing known amounts of S_λ and S_2Cl_2 in tubes, heating them to 100° for several hours and then cooling quickly to the indicated temperatures and shaking for ½ hour in the case of the 0° and 25° results and 2 hours in the case of the −60° results. The saturated solutions were analyzed by oxidizing with HCl + HNO_3 + Br and titrating the H_2SO_4, after removing the volatile acids.

Atoms S per 100 Atoms S+S_2Cl_2 in:				Atoms S per 100 Atoms S+S_2Cl_2 in:			
Original Mixture.	Saturated Solution at:			Original Mixture.	Saturated Solution at:		
	−60°.	0°.	+25°.		−60°.	0°.	+25°.
0	11.6	36.1	53.5	79.4	65.2	72	...
10	18.1	40.1	57.6	80.1	66.1	71.6	...
28.7	31.9	47.4	62	89.9	...	...	82.1
49.9	42.9	56	66.4	90.1	...	80.5	...
60.1	47.7	59.9	69.4	94.6	...	...	87.7
69.1	...	...	72.8	98	...	...	93.4

Results similar to the above are also given (Aten, 1912), for mixtures previously heated to 50°, 75° and 125°. All the data confirm the formation of the the new modification S_π.

SOLUBILITY OF SULFUR (S_γ) IN SULFUR MONOCHLORIDE (S_2Cl_2) AT 25°.

(Aten, 1912, 1913)

The samples were heated to the temperatures indicated and rapidly cooled and powdered. The method of determining the solubilities is not described.

Previous Treatment of Sample.	Atoms S Dissolved per 100 Atoms S + S_2Cl_2.	
Unheated Sulfur	53.5	
Mixture of Rhombic and Amorphous Sulfur	54.5	
Rhombic Sulfur heated to 125°	56–58.5	(depending on excess of S present.)
" " " " 165°	60	(determined immediately.)
" " " " 165°	59.5	" after 1 hr.)
" " " " 165°	57.5	" " 24 hrs.)
" " " " 165°	53.2	" " 8 days.)

100 gms. sat. sol. of sulfur in selenium monochloride (Se Cl) contain 48.81 gms. S at 25°.

(Lenher and Kao, 1925).

SOLUBILITY OF SULFUR IN THE PERSULFIDES OF HYDROGEN.

(Walton and Whitford, 1923.)

The mixtures were constantly stirred in a quartz tube with a quartz stirrer and the solution analyzed repeatedly untill equilibrium had been reached. The analysis was made by adding acetone to decompose the persulfide. The solvents were then allowed to evaporate spontaneously and the residue of rhombic sulfur dried at 90° to constant weight as « sulfur not evolved as hydrogen sulfide ». The existence of a compound having the composition H_2S_4, and stable below — 1°.45 was established. Hydrogen disulfide (H_2S_2) and hydrogen trisulfide (H_2S_3) dissolve sulfur copiously. When these two liquids are saturated with sulfur at a given temperature the two resulting liquid phases have the same composition. The following results were obtained for the solubility of sulfur in the trisulfide of hydrogen.

t°.	Per cent S in sat. sol. not evolved as H_2S.	t°.	Per cent S in sat. sol. not evolved as H_2S.	t°.	Per cent S in sat. sol. not evolved as H_2S.
—34.72	53.56	— 1.45	82.50	35.4	89.46
—15.42	71.18	— 0,05	82.97	45.15	91.00
—10.6	75.16	17.92	86.77	55.3	92.49
— 3.75	80.71	25.4	87.98		

SOLUBILITY OF SULFUR IN AQUEOUS SOLUTIONS OF ALKALIES AT THE ORDINARY TEMPERATURE.

(Calcagni, 1920.)

Solvent.	Gms. S per 100 cc. of sat. solution.	Solvent.	Gms. S per 100 cc. of sat. solution.
Aq. Ammonia ($d = 0.888$)	1.367	Aq. saturated $Mg(OH)_2$	0.014
Aq. 66 % KOH	17.70	" $Ca(OH)_2$	0.112
" NaOH	24.55	" $Ba(OH)_2$	2.60

No difference was found between solutions which had been kept in the dark and in the light.

SOLUBILITY OF SULFUR IN AQUEOUS SODIUM SULFIDE SOLUTIONS.

(Küster and Heberlein, 1905.)

The results are expressed in terms of x which represents the number of S atoms dissolved for each Na_2 in the solution. The figures, therefore, show the atomic ratio of S to Na_2 in the saturated solution and at the same time, the sulfur content of the compound Na_2S_x which is formed. In order to find the actual amount of sulfur dissolved per liter, it is only necessary to multiply the x value by the normality of the aqueous sodium sulfide solution used as solvent in the particular case.

A series of determinations made at 25°, by agitating aqueous sodium sulfide solutions with crystalline sulfur until equilibrium was reached, and then diluting each solution with an equal volume of water and shaking with excess of sulfur until equilibrium was again reached, gave the following results:

Normality of the Aq. Na_2S Solution.	x in the Resulting Na_2S_x.	Normality of the Aq. Na_2S Solution.	x in the Resulting Na_2S_x.
4	4.475	0.125 (32 hrs.)	5.225
2 (2 hrs.)	4.666	0.0625	5.239
1	4.845	0.03125	5.198
0.5	4.984	0.015625	5.034
0.25	5.115	0.007812 (128 hrs.)	4.456

The figures in parentheses in the above table show the number of hours required for attainment of equilibrium in these three cases. The authors also made determinations of the influence of temperature on the amount of sulfur dissolved, and found that for a normal Na_2S solution, the x value did not vary appreciably from the figure given above, over the range 0° to 50°.

Results are also given showing the influence of the presence of NaCl and of KOH on the amount of sulfur dissolved by aqueous Na_2S solutions. In the former case the solubility was distinctly lowered, while in the latter it was notably increased.

SOLUBILITY OF SULFUR IN LIQUID AMMONIA.

(Ruff and Hecht, 1911.)

At the temperatures 0° to 40°, the solutions were constantly shaken for 3 to 4 days. For the results at the lower temperatures the solutions were saturated at room temperature then cooled, partially evaporated and shaken 4 to 6 hours. The saturated solutions were analyzed by evaporation of the ammonia by means of a current of hydrogen, absorbing in HCl and converting to the platinic chloride for weighing. The S residues were dried at 100°, with proper precautions, and weighed.

t°.	Gms. S per 100 Gms. Sat. Solution.	t°.	Gms. S per 100 Gms. Sat. Solution.
−78	38.6*	+16.4	25.65
−20.5	38.1*	30	21
0	32.34	40	18.5

* This figure corresponds to the compound $S(NH_3)_2$ = 38.5% S.

SOLUBILITY OF SULFUR IN ETHYL AND METHYL ALCOHOLS.

t°.	Alcohol.	Gms. per 100 Gms. Alcohol.	Authority.
15	Abs. Ethyl	0.051	(Pohl.)
18.5	"	0.053	(de Bruyn — Z. physik. Chem. 10, 781, '92.)
b. pt.	"	0.42	(Payen — Compt. rend. 34, 356, '52.)
18.5	Abs. Methyl	0.028	(de Bruyn.)

SOLUBILITY OF SULFUR IN AQUEOUS ACETONE AT 25°.

(Herz and Knoch, 1905.)

Wt. Per cent Acetone in Solvent.	Sulfur per 100 cc. Solution. Millimols.	Sulfur per 100 cc. Solution. Gms.	Sp. Gr. of Solution.
100	65	2.084	0.7854
95.36	45	1.442	0.7911
90.62	33	1.058	0.8165
85.38	25.3	0.811	0.8295

SOLUBILITY OF SULFUR IN SEVERAL SOLVENTS AT 25°.

(Hoffmann, Kirmreuther and Thal, 1910.)

Solvent	Formula	Gms. S_8 per 100 gms. sat. sol.
Tetra chlor ethylene	$CCl_2:CCl_2$	1.507
Penta chlor ethane	$CCl_3.CHCl_2$	1.183
Acetylene di chloride	$CHCl:CHCl$(?)	1.260
Tetra chlor ethane	$CHCl_2.CHCl_2$	1.214

SOLUBILITY OF SULFUR IN TRIPHENYL METHANE, DETERMINED BY THE SYNTHETIC METHOD.

Results of Smith, Holmes & Hall, 1905. % Triphenyl Methane in Mixture.	t° of First Limit of Mixing.	% Triphenyl Methane in Mixture.	t° of Second Limit of Mixing.	Results of Kruyt, 1908–09. % Triphenyl Methane in Mixture.	t° of First Limit of Mixing.	% Triphenyl Methane in Mixture.	t° of Second Limit of Mixing.
69.1	108.5	35.5	214.5	66.7	113	7	211.5
58.8	127	32.5	211	60.2	125.3	9.3	201.5
50.8	136.5	28.4	206	50.2	136.8	12	198.8
46.6	141	24.5	203	41	144.2	13.7	199.5
42.8	144	21.6	200	30.8	146	16.4	200.4
37.8	146	19.2	199	20	145.2	19.8	202.1
33.7	146.5	15.4	198	13.2	137.6	23.5	203.7
30.3	147			8.1	118.6	28.7	208
25.4	146			7	crystals	34.5	215.2

Later results for this system are given by Mondain-Monval and Schneider, 1928.

SOLUBILITY OF SULFUR IN:

Tin Tetrachloride.

(Gerardin, 1865.)

t°.	Gms. S per 100 Gms. $SnCl_4$.	Solid Phase.
99	5.8	Solid S
101	6.2	"
110	8.7–9.1	"
112	9.4–9.9	Liquid S
121	17.0	"

Amyl Alcohol.

(Gerardin.)

t°.	Gms. S per 100 Gms. $C_5H_{11}OH$.	Solid Phase.
95	1.5	Solid S
110	2.1–2.2	"
112	2.6–2.7	Liquid S
120	3.0	"
131	5.3	"

SOLUBILITY OF SULFUR IN CARBON TETRACHLORIDE.

(Hildebrand and Jenks, 1921; Delaplace, 1922; Jacek, 1926.)

t°.	Gms. S per 100 gms sat. sol.	t°.	Gms. S per 100 gms. sat. sol.	t°.	Gms. S per 100 gms. sat. sol.
—24.0....	0.148 (J.)	0.0...	0.339 (H. and J.)	25....	0.831 (H. and J
20.75...	0.185 »	15.5...	0.641 (D.)	35....	1.155 »
11.25...	0.255 »	18.....	0.720 »	45....	1.564 »
- 9.0....	0.277 »	22.....	0.748 »	54....	2.008 »
0.0....	0.366 »	23.25..	0.841 (J.)		

SOLUBILITY OF SULFUR IN CARBON DISULFIDE.

(Jacek, 191 .)

Saturation was secured by constant agitation and all necessary precautior were taken for accurate work.

t°.	Gms. S per 100 gms CS_2	t°.	Gms. S per 100 gms CS_2	t°.	Gms. S per 100 gms CS_2
—109.5.....	1.05	—65.....	3.674	—36.5.....	7.950
86.9.....	2.24	- 59.....	4.387	—25.0.....	10.960
— 81.5.....	2.443	—47.....	5.889	—17.0.....	13.96
74.0 . .	2.89	44.....	6.440	—13.0.....	15.28
				0.0.....	23.13

SOLUBILITY OF SULFUR IN CHLOROFORM IN ETHYL ETHER AND IN ETHYLEN CHLORIDE.

In Chloroform. (Delaplace, 1922.)		In Ethyl Ether (anhy.). (Delaplace, 1922)		In Ethylene Chloride. (Hildebrand and Jenks, 1921.)	
t	Gms. S per 100 gms. sat. sol.	t	Gms. S per 100 gms. sat. sol.	t°	Gms. S per 100 gms. sat. sol.
13....	0.790	13.....	0.187	25....	0.826
15	0.868	23....	0.283	40.....	1.380
24.....	1.216			79....	5.43
				97.5...	9.97

SOLUBILITY OF SULFUR (S_μ) IN CARBON DISULFIDE AND CARBON TETRACHLORIDE.

(Wigand, 1910)

When "insoluble" sulfur (S_μ) is treated with CS_2 or CCl_4, a small amount dissolves, depending upon the length of time of contact, temperature and nature of the solvent but not on the relative amount of solvent. This action is explained on the assumption that a partial transformation of S_μ to soluble sulfur S_λ, takes place.

Data for the fusion points of mixtures of rhombic sulfur and "insoluble" sulfur (S_μ) and for monoclinic sulfur and "insoluble" sulfur (S_μ) are given by Kruyt (1908).

SOLUBILITY OF SULFUR IN CARBON DISULFIDE.

(Etard, 1894, Cossa, 1865; at 10°, Retgers, 1893; below 77°, Arctowski, 1895–96.)

t°.	Gms. S per 100 Gms. Solution.	Gms. S per 100 Gms. CS_2	t°.	Gms. S per 100 Gms. Solution.	Gms. S per 100 Gms. CS_2.	t°.	Gms. S per 100 Gms. Solution.	Gms. S per 100 Gms. CS_2
—110	3.0	3.1	—10	13.5	15.6	50	59.0	143.9
—100	3.5	3.6	0	18.0	22.0	60	66.0	194.1
— 80	4.0	4.2	10	23.0*	29.9	70	72.0	257.1
— 60	3.5	3.6	20	29.5	41.8	80	79.0	376.1
— 40	6.0	6.4	25	33.5	50.4	90	86.0	614.1
— 20	10.5	11.7	30	38.0	61.3	100	92.0	1150.0
			40	50.0	100.0			

* 20.4 R.

Sp. Gr. of solution saturated at 15° containing 26 gms. S per 100 gms. solution = 1.372.

The following determinations upon this system were made by Hammik, Cousnes and Langford, 1928, by the method of chilling liquified sulfur.

t°	Percent S_μ dissolved by CS_2	t°	Percent S_μ dissolved by CS_2	t°	Percent S_μ dissolved by CS_2
155	4.3	196	35.0	260	38.6
160	9.1	210	38.7	263	37.7
170	18.4	213	38.8	271	39.9
175	22.7	223	37.1	279	37.9
178	23.5	227	39.0	280	39.3
186	28.7	229	40.7	287	39.9
240	33.9*	242	39.6	271	35.9*
245	34.2*	260	33.7*	290	33.2*
254	30.8*	261	32.6*	299	31.7*
		266	34.8*		

* In these cases the droplets of sulfur were graded as fair, in all other cases, as good.

SOLUBILITY OF OCTOHEDRAL AND OF PRISMATIC SULFUR IN SEVERAL SOLVENTS.

(Brönsted, 1906.)

The solubility of prismatic sulfur could not be determined in the ordinary way on account of its rapid transition to octohedral sulfur. A special apparatus was used which permitted the solvent to remain in contact with the solid for only a short time. Since sulfur dissolves very rapidly, this procedure was found to give satisfactory results.

Solvent.	t°.	Gms. each Variety Separately per 100 cc Saturated Solution. Prismatic Sulfur.	Gms. each Variety Separately per 100 cc Saturated Solution. Octohedral Sulfur.
Benzene	18.6	2.004	1.512
"	25.3	2.335	1.835
Chloroform	0	1.101	0.788
"	15.5	1.658	1.253
"	40	2.9	2.4
Ethyl Ether	0	0.113	0.080
"	25.3	0.253	0.200
Ethyl Bromide	0	0.852	0.611
"	25.3	1.676	1.307
Ethyl Formate	0	0.028	0.019
Ethyl Alcohol	25.3	0.066	0.052

SOLUBILITY OF SULFUR IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms. S per 100 Gms. Solvent.	Solvent.	t°.	Gms. S per 100 Gms. Solvent.
Aniline	130	85.3 (1)	Glycerol	15.5	0.14 (4)
Benzene	15.2	1.5 (2)	Hydrazine (anhy.)	room temp.	54 (decomp.) (5)
"	19.3	1.7 (2)	Lanoline (anhy.)	45	0.38 (6)
"	26	0.97 (1)	Methylene Iodide	10	10 (7)
"	71	4.38 (1)	Nicotine	100	10.6 (8)
Carbon Tetrachloride	25	0.86 (3)	Phenol	174	16.4 (1)
Chloroform	12.2	0.75 (2)	Pentachlor Ethane	25	1.2 (3)
"	19.3	0.92 (2)	Toluene	23	1.48 (1)
"	22	1.21 (1)	Tetrachlor Ethane	25	1.23 (3)
Dichlor Ethylene	25	1.28 (3)	Tetrachlor Ethylene	25	1.53 (3)
Ethylene Chloride	25	0.84 (3)	Trichlor Ethylene	25	1.63 (3)
Ethyl Ether	23.5	0.97 (1)	"	15	1.16 (9)

(1) Cossa, 1868; (2) Brönsted, 1906; (3) Hoffman, Kirmreuther and Thal, 1910; (4) Ossendowski, 1907; (5) Welsh and Broderson, 1915; (6) Klose, 1907; (7) Retgers, 1893; (8) Kleven, 1872; (9) Wester and Bruins, 1914.

SOLUBILITY OF SULFUR IN BENZENE, IN BENZINE AND IN BROMOFORM.

Solvent.	t°.	Gms. S per 100 gms. sat. solution.	Autority.
Benzene	25	2.074	Hildebrand and Jenks, 1921.
»	54	5.165	»
»	84	13.02	»
Benzine	15	1.56	Delaplace, 1922.
»	20	1.96	»
Bromoform	5.6	3.64	Amadori, 1922.

Additional results for the system Sulfur + Bromoform are given by Rheinboldt and Schneider, 1929.

RECIPROCAL SOLUBILITY OF SULFUR AND BENZENE, DETERMINED BY THE SYNTHETIC METHOD.

(Alexejew, 1886.)

t°.	Gms. C_6H_6 per 100 Gms. S Layer.	Gms. C_6H_6 per 100 Gms. C_6H_6 Layer.	t°.	Gms. C_6H_6 per 100 Gms. S Layer.	Gms. C_6H_6 per 100 Gms. C_6H_6 Layer.
100	6	75	140	16	61
110	8	72·5	150	19	55
120	10	70	160	25	45
130	12	66	164 (crit. temp.)	35	

(Kruyt, 1908–09.)

Wt. % S in Mixture.	Limiting t° of Homogeneity. Lower.	Limiting t° of Homogeneity. Upper.	Wt. % S in Mixture.	Limiting t° of Homogeneity. Lower.	Limiting t° of Homogeneity. Upper.
41·5	146	247	79.8	141	230
55·2	158	230	81.4	138	above 246
74·5	157	226	83.4	131	" 272

100 gms. sat. solution of S in benzoyl chloride, $C_6H_5.COCl$, contain 1 gm. S at 0° and 55.8 gms. at 134°. (Bogousky, 1905.)

SOLUBILITY OF SULFUR IN BENZENE AND IN ETHYLENE DIBROMIDE.

(Etard, 1894; see also Cossa, 1868.)

In C_6H_6.

t°.	Gms. S per 100 Gms. Solution.	t°.	Gms. S per 100 Gms. Solution.
0	1·0	70	8.0
10	1·3	80	10·5
20	1·7	90	13·8
25	2·1	100	17·5
30	2·4	110	23·0
40	3·2	120	29·0
50	4·3	130	36·0
60	6.0		

In $C_2H_4Br_2$.

t°.	Gms. S per 100 Gms. Solution.	t°.	Gms. S per 100 Gms. Solution.
0	1.2	50	6.4
10	1·7	60	8.4
20	2·3	70	11·4
25	2.8	80	16·5
30	3·3	90	24·0
40	4·4	100	36·5

SOLUBILITY OF SULFUR IN BENZENE, ACETIC ACID AND THEIR MIXTURES.

(Anders, 1933.)

t°	Wt. % CH_3COOH in C_6H_6 Solvent	Gms. S per 100 gms. sat. sol.	t°	Wt. % CH_3COOH in C_6H_6 Solvent	Gms. S per 100 gms. sat. sol.
0	39.86	0.307	30	0.0	2.019
20	0.0	1.768	30	37.76	0.603
20	37.57	0.541	30	67.76	0.186
20	70.78	0.156	30	100.0	0.037
20	100.00	0.032			

RECIPROCAL SOLUBILITY OF PARA DICHLORO BENZENE AND SULFUR.

(Bruni and Pelizzola, 1921.)

Initial temp. of cryst.	Gms. $C_6H_4Cl_2p$ per 100 gms. mixture.	Initial temp. of cryst.	Gms. $C_6H_4Cl_2p$ per 100 gms. mixture.	Initial temp. of cryst.	Gms. $C_6H_4Cl_2p$ per 100 gms. mixture.
52.9	100.0	79.6	85	96.5	40
52.6	99	86.6	80	97.4	30
52.2	97	94.6	70	98.4	25
51.0 (Eutec.)	–	97.1	60	99.05	20
51.5	95	96.8	55	101.4	10
67.8	90	96.9	50	107.2	5
				113	0(=pure S)

Data for equilibrium in the system Sulfur + Benzoic Acid are given by Hammick and Holt, 1927.

SOLUBILITY OF SULFUR IN PHENOL, DETERMINED BY THE SYNTHETIC METHOD.

(Smith, Holmes and Hall, 1905.)

The mixtures of sulfur and phenol were heated until they were homogeneous and then cooled to the temperature at which clouding appeared.

t° of Clouding.	Gms. S per 100 Gms. Phenol.	t° of Clouding.	Gms. S per 100 Gms. Phenol.	t° of Clouding.	Gms. S per 100 Gms. Phenol.
89.5	9.1	155	26.3	166	31.6
96.5	10.4	157.5	27.1	167.5	32.4
122.5	15.3	160.5	28.6	170	33.5
138	19.9	162	29.6	172	34.9
148.5	23.6	164.5	30.7	175	36.5

RECIPROCAL SOLUBILITY OF SULFUR AND TOLUENE, DETERMINED BY THE SYNTHETIC METHOD.

(Kruyt, 1908–09.)

Wt. % S in Mixture.	Limiting t° of Homogeneity.		Wt. % S in Mixture.	Limiting t° of Homogeneity.	
	Lower.	Upper.		Lower.	Upper.
50.5	167	250	75.7	178	221
62	179	223	77.9	174	...
69.6	180	222	83.3	160	223
73	180	222	90.5	124	above 250

SOLUBILITY OF SULFUR (S_π) IN TOLUENE AT 0° AND AT 25°.

(Aten, 1913.)

Comp. of Mixture in Atom Per cent S.	Solubility in Atom % S. At 0°.	Solubility in Atom % S. At 25°.	Comp. of Mixture in Atom Per cent S.	Solubility in Atom % S. At 0°.	Solubility in Atom % S. At 25°.
35	2.88	5.94	74	4.05	7.52
47	...	6.65	77	3.90	...
54	3.26	6.76	80	4.22	...
57	3.30	6.88	83	...	7.93
73	...	7.45	85	...	8.08

These results show that the greater the excess of S_π, the greater the solubility. It was found that under the same conditions, unchanged rhombic sulfur gives constant figures irrespective of the excess of S present. At 0°, 2.59 atom per cent S_λ was found and at 25°, 5.65 atom per cent.

SOLUBILITY OF SULFUR IN TOLUENE.

(Jacek, 1926; Delaplace, 1922; Hildebrand and Jenks, 1921.)

t°.	Gms. S per 100 gms. sat. sol.	t°.	Gms. S per 100 gms. sat. sol.	t°.	Gms. S per 100 gms. sat sol
−58.25...	0.079 (J)	−16.0...	0.480 (J)	20...	1.827 (D)
−40.25...	0.169 »	−10.....	0.576 »	23...	1.889 »
−33.75...	0.214 »	0.....	0.923 »	25...	2.018 (H and J)
−28.50...	0.296 »	0.....	0.897 (H and J)	35...	2.722 »
−21.0....	0.380 »	13.....	1.515 (D)	54...	4.85 »
−17.75...	0.437 »	15.5...	1.649 (J)	83.5.	11.64 »

Experiments by Aten, 1918, showed that when rhombic sulfur is heated in sulfur chloride or toluene solutions, its solubility is increased, due to the transformation of rhombic sulfur to another form, S_π. This is accompained by a change in the color of the solution. The increase in solubility is greater the more concentrated the original solution. The author studied the influence of temperature and of concentration, upon the transformation of ulfur dissolved in toluene. The mixtures containing different concentrations of sulfur, were heated respectively for 6 hours at 140°, 4 hours at 150° and 2 hours at 160°. They were cooled and the amount of sulfur remaining in solution after addition of a small quantity of rhombic sulfur and stirring for one hour at 0° was determined.

Mixtures heated at 140°.		Mixtures heated at 150°.		Mixtures heated at 160°.	
% concentration of original solution.	Gms. S per 100 gms. sat. sol. at 0°.	% concentration of original solution.	Gms. S per 100 gms. sat. sol. at 0°.	% concentration of original solution.	Gms. S per 100 gms. sat. sol. at 0°.
3.4	1.18	3.6	1.24	3.2	1.24
6.2	1.42	6.6	1.50	6.2	1.54
9.2	1.64	10.6	1.79	15.0	2.40
22.0	2.69	22.6	2.96	21.6	3.00
27.6	3.23	30.1	3.54	30.0	3.64

The quantity of S_π formed in CS_2 solutions is about equal to that formed in toluene and is much smaller than the quantity formed in sulfur chloride solutions.

SOLUBILITY OF SULFUR IN PYRIDINE. (Hammick and Holt, 1926.)

The temperature of weighed mixtures of the constituents, contained in sealed tubes, was raised or lowered untill the point was reached at which the sulfur phase increased or diminished. The observations of the end point were accurate to 0.3-0°.5.

Solid-Liquid Equilibria.

t°.	Wt. % S.	Solid Phase.
84.5 ..	10.5	Rhombic S
91.5...	13.35	»
95.2...	15.9	»
97.5...	16.9	»
101.....	19.2	Monoclinic S
110.....	98.0	»

Liquid-Liquid Equilibria.

t°.	Wt. % S.	t°.	Wt. % S.
About 80..	13.35	160.5...	59.0
98.0...	19.2	161.0...	70.0
116.0...	24.65	156.0...	79.7
127.5...	29.8	147.0...	87.78
144.0...	38.8	132.5...	88.4
157.0...	50.7	137.0...	90.0
		127.0...	91.94

100 gms. Pyridine dissolve 1.5 gm. S at about 20° and 63.0 gms. at the b. pt. (Le fevre, 1932.)

SOLUBILITY OF SULFUR IN QUINOLINE. (Hammick and Holt, 1926.)

The determinations were made as described above.

Solid-Liquid Equilibria.				Liquid-Liquid Equilibria (Metastable). (The mixtures were cooled without being seeded with Sulfur.)			
Rhombic Sulfur.		Monoclinic Sulfur.					
t°.	Wt. % S.	t°.	Wt. % S.	t°.	Wt. % S.	t°.	Wt. % S.
74.5...	13.8	88.75...	24.0	60.0...	27.35	94.8....	57.0
85.8...	19.8	91.0....	25.9	72.6...	32.8	95.2....	60.9
93.2...	25.9	96.0....	32.8	78.0...	35.8	96.0....	65.3
93.8...	27.35	97.1....	35.8	82.5...	39.0	95.5-96.2.	66.3
94.2...	28.7	98.5....	39.0	85.0...	41.5	96.5....	66.75
94.6...	30.4	99.2....	41.9	85.5...	41.9	94.8....	73.8
96.5...	32.8	100.9....	45.4	89.2...	45.4	93.9....	79.0
96.0...	32.95	101.1....	49.5	90.2...	46.8	92.6....	79.8
98.5...	41.9	101.4....	57.0	91.6...	49.5	91.9....	80.5
99.5...	49.5	101.8....	66.75	91.6...	49.7	85.4....	85.2
99.5...	49.7	102.0....	73.8	94.3...	55.4	70.0....	90.4
100.0...	65.3	102.3....	79.0	94.5...	55.5		
101.0...	85.5	104.7....	90.4				
		111.5....	97.8				

RECIPROCAL SOLUBILITY OF SULFUR AND META XYLENE, DETERMINED BY THE SYNTHETIC METHOD.

(Kruyt, 1908-09.)

Wt. % S in Mixture.	Limiting t° of Homogeneity.		Wt. % S in Mixture.	Limiting t° of Homogeneity.	
	Lower.	Upper.		Lower.	Upper.
50.9	181	213	39.9	152	none (230)
49.1	177	228	84.2	none	"
47.7	172.5	none (?)	86.1	164.5	199
44.2	161.5	" (255)	87	159	202.5
40.4	153.5	" (215)	90	139	none (220)

SOLUBILITY OF SULFUR IN META XYLENE. (Hildebrand and Jenks, 1921.)

t°....................	25.	45.	80.
Gms. S per 100 gms. sat. sol.......	1.969	3.604	10.29

SOLUBILITY OF SULFUR IN PARA XYLENE. (Hammick and Holt, 1926.)

Resuls for the Solid-Liquid Equilibria.			Results for the Liquid-Liquid Equilibria.					
t°.	Gms. S per 100 gms. sat. sol.	Solid Phase.	$t_1^0-t_2^0$.	Gms. S per 100 gms. sat. sol.	$t_1^0-t_2^0$.	Gms. S per 100 gms. sat. sol.	$t_1^0-t_2^0$.	Gms. S per 100 gms. sat. sol.
92.5...	13.95	Rhombic S	about 80...	16.25	149–150...	34.9	184.......	81.0
100.5...	17.85	"	94.......	20.38	158–165...	39.9	175.......	85.6
85.0...	11.0	"	101–109...	21.8	167–174 (235)	44.0	156.......	85.5
107.0...	21.8	Monoclinic S	117–121...	25.9	171–179...	45.7	162–177 (187)	87.9
98.2...	16.25	"	124–129...	27.95	175–183 (220)	46.3	150–155 (203)	90.0
98.0...	16.3	"	130–134...	30.22	175–196 (206)	48.3	143–147 (205)	91.0
106.0...	20.38	"	137–141...	31.95	190.......	61.7	84....	96.2
103.3...	17.85		144–148...	34.6	190.......	71.2		

t_1^0 is the temperature at which the second liquid phase first dissolves.

t_2^0 is the temperature at which the second liquid phase finally dissolves.

The figures in parentheses show the temperatures at which mixtures that have become homogeneous at lower temperatures again separate into two liquid layers.

SOLUBILITY OF SULFUR IN HEXANE (C_6H_{14}).

(Etard.)

t°.	Gms. S per 100 Gms. Solution.	t°.	Gms. S per 100 Gms. Solution.	t°.	Gms. S per 100 Gms. Solution.
−20	0.07	60	1.0	130	5.2
0	0.16	80	1.7	140	6.0
20	0.25	100	2.8	160	7.2
40	0.55	120	4.4	180	8.2

SOLUBILITY OF SULFUR (S_λ) IN β NAPHTHOL, DETERMINED BY THE SYNTHETIC METHOD.

(Smith, Holmes and Hall, 1905.)

The mixtures of sulfur and β naphthol were heated until they were homogeneous and then cooled to the temperature at which clouding appeared.

t° of Clouding.	Gms. S per 100 Gms. β Naphthol.	t° of Clouding.	Gms. S per 100 Gms. β Naphthol.	t° of Clouding.	Gms. S per 100 Gms. β Naphthol.
118	34	154	84.1	164	209.7
132.5	46.6	157	97.4	163.8	238.1
134.5	48.8	160.5	119.3	163.8	264.8*
143.5	59.3	162.5	145.1	163	300 *
149.5	70	163.5	177.6		

* Solid phase, β naphthol.

SOLUBILITY OF SULFUR IN HEPTANE.

(Hildebrand and Jenks, 1921.)

t°.	0.	25.	35.	45.	54.
Gms. S per 100 gms. sat. sol...	0.124	0.362	0.512	0.698	0.926

SOLUBILITY OF SULFUR IN RAIL ROAD LIGHT OIL.

(Thompson and Odeen, 1920.)

t°.	0.	24.	28.
Gms. per 100 cc. sat. sol.	0.198	0.324	0.364

Results are given for equilibrium in the following systems.

S + CHI_3 (Iodoform) (1)
S + CH_2I_2 (Methylene Iodide (1)
S + C_2I_4 (Tetra iodo ethylene (1)
S + $C_2H_2I_2$ (Di iodo ethylene (1)
S + C_2I_2 (Di iodo acetylene (1)
S + $C_2H_2I_2$ (1.2 Di iodo ethane (1)
S + C_2Br_4 ((Tetra brom ethylene (1)
S + $C_2NO_2I_3$ (Tri iodo nitro ethylene(1)
S + $[(C_6H_5)_2I]I_3$ (Di phenyl iodinium tri iodide) (1)
S + $C_6H_4I_2$ (Di iodo benzene) (1)
S + $C_6H_4Cl_2$ (p Di chlor benzene) (2)
S + $C_4H_8Cl_2S$ (Di-2-chlor ethyl sulfide)(3)
S + $CO(NH_2)_2$ (Urea) (4)
S + $NH_2COOC_2H_5$ (Ethyl Urethan)(4)
S + $C_6H_4(OH)_2$ (Hydroquinone')(4)
S + $C_6H_4OHCO_2C_6H_5$ (Salol) (4)
S + $C_6H_4(OH)_2$(m)(Resorcinol + αC_pH_7
S + (αNaphthalamin)(5)
S + $C_6H_5NHCOCH_3$ (Acetanilid)(4)
S + α $C_{10}H_7$ (α Naphthylamine(4)
S + $C_{10}H_{13}NO_2$ (Phenacetin (4)
S + $C_{10}H_{20}O$ (Menthol) (4)
S + $C_{11}H_{12}N_2O$ (Antipyrine)(4)
S + $C_{20}H_{24}N_2O_2$(Quinine)(4)

(1) Rheinboldt and Schneider, 1929; (2) Bruni and Pelizzola, 1921; (3) Wilkinson, Neilson & Wylde, 1920; (4) Hrynakowski and Adamansis, 1934.; (5) Hrynakowski, Staszeroski and Szinzt, 1937.

SOLUBILITY OF SULFUR IN COAL TAR OIL, LINSEED OIL AND IN OLIVE OIL.

(Pelouze, 1869; Pohl.)

t°.	Grams S per 100 Grams Coal Tar Oil of: Sp.Gr.: 0.87 b. pt.: 80°-100°.	0.88 85°-120°.	0.882 120°-220°.	0.885 150°-200°.	1.01 210°-300°.	1.02 220°-300°.	G. S per 100 Gms. Linseed Oil.	Olive Oil of 0.885 Sp. Gr
15	2.1	2.3	2.5	2.6	6.0	7.0	0.4	2.3
30	3.0	4.0	5.3	5.8	8.5	8.5	0.6	4.3
50	5.2	6.1	8.3	8.7	10.0	12.0	1.2	9.0
80	11.8	13.7	15.2	21.0	37.0	41.0	2.2	18.0
100	15.2	18.7	23.0	26.4	52.5	54.0	3.0	25.0
110	...	23.0	26.2	31.0	105.0	115.0	3.5	30.0
120	...	27.0	32.0	38.0	∞	∞	4.2	37.0
130	...	...	38.7	43.8	∞	∞	5.0	43.0
						(160°)	10.0	

100 gms. oil of turpentine dissolve 1.35 gms. S at 16°, and 16.2 gms. at b. pt. (Payen, 1852.)

SOLUBILITY OF SULFUR IN RUBBER.

(Venable and Greene, 1922.)

Thin strips of rubber stock, which had been compounded with 0 to 20 per cent of sulfur, were packed in flowers of sulfur and kept at desired temperatures untill equilibrium was established. The samples were then analyzed for free and combined sulfur. Equilibrium was approached from above and below, and was reached fairly quickly from below but from above, little of any of the excess sulfur migrated to the outside of the sheet. Consequently all the samples were given a preliminary heating to insure complete solution of the crystals before being placed in the pack. The results are given only in the form of curves and from these, the following approximate values were read. They show that the solubility increases as a « straight line function of the amount of combined sulfure up to a vulcanisation coefficient of about 7 ».

Per cent combined Sulfur.	Per cent free Sulfur at 55°.	78°.	95°.
1.0	2.8	4.8	7.1
3.0	2.9	5.2	8.1
5.0	3.0	5.4	9.1
7.0	3.1	5.8	10.0

Solubility of Sulfur in Rubber.

(Morris, 1932.)

Mixtures of weighed amounts of pale crepe uncured rubber and sulfur were prepared in a laboratory mill and thin sheets of these were mounted between microscope slides and kept at controlled temperatures. Observation of these sheets by transmitted light with the aid of a microscope were made at a series of temperatures, and the point ascertained at which the solubility of the sulfur in the rubber is complete. The results are given in the form of a small diagram from which the following approximate values were read.

t°	Gms. S per 100 gms. rubber	t°	Gms. S per 100 gms. rubber
30	0.8	70	2.9
40	1.2	80	3.6
50	1.7	90	4.7
60	2.3	100	6.0

Distribution of Sulfur Between Rubber and Amyl Alcohol and Between Rubber and *n* Butyl Alcohol.

(Kelly and Ayers, 1924.)

The determinations were made by two methods : (1) The sulfur was mixed with rubber and the mixture kept in contact with amyl alcohol. After attainment of equilibrium the sulfur in the amyl alcohol was determined. (2) The rubber was kept in contact with *n* butyl alcohol saturated with sulfur, and after attainment of equilibrium, the sulfur in the *n* butyl alcohol was determined.

Results for Rubber and Amyl Alcohol by method (1) and at 40°.

Per cent S in original S + Rubber mixture.	Distribution of Sulfur Gms. S per 100 gms. Amyl alcohol (C_1).	Rubber (C_2).	$\frac{C_2}{C_1}$.
0.42	0.0395	0.336	8.50
0.42	0.0395	0.342	8.68
0.80	0.0466	0.536	11.5
0.80	0.0455	0.556	12.5
0.95	0.0497	0.570	11.5
0.95	0.0499	0.592	11.8
1.21	0.0681	0.729	11.7
1.41	0.0783	0.850	10.7

Results for Rubber and *n* Butyl Alcohol by method (2) and at 30°.

Gms. Rubber per 100 cc. Butyl alc. sat. with S	Distribution of Sulfur Gms. S per 100 gms. Butyl alcohol (C_1).	Rubber (C_2).	$\frac{C_2}{C_1}$.
2	0.168	0.840	5.0
4	9.148	0.79	5.3
6	0.136	0.72	5.3
8	0.123	0.67	5.4
10	0.109	0.64	5.9
12	0.106	0.55	5.2
14	0.098	0.52	5.3

The solubility of sulfur in *n* butyl alcohol at 30° was found to be 0.187 gm. S per 100 gms. alcohol. Assuming that the same ratio holds at saturation as that found by the distribution experiments, the solubility of sulfur in rubber was calculated to be (0.187 × 5.4 =) 1.01.gm. S per 100 gms. rubber at 30°.

A series of experiments made by suspending slabs of rubber, having different coefficients of vulcanisation, in *n* butyl alcohol saturated with sulfur, and stirring gently, gave results for the solubility which increased linearly with the coefficient of vulcanisation up to a value of 17. This corresponds to the point where about 35 per cent of the double bonds of the rubber are saturated with sulfur. The results show that rubber dissolves but does not adsorb sulfur.

Fusion-point data are given for:

- S + Sb (Pelabon, 1909; Jaeger, 1911; Guertier and Schack, 1923.)
- S + Se (Matsumato, 1916.)
- S + Sn (Pelabon, 1909.)
- S + Te (Pelabon, 1909; Pellini, 1909; Chikashige, 1911, 1911-2; Jaeger and Menke, 1912; Losana, 1923.)
- S + Pb; S + Ag; S + Au; S + As (Pelabon, 1909.)

SULFUR Mono BROMIDE S_2Br_2.

Fusion-point data are given for S_2Br_2 + $SbBr_3$ and S_2Br_2 + $SnBr_4$ by Pusin and Makuc, 1938.

SULFUR NITRIDE S_4N_4.

SOLUBILITY OF SULFUR NITRIDE IN SEVERAL SOLVENTS.

(Vosnesenskij, 1927.)

t°	Gms. S_4N_4 per 1000 cc of: CS_2	C_6H_6	C_2H_5OH
0	3.705	2.266	0.645
10	6.845	4.260	0.830
20	9.391	6.301	1.050
30	13.188	8.692	1.271
40	16.887 (?)	11.107	1.478
50	—	13.721	1.640
60	—	17.100	—

SULFUR DIOXIDE SO_2

SOLUBILITY IN WATER.

(Schonfeld, 1855; Sims, 1861; Roozeboom, 1884.)

Schönfeld.				Sims.			Roozeboom.	
t°.	Vols. SO_2 (at 0° and 760 mm.) per 1 Vol Sat. SO_2 + Aq.	Vols. SO_2 (at 0° and 760 mm.) per 1 Vol H_2O.	Gms. SO_2 per 100 Gms. H_2O at total pressure 760 mm.	t°.	SO_2 per 1 Gm. H_2O. Gms.	SO_2 per 1 Gm. H_2O. Vols.	t°.	SO_2 Dissolved per 1 pt. H_2O at 760 mm. pressure.
0	68.86	79.79	22.83	8	0.168	58.7	0	0.236
5	59.82	67.48	19.31	10	0.154	53.9	2	0.218
10	51.38	56.65	16.21	14	0.130	45.6	4	0.201
15	43.56	47.28	13.54	20	0.104	36.4	6	0.184
20	36.21	39.37	11.29	26	0.087	30.5	7	0.176
25	30.77	32.79	9.41	30	0.078	27.3	8	0.168
30	25.82	27.16	7.81	36	0.065	22.8	10	0.154
35	21.23	22.49	...	40	0.058	20.4		
40	17.01	18.77	5.41	46	0.050	17.4	12	0.142
				50	0.045	15.6		

Sp. Gr. of sat. solution at 0° = 1.061; at 10°, 1.055; at 20° = 1.024.

The results of Sims are discussed and recalculated by Fulda, 1909.

1 gm. H_2O dissolves 0.0909 gm. SO_2 = 34.73 cc. (measured at 25°) at 25° and 760 mm. pressure. (Walden and Centnerszwer, 1902–03.)

Freezing-point Data for the System Sulfur Dioxide — Water.

(Baume and Tykociner, 1914.)

t° of Freezing.	Mols. SO_2 per 100 Mols. SO_2+H_2O.	Solid Phase.	t° of Freezing.	Mols. SO_2 per 100 Mols. SO_2+H_2O.	Solid Phase.
0	0	Ice	7.7	5.1	SO_2 Hydrate
−0.2	0.8	"	8.3	5.9	"
−3 Eutec.	...	" $+SO_2$ Hydrate	9.3	7.1	"
−0.2	2.8	SO_2 Hydrate	12.1	11	"
+3.5	3.3	"	⋮	⋮	⋮
6.8	5.5	"	12.2	95.1	"

At the temperature +12.1° and extending over the range of concentration 11 to 95.1 mols. per cent SO_2 a second phase rich in SO_2 separates. This crystallizes at −74° and the diagram is consequently composed of two lines parallel to the axis of concentration, the one at the +12.1° level corresponding to the SO_2 hydrate, and the other at the −74° level, to the SO_2 rich phase. The diagram is terminated by a very short branch rising from −74° to the temperature of solidification of pure SO_2 (−72.3°).

More recent determinations of the equilibrium in the system $SO_2 + H_2O$, made by the synthetic method, are described by Terres and Rühl, 1934. A hitherto unrecognized second modification of solid SO_2 was obtained. Its formation is apparently caused by traces of H_2O. Its melting point is -63.5° instead of 71° the m.pt. of the ordinary form of solid SO_2. The numerical results of the determinations are given only in the complete report of the work published. Beihefte zu den Zeitschriften des Vereins deutscher Chemiker No. 8, 1934, Verlag chemie Berlin W35 Cornelius Str. 3.

Solubility of Sulfur Dioxide in Water at Different Pressures.

(Lindner, 1912.)

Results at 0°.		Results at 25°.		Results at 50°.	
Pressure in mm. Hg.	Gms. SO_2 per 100 cc. Sat Sol.	Pressure in mm. Hg.	Gms SO_2 per 100 cc Sat. Sol.	Pressure in mm. Hg.	Gms. SO_2 per 100 cc. Sat. Sol.
0.4	0.0537	1.4	0.0534	4.9	0.0525
3.5	0.237	11.75	0.234	30.5	0.2276
29.4	1.227	87.9	1.212	204.5	1.181
109.4	3.804	313	3.750	696	3.628

Solubility of Sulfur Dioxide in Water at Low Partial Pressures.

Results of

Conrad and Benschlein, 1934 Johnstone and Leppla, 1934.

at 25°		at 25°		at 35°		at 50°	
P mm	Gms. SO_2 per 100 gms. H_2O	P at.	Gm. Mols. SO_2 per 1000 gms. H_2O	P at.	Gm. Mols. SO_2 per 1000 gms. H_2O	P at.	Gm. Mols. SO_2 per 1000 gms. H_2O
299	3.63	0.00027	0.002484	0.00103	0.00419	0.00230	0.00467
308	3.72	0.00120	0.006203	0.00249	0.00745	0.00383	0.00637
593	6.89	0.00229	0.009546	0.00412	0.00999	0.00538	0.00838
611	6.99	0.00267	0.01084	0.00580	0.01356	0.00879	0.01057
640	7.28	0.00671	0.02059	0.00955	0.01987		
730	8.37	0.00911	0.02561				
		0.01350	0.03328				

Pmm = partial pressure of SO_2 in mm.Hg.; that is the total pressure minus the partial pressure of the H_2O.

Pat. = partial pressure of SO_2 in atmospheres.

SOLUBILITY OF SULFUR DIOXIDE IN WATER.

Results of Hudson, 1925.

t°.	Gms. SO_2 (at partial pressure of 760^{mm} Hg) per 100 gms. H_2O.
10	15.39
15	12.73
20	10.64
29.9	7.58
40	5.54
48.15	4.39
60	3.25
70	2.61
80	2.13
90	1.805

Results of Smith and Parkhurst, 1922.

t°.	Pressure of SO_2 in mm. Hg.	Gms. SO_2 per 100 cc. H_2O.
5	474.8	11.55
20	198.6	2.97
20	224.4	3.34
20	366.6	5.22
20	1107.8	15.01
40	306.4	2.21
40	373.8	2.68
60	175.7	0.84

The determinations of Hudson were made by bubbling the gas through the solution untill saturation was reached. Especial care was taken to obtain accurate results. Attention is called to the sources of error in the determinations of Schönfeld, 1855.

In addition to the above results given by Smith and Parkhurst these authors also determined the solubility of sulfur dioxide in aqueous suspensions of calcium and magnesium hydroxides.

Freese, 1920, gives results for the solubility of sulfur dioxide in water which are identical with those of Schönfeld, 1855.

PARTIAL VAPOR PRESSURES OF AQUEOUS SOLUTIONS OF SULFUR DIOXIDE.

(Sherwood, 1925.)

The author collected the available data on the partial vapor pressure of sulfur dioxide in water and from the plotted results constructed the following table. Heassumed that the dissociation is constant at any particular temperature and that Henry s law applies to the undissociated solute. On the basis of this assumption it has been shown (Haslam, Hershey and Keen, *Ind. Eng. Chem*, **16**, 1225, 1924) that $S = Hp + \sqrt{KHp}$ or $\frac{S}{\sqrt{p}} = H\sqrt{p} + \sqrt{KH}$, when S = gms. SO_2 dissolved in 1000 gms. H_2O; p = partial pressure of SO_2 in mm. Hg; H = Henrys law constant and K = dissociation constant of the H_2SO_3. The results of Schönfeld, Sims, Roozeboom, Lindner, Freeze, Smith and Parkhurst and Watts, were used.

Gms. SO_2 per 1000 gms. H_2O.	Partial pressure of SO_2 in mm. Hg at							
	0°.	7°.	10°.	15°.	20°.	30°.	40°.	50°.
0.2	0.25	0.3	0.3	0.3	0.5	0.6	0.8	1.3
0.5	0.6	0.7	0.75	0.8	1.2	1.7	2.8	4.3
1.0	1.2	1.5	1.75	2.2	3.2	4.7	7.5	12.0
1.5	1.9	2.6	3.1	3.8	5.8	8.1	12.9	20.0
2.0	2.8	3.7	4.6	5.7	8.5	11.8	13.3	31.0
3.0	5.1	6.9	7.9	10.0	14.1	19.7	57.0	82.0
5.0	9.9	13.5	15.6	19.3	26.0	36.0	87.0	116.0
7.0	15.2	20.6	23.6	28.0	39.0	52.0	121.0	172.0
10.0	23.3	31.0	37.0	44.0	59.0	79.0	186.0	266.0
15.0	38.0	51.0	59.0	71.0	92.0	125.0	322.0	458.0
25.0	69.0	92.0	105.0	127.0	161.0	216.0	665.0	
50.0	148.0	198.0	226.0	270.0	336.0	452.0		
75.0	228.0	307.0	349.0	419.0	517.0	688.0		
100.0	308.0	417.0	474.0	567.0	698.0			
150.0	474.0	637.0	726.0					
200.0	646.0	657.0						

SOLUBILITY OF SULFUR DIOXIDE IN AQUEOUS SULFURIC ACID SOLUTIONS.

(Dunn; see also Kolb, 1872.)

t°.	Sp. Gr. of H_2SO_4 Solution.	Approximate Per cent H_2SO_4.	Coefficient of Absorption.	t°.	Sp. Gr. of H_2SO_4 Solution.	Approximate per cent H_2SO_4.	Coefficient of Absorption
6.9	1.139	20	48.67	15.2	1.173	25	31.82
6.9	1.300	40	45.38	16.8	1.151	21	31.56
8.6	1.482	58	39.91	14.8	1.277	36	30.41
9.8	1.703	78	29.03	15.1	1.458	56	29.87
5.5	1.067	10	36.78	15.6	1.609	70	25.17
6.0	1.102	15	3.408	15.0	1.739	81	20.83

For definition of Coefficient of Absorption, see p. 1136

SOLUBILITY OF SULFUR DIOXIDE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°.

(Johnstone and Lepple, 1934.)

Partial pressure of SO_2 in Atmospheres	Gm. Mols. per 1000 gms. H_2O		Partial pressure of SO_2 in Atmospheres	Gm. Mols. per 1000 gms. H_2O	
	H_2SO_4	SO_2		H_2SO_4	SO_2
0.00130	0.0879	0.00193	0.00571	0.5174	0.00796
0.00571	0.0879	0.01129	0.01022	0.5174	0.01345
0.01022	0.0879	0.01878	0.00130	1.103	0.00134
0.00130	0.5174	0.00161	0.00573	1.103	0 00719
			0.01022	1.103	0.01253

SOLUBILITY OF SULFUR DIOXIDE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 760mm.

(Cupr, 1926, 1928.)

Results at 41°			Results at 62°		
Percent H_2SO_4 in Solvent	Gms. SO_2 per 100 gms. solvent	cc SO_2 per 1 cc sat. sol.	Percent H_2SO_4 in Solvent	Gms. SO_2 per 100 gms. solvent	cc SO_2 per 1 cc sat. sol.
0	4.81	16.7	0.0	2.15	7.37
7.32	3.65	13.3	10	1.71	6.28
18.02	3.35	12.8	30.26	1.26	5.25
44.34	2.57	11.9	54.06	1.20	5.90
71.86	1.68	9.47	79.07	1.19	6.95
86.20	1.36	8.40	84.34	1.15	6.95
93.28	1.81	11.5	90.73	1.19	7.36
97.69	2.15	13.6	93.68	1.16	7.26
			96.10	1.16	7.29

SOLUBILITY OF SULFUR DIOXIDE IN SULFURIC ACID OF 1.84 SP. GR.

Interpolated from original results. (Dunn, 1882.)

t°.	Sp. Gr. of Sat. Solution.	Coefficient of Absorption (760 mm.).	t°.	Sp. Gr. of Sat. Solution.	Coefficient of Absorption (760 mm.)
0	...	53.0	50	1.8186	9.5
10	1.8232	35.0	60	1.8165	7.0
20	1.8225	25.0	70	1.8140	5.5
25	1.8221	21.0	80	1.8112	4.5
30	1.8216	18.0	90	1.8080	4.0
40	1.8205	13.0			

SOLUBILITY OF SULFUR DIOXIDE IN CONCENTRATED AQUEOUS SOLUTIONS OF SULFURIC ACID AT 20°. (Miles and Fenton, 1920.)

The solutions were saturated by means of a stream of SO_2 passing through the actively stirred mixture. The dissolved SO_2 was determined iodometrically.

Per cent H_2SO_4 in acid mixture.	Gms. SO_2 per 100 gms. acid mixture.	Per cent H_2SO_4 in acid mixture.	Gms. SO_2 per 100 gms. acid mixture.	Per cent H_2SO_4 in acid mixture.	Gms. SO_2 per 100 gms. acid mixture.
55.1	5.13	84.2	2.88	94.0	3.31
59.6	4.90	85.3	2.83	94.6	3.50
61.6	4.82	85.8	2.80	95.5	3.69
68.9	4.16	86.5	2.82	95.6	3.77
74.1	3.63	88.1	2.90	96.5	3.83
78.3	3.23	90.8	3.10	98.0	3.98
80.2	3.12	92.8	3.21	98.5	4.03
82.5	2.99	93.7	3.27		

Calculations of the above results showing that the solubility of SO_2 is the sum of its solubility in H_2O and $H_2SO_4.H_2O$ are given by Friend, 1931.

SOLUBILITY OF SULFUR DIOXIDE IN CONCENTRATED SULFURIC ACID.

(Milbauer, 1936.)

Results for H_2SO_4 of d = 1.824 (= 90.8%)

t°	Gms. SO_2 per 100 gms. solvent
23	3.075
30	2.270
50	1.525
100	0.436
150	0.171
200	0.053
237	0.043

Results for H_2SO_4 of d = 1.53 (= 62.61%)

t°	Gms. SO_2 per 100 gms. solvent
25	3.1582
45	1.4597
60	1.0200
80	0.5813
100	0.4908
100+	Uncertain results

SOLUBILITY OF SULFUR DIOXIDE IN AQUEOUS SALT SOLUTIONS.

(Fox, 1902.)

Results in terms of the Ostwald Solubility Expression. See p. 1136

Aqueous Salt Solution.	Solubility Coefficient l of SO_2 in aq. Solutions of Concentrations:					
	0.5 Normal	1.0 N.	1.5 N.	2.0 N.	2.5 N.	3.0 N.
NH_4Cl	$l_{25}=34.58$	36.37	38.06	39.76	41.37	42.78
NH_4Br	$l_{25}=36.25$	39.46	42.78	46.06	49.17	52.25
NH_4CNS	$l_{25}=37.78$	42.74	47.26	52.26	57.01	61.46
NH_4NO_3	$l_{25}=33.96$	35.07	36.28	37.27	38.01	39.14
NH_4NO_3	$l_{35}=23.35$	24.23	24.78	25.57	26.66	27.43
$(NH_4)_2SO_4$	$l_{25}=33.35$	33.82	34.33	34.95	35.47	35.96
$(NH_4)_2SO_4$	$l_{35}=22.91$	23.14	23.49	23.93	24.23	24.60
$CdCl_2$	$l_{25}=31.66$	30.55	29.46	28.16	27.09	26.06
$CdCl_2$	$l_{35}=21.73$	21.23	20.55	20.02	19.23	18.68
$CdBr_2$	$l_{25}=31.91$	31.01	30.17	29.27	28.15	27.46
$CdBr_2$	$l_{35}=21.88$	21.46	20.81	20.60	19.70	19.17
CdI_2	$l_{25}=33.27$	33.76	34.16	34.74	34.98	35.77
CdI_2	$l_{35}=22.75$	23.06	23.36	23.71	23.99	24.30
$CdSO_4$	$l_{25}=31.11$	29.71	28.24	26.58	25.14	23.76
$CdSO_4$	$l_{35}=21.45$	20.43	19.42	18.31	17.41	16.25
KCl	$l_{25}=34.42$	36.05	37.76	39.32	40.96	42.27
KCl	$l_{35}=23.74$	25.15	26.54	27.94	28.93	30.02
KBr	$l_{25}=35.94$	39.11	42.41	44.96	48.87	52.26
KBr	$l_{35}=24.83$	27.49	29.64	31.93	34.12	36.14
KCNS	$l_{25}=37.57$	42.38	47.02	51.81	55.87	61.26
KCNS	$l_{35}=25.63$	28.79	32.03	35.05	38.13	42.94
KI	$l_{25}=38.66$	44.76	50.58	56.75	62.63	68.36
KI	$l_{35}=26.30$	30.25	34.64	38.04	41.87	45.43
KNO_3	$l_{25}=33.80$	34.79	35.77	36.66	37.57	38.52
KNO_3	$l_{35}=23.27$	24.03	24.79	25.72	26.54	27.33
K_2SO_4	$l_{25}=33.20$	33.61	...	...	...	...
NaBr	$l_{25}=33.76$	34.54	35.27	36.26	36.84	37.74
NaCl	$l_{25}=32.46$	32.25	31.96	31.76	31.51	31.36
NaCNS	$l_{25}=35.44$	38.24	40.78	43.37	45.86	48.34
Na_2SO_4	$l_{25}=31.96$	31.14	30.45	29.51	28.66	28.44
Na_2SO_4	$l_{35}=21.88$	21.35	20.81	20.21	19.75	19.27

The author also gives a series of determinations in which a mixture of $SO_2 + CO_2$ is used for saturating the solutions, thus changing the concentration of the SO_2 and yielding results for certain partial pressures of this gas.

Additional data for the solubility of sulfur dioxide in aqueous salt solutions are given by Walden and Centnerszwer (1902–03) but these authors present their results in terms of the difference between the amount of SO_2 dissolved in water and in the aqueous solution. The exact manner in which these calculations were made is not clearly explained.

SOLUBILITY OF SULFUR DIOXIDE IN AQUEOUS SALT SOLUTIONS AT 25° AND 760mm PRESSURE.

(Bancroft and Gould, 1934.)

Aq. solvents containing 0.5 gm. mol. of the following salts, per liter	Abs. Coef. of SO_2	Aq. solvents containing 0.5 gm. mol. of the following salts, per liter	Abs. Coef. of SO_2
H_2O alone	32.76	KNO_3	30.97
Na_2SO_4	29.28	KCl	31.53
NaCl	29.74	KBr	32.97
NaBr	30.93	KCNS	34.42
NaCNS	32.47	KI	35.42
K_2SO_4	30.42		

SOLUBILITY OF SULFUR DIOXIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT A PARTIAL PRESSURE OF 760 MM. (Hudson, 1925.)

	Gms. per 100 gms. H_2O.			Gms. per 100 gms. H_2O.			Gms. per 100 gms. H_2O.	
t°.	KCl.	SO_2.	t°.	KCl.	SO_2.	t°.	KCl.	SO_2.
10.....	5.55	17.05	29.9...	10.11	8.80	48.15..	32.72	6.18
10.....	10.22	18.58	29.9...	20.82	10.05	60.....	5.30	3.45
10.....	15.85	20.28	29.9...	29.86	11.26	60.....	10.67	3.52
10	20.78	21.96	40.0...	5.17	5.96	60.....	21.12	3.92
10.....	29.90	25.40	40.0...	10.20	6.32	60.....	30.98	4.24
15.....	10.39	15.32	40.0...	15.44	6.675	70.....	8.74	2.80
15.....	19.91	17.64	40.0...	20.14	7.07	70.....	21.68	3.05
15.....	30.71	20.59	40.0...	24.83	7.45	70.....	30.73	3.26
20.....	5.14	11.62	40.0...	28.95	7.75	80.....	8.66	2.27
20.....	10.30	12.52	48.15..	5.06	4.70	80.....	21.35	2.415
20.....	15.61	13.55	48.15..	10.14	4.945	80.....	29.68	2.52
20.....	24.98	15.38	48.15..	15.82	5.24	90.....	9.23	1.855
20.....	30.38	16.65	48.15..	21.11	5.48	90.....	19.49	1.97
29.9...	5.19	8.21	48.15..	25.09	5.74	90.....	32.75	2.11

SOLUBILITY OF SULFUR DIOXIDE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE AT A PARTIAL PRESSURE OF 760 MM. (Hudson, 1925.)

Results at 20°.		Results at 30°.		Results at 40°.		Results at 60°.	
Gms. per 100 gms. H_2O.		Gms. per 100 gms. H_2O.		Gms. per 100 gms. H_2O.		Gms. per 100 gms. H_2O	
Na_2SO_4.	SO_2.	Na_2SO_4.	SO_2.	Na_2SO_4.	SO_2.	Na_2SO_4.	SO_2.
0.0	10.64	0.0	7.608	0.0	5.585	0.0	4.214
1.94	10.66	2.04	7.709	2.49	5.812	2.49	4.508
4.98	10.57	3.99	7.776	5.04	5.910	5.04	4.678
7.95	10.36	5.47	7.773	7.95	5.927	–	–
10.00	10.07	7.83	7.716	10.00	5.882	10.04	4.728
15.00	9.66	10.0	7.586	14.94	5.802	14.94	4.730
20.0	9.17	20.0	7.006	20.01	5.630	19.99	4.648

DISTRIBUTION OF SULPHUR DIOXIDE AT 20° BETWEEN:

(McCrae and Wilson, 1903)

Water and Chloroform.					Aq. HCl and Chloroform.			
Gms. SO_2 per Liter in:		Gm. Equiv. $\frac{1}{2}SO_2$ per Liter in:		Conc. of HCl.	Gms. SO_2 per Liter in:		Gm. Equiv. $\frac{1}{2}SO_2$ per Liter in:	
Aq. Layer.	$CHCl_3$ Layer.	Aq. Layer.	$CHCl_3$ Layer.		Aq. Layer.	$CHCl_3$ Layer.	Aq. Layer	$CHCl_3$ Layer.
1.738	1.123	0.0543	0.0351	0.05	1.86	1.46	0.0581	0.0456
1.753	1.122	0.0547	0.0350	"	3.07	2.83	0.0960	0.0884
2.346	1.703	0.0732	0.0532	"	4.28	4.07	0.1336	0.1271
2.628	1.897	0.0821	0.0592	"	5.34	5.42	0.1667	0.1692
3.058	2.385	0.0955	0.0745	0.10	1.25	1.41	0.039	0.044
3.735	3.062	0.1166	0.0956	"	2.78	3.08	0.0868	0.0962
4.226	3.626	0.1319	0.1132	"	3.86	4.08	0.1199	0.1275
5.269	4.798	0.1645	0.1498	"	5.161	5.72	0.1612	0.1784
6.588	6.183	0.2057	0.1930	0.2	1.268	1.51	0.0396	0.0471
31.92	33.84	0.9968	1.056	"	1.914	2.27	0.0597	0.0710
33.26	37.25	1.038	1.163	"	2.464	3.04	0.0769	0.0949
				"	3.967	4.90	0.1239	0.1530
				0.4	1.202	1.61	0.038	0.0504
				"	1.894	2.26	0.059	0.0706

D

Freezing-point data for mixtures of sulfur dioxide and sulfuryl chloride (SO_2Cl_2) are given by van der Goot (1913).

SOLUBILITY OF SULFUR DIOXIDE IN ALCOHOLS AND IN OTHER SOLVENTS.

(de Bruyn, 1892; Schulze, 1881.)

	In Ethyl Alcohol at 760 mm.		In Methyl Alcohol at 760 mm.		In Several Solvents at 0° and 725 mm. (S.)		
t°.	Gms. SO_2 per 100 Gms.		Gms. SO_2 per 100 Gms.		Solvent.	SO_2 per 1 Gm. Solvent	
	Solution.	C_2H_5OH.	Solution.	CH_3OH.		Grams.	Vols.
0	53.5	115.0	71.1	246.0	Camphor	0.880	308
7	45.0	81.0	59.9	149.4	CH_3COOH	0.961	318
12.3	39.9	66.4	52.2	109.2	HCOOH	0.821	351
18.2	32.8	48.8	(17.8°) 44.0	78.6	$(CH_3)_2CO$	2.07	589
26.0	24.4	32.3	31.7	46.4	SO_2Cl_2	0.323	189

SOLUBILITY OF SULFUR DIOXIDE IN AQUEOUS SOLUTIONS OF ACETIC ACID AT 27° AND 760mm PRESSURE.

(Cupr, 1926, 1928.)

Percent CH_3COOH in solvent	Gms. SO_2 per 100 gms. solvent	cc SO_2 per 1cc sat. sol.	Percent CH_3COOH in solvent	Gms. SO_2 per 100 gms. solvent	cc SO_2 per 1cc sat. sol.
0.0	8.10	26.1	63.51	16.35	61.6
16.72	8.86	31.6	83.59	22.83	84.8
45.58	12.04	44.1	91.89	26.49	97.8
			100	31.5	112.8

Solubility of Sulfur Dioxide in Chloroform.

(Lindner, 1912.)

Results at 0° Pressure in mm. Hg.	Results at 0° Gms. SO_2 per 100 cc Sat. Sol.	Results at 25°. Pressure in mm. Hg.	Results at 25°. Gms. SO_2 per 100 cc. Sat. Sol
2.7	0.0701	5.7	0.0669
5.6	0.1790	12.9	0.1712
22	0.6982	48	0.6728
90.2	3.097	200.2	2.954
219.6	8.217	488.8	7.839

Solubility of Sulfur Dioxide in Several Organic Solvents at 25° and Varying Pressures.

(Horiuti, 1931.)

Results for:

CCl_4		C_6H_5Cl		C_6H_6		$(CH_3)_2CO$		$CH_3CO_2CH_3$	
Pmm	S	Pmm	S	Pmm	S	Pmm	S	Pmm	S
112.4	0.0	11.6	0.0	93.7	0.0	229.2	0.0	213.4	0.0
265.5	1.26	274.9	6.02	294.3	6.18	304.2	14.2	324.4	14.3
357.7	2.08	506.3	11.63	493.7	12.47	381.8	23.7	456.7	25.4
508.6	3.48	669.4	16.66	663.7	17.83	473.4	30.8	602.5	33.6
646.3	4.90	778.3	18.76	808.9	22.52	574.0	36.8	754.4	40.6
814.4	6.73	895.4	22.02	923.2	26.05	740.1	44.5	894.3	45.6
991.8	8.80	1048.5	26.35	1012.2	29.09	994.3	51.9	1038.5	49.7

Pmm = Pressure in millimeters; S = Gm. Mols. SO_2 per 100 gm. mols. sat. solution.

Solubility of Sulfur Dioxide in Several Organic Solvents.

(Horiuti, 1931.)

t°	Solubility of SO_2 in terms of the Ostwald Solubility Expression l, in: CCl_4	C_6H_5Cl	C_6H_6	$(CH_3)_2CO$	$CH_3CO_2CH_3$
0	—	169.3	—	—	—
10	30.96	97.4	126.4	276.4	254.9
25	18.45	59.14 (20°)	70.01	216.4	182.1
40	12.52	29.92	43.01	171.3	133.8
50	—	22.88	32.63	—	—
60	—	17.83	25.36	—	—
80	—	12.23	—	—	—

SOLUBILITY OF SULFUR DIOXIDE IN SEVERAL SOLVENTS.

(Lloyd, 1918.)

The dry, air free, SO_2 was passed through the solvent until saturation was reached and 5 cc. (usually) of the saturated solution were mixed with a large volume of water and titrated with standardized iodine solution.

t°.	Gms. SO_2 per Liter of Saturated Solution in:				
	Benzene.	Nitro-benzene.	Toluene.	*o* Nitro-toluene.	Acetic Anhydride.
− 5	...	...	...	...	196
0	...	...	...	...	148 ($d = 1.22$)
+ 5	...	...	...	...	136
10	...	...	...	...	122
15	...	311.4	...	290.8	114
20	...	267.4	217.5	236	106
25	...	227.9	170.4	192.2	99
30	127.5	190	124.4	160.7	90
40	82.9	132	93.6	118.5	...
50	60.3	98.7	77.2	87.2	...
60	34	78.6	54.7	68.8	...

RECIPROCAL SOLUBILITY OF LIQUID SULFUR DIOXIDE AND TOLUENE.

(Zerner, Weisz and Opalzki, 1922.)

The accurately weighed mixtures were sealed in tubes of resistance glass and the temperatures determined at which clouding and clearing occured. The liquid SO_2 contained 0.56 % H_2O and 0.67 % oily residue.

t° of clouding..........	17.0.	21.0.	21.0.	13.5.	7.0.	About—25.0°.
Per cent SO_2 in mixture.	21.64	24.21	34.56	54.50	72.07	92.95

The correctness of the above results is questioned by Fontein, 1923, who points out that the observed clouding is due to the water content of the SO_2 used. A repetition of the determinations showed Zerner Weisz and Opulski that both toluene and tetralin are completely miscible with sulfur dioxide.

SOLUBILITY OF SULFUR DIOXIDE IN RUBBER. (Venable and Fuwa, 1922.)

100 cc. of rubber saturated with sulfur dioxide at 21° dissolve 1950 cc. SO_2 (0° and 760 mm.). The determination was made by pumping out the gas with a Töpler pump and measuring it over mercury. In the same way 100 cc. of H_2O at 21° was found to dissolve 3, 661.7 cc. SO_2 (0° and 760 mm.). The authors also give results for the effect of pressure and temperature upon the solubility of sulfur dioxide in rubber.

Data for the reciprocal Solubility of SO_2 (also of air, CO_2, NH_3 and HCl) and the vapors of Ether, Methyl Alcohol, Acetone and Chloroform, as determined by measuring at 25° the change in pressure produced by adding a weighed amount of the volatile liquid to a given volume of SO_2 are given by MacFarlane and Wright, 1934.

Vapor pressure measurements between -20° and +30° are given by Foote and Fleischer, 1934, for the systems composed of SO_2 and each of the following compounds:

- • Aniline
- • Methyl aniline
- • Ethyl aniline
- Di ethyl aniline
- Di phenyl amine
- • Toluidine
- Naphthalene
- Di phenyl
- Di phenyl ether
- α Naphthol
- β Naphthol
- Ethylene glycole

Solid addition compounds were formed with those marked with an •.

Freezing-point data are given for:

SO_2 + $SiCl_4$ (1)
" + $SnBr_4$ (2)
" + $SnCl_4$ (2)
" + SnI_4 (3)
" + $TiBr_4$ (4)
" + $GeCl_4$ (4)
" + CCl_4 (2)(3)
" + Methyl Alcohol (5)
" + Methyl Alcohol + Propionic Acid (6)
" + Methyl Ester (6)(7)
" + Benzene (8)(9)
" + Cyclohexane (10)(11)
" + Cyclohexene (11)
" + Cyclohexadiene (11)
" + n Hexane (12)
" + n Butane (12)
SO_2 + Cetene (13)
" + Cetyl alcohol (13)
" + n Decane (12)
" + Octane (12)(14)
" + n Dodecane (12)
" + n Tetra decane (12)
" + n Dotria contane (12)
" + Caprylene (15)
" + Decalin (cis and trans Deca hydronaphthalene (16)
" + Styrene (17)
" + 10-Hendecenoic Acid (17)
" + 1-Pentane (17)
" + Vinye chloride (17)
" + Camphor (18)
" + Toluene (9)
" + Tetraline, (9)

(1) Bond and Stephens, ; (2) Bond and Beach, 1926; (3) Beach and Bond, 1925; (4) Bond and Crone, 1934; (5) Baume and Pamfil, 1914; (6) Baume et. al., 1914; (7) Baume, 1914; (8) Seyer and Peck, 1930; (9) DeCarli, 1926, 1926a; (10) Seyer and Dunbar, 1922; (11) Seyer and King, 1933; (12) Seyer and Todd, 1931; (13) Seyer and Ball, 1926; (14) Seyer and Gallanger, 1926; (15) Seyer and Hodnett, 1936; (16) Seyer and Cornett, 1937; (17) Marvel and Glavis, 1938; (18) Bellucci and Grassi, 1913.

SULFUR TRIOXIDE SO_3.

Data for equilibrium in the system SO_3 + H_2O + H_2SO_4, determined by the freezing-point method, are given by, Moles and Carlota, 1936.

SAMARIUM Sa (or Sm)

SAMARIUM BROMATE $Sa(BrO_3)_3.9H_2O$.

SOLUBILITY OF SAMARIUM BROMATE IN WATER.

(James, Fogg, McIntire, Evans and Donovan, 1927.)

t°	Gms. per 100 gms. sat. sol. $Sa(BrO_3)_3.9H_2O$	Gms. per 100 gms. sat. sol. $Sa(BrO_3)_3$
0	33.24	25.50
5	37.58	28.83
10	42.02	32.23
15	46.21	35.45
20	50.16	38.48
25	53.97	41.40
30	57.54	44.14
35	61.12	46.88
40	64.67	49.61
45	68.16	52.28

Solid phase $Sa(BrO_3)_3.9H_2O$ in all cases.

SAMARIUM ACETATE $Sa(CH_3COO)_3.3H_2O$.

100 gms. sat. solution of samarium acetate in water contain 13.05 gm. $Sa(CH_3COO)_3$ at 25°.

(Meyer and Müller, 1930.)

SAMARIUM LACTATE $Sa(C_3H_5O_3)_3.1\frac{1}{2}H_2O$.

1000 cc. sat. solution of samarium lactate in water contain 11.47 gms. $Sa(C_3H_5O_3)_3.1\frac{1}{2}H_2O$ at 20°. (Jantsch, 1926.)

SAMARIUM GLYCOLATE $Sa(C_2H_3O_3)_3$

100 gms. H_2O dissolve 0.6373 gm. $Sa(C_2H_3O_3)_3$ at 20°. (Jantsch and Grünkraut, 1912–13.)

SAMARIUM SULFONATES

SOLUBILITY IN WATER.

Salt.	Formula.	t°.	Gm. Anhydrous Salt per 100 Gms. H_2O.	Authority.
Samarium *m* Nitrobenzene Sulfonate	$Sa[C_6H_4(NO_2)SO_3]_3.7H_2O$	15	50.9	(Holmberg, 1907.)
Samarium Bromonitrobenzene Sulphonate	$Sa[C_6H_3(1)Br(4)NO_2(2)SO_3]_3.10H_2O$	25	7.84	(Katz and James, 1913.)

SAMARIUM OXALATE $Sa_2(C_2O_4)_3.10H_2O$.

One liter H_2O dissolves 0.00054 gm. $Sa_2(C_2O_4)_3$ at 25°, determined by the electrolytic conductivity method. (Rimbach and Schubert, 1909.)

SOLUBILITY OF SAMARIUM OXALATE IN AQUEOUS SOLUTIONS OF ACIDS AT 25°.

(Sarver and Brinton, 1927.)

COO

Composition of aq. solvent in normality	Gms. $Sa_2(C_2O_4)_3$ per 100 gms. sat. sol.	Composition of aq. solvent in normality	Gms. $Sa_2(C_2O_4)_3$ per 100 gms. sat. sol.
0.1008 HCl	0.0052	4.00 HCl + sat. $(COOH)_2$	0.0285
0.2576 "	0.0181	6.00 " + " "	0.1165
0.5702 "	0.0267	0.2482 HNO_3	0.0189
0.978 "	0.0712	1.992 "	0.3408
1.484 "	0.1452	4.054 "	1.062
2.000 "	0.2296	2.00 " + 0.1 $(COOH)$	0.0905
0.978 " + 0.1 $(COOH)_2$	0.0061	3.03 " + 0.1 "	0.2898
2.000 " + 0.1 "	0.0421	4.00 " + 0.1 "	0.6327
2.865 " + 0.1 "	0.1228	2.00 " + 0.5 "	0.0134
3.965 " + 0.1 "	0.3202	3.03 " + 0.5 "	0.0504
0.978 " + 0.5 "	0.0010	4.00 " 0.5 "	0.1603
2.000 " + 0.5 "	0.0061	0.086 H_2SO_4	0.0090
2.865 " + 0.5 "	0.0175	0.419 "	0.424
3.965 " + 0.5 "	0.0594	0.958 "	0.1042
1.484 " + sat. "	0.0031	1.846 "	0.2189

SOLUBILITY OF SAMARIUM OXALATE IN AQUEOUS SOLUTIONS .OF NITRIC AND OXALIC ACIDS AT 90°.

(Neckers and Kremers, 1928.)

Composition of aq. solvent in normality	Gms. Sa_2O_3 per 100 cc sat. sol.	Composition of aq. solvent in normality	Gms. Sa_2O_3 per 100 cc sat. sol.
2.5 HNO_3	1.878	2.5 + 5% $(COOH)_2$	0.5457
5.0 "	5.675	5.0 + "	4.1520

ɜILITY OF SAMARIUM OXALATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°.

(Wirth, 1912.)

ility of $_2SO_4$.	Gm. $Sa_2(C_2O_4)_3$ per 100 Gms. Sat. Sol.	Solid Phase.	Normality of Aq. H_2SO_4.	Gm. $Sa_2(C_2O_4)_3$ per 100 Gms. Sat. Sol.	Solid Phase.
	0.1015	$Sa_2(C_2O_4)_3.10H_2O$	2.8	0.3886	$Sa_2(C_2O_4)_3.10H_2O$
445	0.1804	"	4.32	0.7008	"
93	0.2254	"	6.175	1.072	"

ARIUM CHLORIDE $SaCl_3.6H_2O$.

Cl

SOLUBILITY IN WATER AND IN AQUEOUS HYDROCHLORIC ACID.

(Williams, Fogg and James, 1925.)

turation was secured by constant rotation for 9 hours or more and approaching librium from above and from below. Approximately 1.0 cc. quantities of the rated solutions were diluted to about 150 cc. and precipitated with oxalic acid. precipitate was filtered and the residue ignited and weighed.

Results for Water.

	Gms. $SaCl_3$ per 100 gms. sat sol.	Solid Phase.
.....	48.02	$SaCl_3.6H_2O$
.....	48.29	»
.....	48.60	»
....	49.20	»
....	49.98	»

Results for Aq. HCl of *d* = 1.1051.

t°.	Gms $SaCl_3$ per 100 gms. sat. sol.	Solid Phases
10.......	21.84	$SaCl_3.6H_2O$
20.......	22.42	»
30.......	23.97	»
40.......	25.52	»
50.......	27.49	»

oo gms. Pyridine dissolve 6.38 gms. SaCl at 15 . (Matignon, 1906.
9.

ARIUM CHROMATE $Sa(CrO_4)_3.8H_2O$.

oo gms. sat. solution of Samarium Chromate in Water contain 0.043 gm. $rO_4)_3$ at 25°. . (Britton, 1924.)

ARIUM NITRATE $Sa(NO_3)_3.6H_2O$.

OLUBILITY OF SAMARIUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID.

(Quill and Robey, 1937.)

NO

Results at 25°				Results at 50°		
.per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
$Sa(NO_3)_2$	HNO_3			$Sa(NO_3)_3$	HNO_3	
58.95	0.0	(1)$Sa(NO_3)_3.6H_2O$	1.939	64.81	0.0	$Sa(NO_3)_3.6H_2O$
52.08	6.15	"	1.916	62.97	2.12	"
46.52	11.34	"	1.859	57.57	7.53	"
16.40	44.38	"	—	45.05	22.38	"
14.20	48.40	"	1.648	33.20	36.40	"
13.64	51.58	"	1.664	30.22	47.52	"+$Sa(NO_3)_3.4H_2O$
			1.638	27.89	46.21	$Sa(NO_3)_3.4H_2O$(?)

density of sat. solution = 1.782

ARIUM Double NITRATES.

SOLUBILITY IN CONC. HNO_3 OF d_{16} = 1 325 AT 16°.

(Jantsch, 1912)

Salt.			Formula.		Gms. Hydrated Salt per 100 cc. Sat. Sol.
marium Magnesium Nitrate			$[Sa(NO_3)_6]_2Mg_3$	. 24 H_2O	24.55
" Nickel	"	"	Ni_3	"	29.11
" Cobalt	"	"	Co_3	"	34.27
" Zinc	"	"	Zn_3	"	36.47
" Manganese	"	"	Mn_3	"	50.04

SAMARIUM Dimethyl **PHOSPHATE** $Sa_2[(CH_3)_2PO_4]_6$.

100 gms. H_2O dissolve 35.2 gms. $Sa_2[(CH_3)_2PO_4]_6$ at 25° and about 10.8 gms. at 95°. (Morgan and James, 1914.)

SAMARIUM SULFATE $Sa_2(SO_4)_3.8H_2O$.

100 gms. H_2O dissolve 2.67 gms. $Sa_2(SO_4)_3.8H_2O$ at 20° and 1.99 gms. at 40°. (Jackson and Reinacker, 1930.)

SOLUBILITY IN AQUEOUS SOLUTIONS OF AMMONIUM SULFATE AT 25°.*

(Keyes and James, 1914.)

Gms. per 100 Gms. H_2O.		Solid Phase.
$(NH_4)_2SO_4$.	$Sa_2(SO_4)_3$.	
0.03	2.1	$Sa_2(SO_4)_3$
0.8	2	"
1.1	2.8	" +1.1.7
1.9	1.5	1.1.7
7.4	0.8	"
18.8	0.8	"
32.5	0.9	1.1.7
46.3	1	"
77.5	1.3	" $+(NH_4)_2SO_4$
77.3	0.3	$(NH_4)_2SO_4$
76.8	0.6	"

1.1.7 = $Sa_2(SO_4)_3.(NH_4)_2SO_4.7H_2O$.

SO

SOLUBILITY IN AQUEOUS SOLUTIONS OF SODIUM SULFATE AT 25°.*

(Keyes and James, 1914.)

Gms per 100 Gms H_2O.		Solid Phase.
Na_2SO_4.	$Sa_2(SO_4)_3$	
...	2.05	$Sa_2(SO_4)_3$
0.1	2	"
0.5	0.11	$2Sa_2(SO_4)_3.3Na_2SO_4.6H_2O$
1.9	0.03	"
6.44	0.016	"
10.51	0.012	$2Sa_2(SO_4)_3.3Na_2SO_4.6H_2O$
14.71	0.010	"
20.02	0.012	"
23.68	0.018	"
27.40	0.011	"

* The mixtures were rotated at constant temperature for 5 months.

100 cc. anhydrous hydrazine dissolve 1 gm. $Sa_2(SO_4)_3$ at room temp. (Welsh and Broderson, 1915.)

STIBIUM (Antimony) Sb

Fusion-point data are given for:

Sb + I (Jaeger and Dornbosch, 1912.)
" + " + As (Quercigh, 1912.)
" + S (Jaeger and Dornbosch, 1912.)
Sb + Zn + Pb (Tammann and Schaftmeister, 1924.
" + " + Bi " " "
" + Al + Pb " " "

ANTIMONY TH**BROMIDE** $SbBr_3$.

SOLUBILITY IN BENZENE DETERMINED BY "SYNTHETIC METHOD."

(Menschutkin, 1910.)

t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
5.6 m. pt.	0	C_6H_6
4.5 Eutec.	8.3	$C_6H_6+2SbBr_3.C_6H_6$
15	12.5	$2SbBr_3.C_6H_6$
35	23	"
55	39	"
75	60.5	"
85	74.3	"
90	83	$2SbBr_3.C_6H_6$
92.5 m. pt.	90.2	"
91.5	92.8	"
90	93.8	"
85 Eutec.	96.3	$2SbBr_3.C_6H_6+SbBr_3$
90	98	$SbBr_3$
94	100	"

RECIPROCAL SOLUBILITIES OF ANTIMONY TRIBROMIDE AND VARIOUS ORGANIC COMPOUNDS, DETERMINED BY THE "SYNTHETIC METHOD."

(Menschutkin, 1911.)

$SbBr_3$ + Acetic Acid. t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	$SbBr_3$ + Benzoic Acid. t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	$SbBr_3$ + Benzoyl Chloride. t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	$SbBr_3$ + Benzene Sulphonic Acid. t°.	Gms. $SbBr_3$ per 100 Gm. Sat. Sol.
16.5 *	0	120 *	0	− 0.5 *	0	52.5 *	0
15	12.2	115	20.1	− 3	19.5	50	15.8
10	41.8	110	36.8	− 6 †	32	47.5	26.2
4 †	58.2	105	50	+10	41.2	44 †	36.9
20	64.3	100	61.5	20	47.5	50	39.1
40	72.5	95	71	30	54	60	45.7
60	81.9	85	83.1	40	60.8	70	55.2
70	97.1	79 †	87.6	50	67.8	80	68.1
80	92.4	85	92	60	74.9	85	77.6
90	97.8	90	96.4	80	89.4	90	90.3
94	100	94	100	94	100	94	100

Molecular compounds are not formed in the above systems. The diagram in each case consists of two arms meeting at the eutectic.

$SbBr_3$ + Acetophenone.

t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
19.5 *	0	$C_6H_5COCH_3$
15	22.7	"
1.5 *	48.6	" +1.1
20	56.8	1.1
30	63.3	"
37.5 *	75	"
31 †	83.2	1.1+$SbBr_3$
40	84.6	$SbBr_3$
60	88.4	"
80	94.1	"
94	100	"

$SbBr_3$ + Amylbenzene.

t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−70	4.5	$SbBr_3.C_6H_5.C_5H_{11}$
−50	8.3	"
−30	16.6	"
−25	21	"
−17 ‡	32.5	"+$SbBr_3$
−10	33.5	$SbBr_3$
0	35.6	"
20	41.6	"
40	51.3	"
60	65	"
80	84	"

$SbBr_3$ + Anisole.

t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−34 *	0	$C_6H_5OCH_3$
−35	2.5	"+1.1
−20	11.7	1.1
0	26.5	"
10	37.1	"
20	50.5	"
25	59	"
30.5 *	77	"
30 †	77.9	"+$SbBr_3$
40	80.6	$SbBr_3$
60	86.4	"
80	93.6	"

$SbBr_3$ + Benzaldehyde.

t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−20	38.4	1.1
0	45.5	"
20	54.3	"
35	64.1	"
40	70.3	"
41.5 *	77.2	"
37.8 †	84.4	1.1+$SbBr_3$
55	88	$SbBr_3$
75	93.1	"
85	96.1	"
90	98.2	"
94	100	"

$SbBr_3$ + Benzonitrile.

t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−13.2 *	0.0	C_6H_5CN
−16	19.2	"
−18 †	28.7	"+1.1
0	43	1.1
20	59	"
30	67	"
38 *	77.8	"
35 †	82.5	1.1+$SbBr_3$
55	87.5	$SbBr_3$
75	93.3	"
85	96.5	"
90	98.3	"
94	100	"

$SbBr_3$ + Benzophenone.

t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
48 *	0	$C_6H_5CO.C_6H_5$
40	24	"
29 †	41.2	"+1.1
40	50	1.1
45	56.3	"
48.5 *	66.4	"
45	76	"
40	80	1.1+$SbBr_3$
50	82.6	$SbBr_3$
70	88.7	"
80	92.4	"
90	97.3	"
94	100	"

* m. pt. † Eutec. ‡ tr pt.

1.1 = compound of equimolecular amounts of the two constituents in each case.

RECIPROCAL SOLUBILITIES OF ANTIMONY TRIBROMIDE AND VARIOUS ORGANIC COMPOUNDS, DETERMINED BY THE "SYNTHETIC METHOD."

(Menschutkin, 1910.)

SbBr₃ + Brombenzene.		SbBr₃ + Chlorbenzene.		SbBr₃ + Iodobenzene.		SbBr₃ + Fluorbenzene.	
t°.	Gms. SbBr₃ per 100 Gms. Sat. Sol.	t°.	Gms. SbBr₃ per 100 Gms. Sat. Sol.	t°.	Gms. SbBr₃ per 100 Gms. Sat. Sol.	t°.	Gms. SbBr₃ per 100 Gms. Sat. Sol.
−31 *	0	−45.2 *	0	−28.6 *	0	−39.2 *	0
−32	5.7	−47 †	5.2	−30.3	7.0	−39.5 †	1.3
−25 †	9.5	−40	6.8	−32 †	14.3	−25	4.3
−15	15	−30	9.6	−20	21.6	−15	6.7
− 5	20.8	−20	12.6	−10	27.5	+ 5	12.6
+ 5	26.8	−10	16	0	33.4	25	21.8
15	33	0	20	+10	39.3	45	35.3
25	39.6	20	30	20	45.2	55	45.5
45	54.6	40	45.4	40	57.6	65	60.8
65	71.9	60	65.8	60	71.1	75	81.8
85	90.7	80	86.3	80	86.3	85	93.5
94	100	94	100	94	100	94	100

Br

SbBr₃ + *p* Dibrombenzene.		SbBr₃ + *p* Dichlorbenzene.		SbBr₃ + Nitrobenzene.		SbBr₃ + *m* Dinitrobenzene.	
t°.	Gms. SbBr₃ per 100 Gms. Sat. Sol.	t°.	Gms. SbBr₃ per 100 Gms. Sat. Sol.	t°.	Gms. SbBr₃ per 100 Gms. Sat. Sol.	t°.	Gms. SbBr₃ per 100 Gms. Sat. Sol.
88 *	0	54.5 *	0	6 *	0	90 *	0
85	10	51.5	14	1	22	80	29.1
80	25.2	48.5 †	26.5	− 4	37.4	70	50
75	39.2	55	35.9	− 9	48.4	60	63
70	52	60	43.1	−14.5 †	55.3	50	70.8
65 †	62.2	65	50.7	− 5	58.3	47.5 †	72
70	68.7	70	58.8	+ 5	61.5	50	73.4
75	75.3	75	67.2	25	68.6	60	78.2
80	81.8	80	75.8	45	76.6	70	84
85	88.3	85	84.5	65	85.3	80	90.4
90	94.3	90	93.4	85	94.7	90	96.8
94	100	94	100	94	100	94	100

Molecular compounds are not formed in the above systems. The diagram in each case consists of two arms meeting at the eutectic.

SbBr₃ + Ethylbenzene.			SbBr₃ + Propylbenzene.			SbBr₃ + *p* Cymene.		
t°.	Gms. SbBr₃ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. SbBr₃ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. SbBr₃ per 100 Gms. Sat. Sol.	Solid Phase.
−93 *	0	$C_6H_5.C_2H_5$	−80	1.3	1.1	−75 *	0	
−93.2 †	0.4	"+1.1	−60	3.7	"	−77 †	2	
−70	1	1.1	−40	9.4	"	−50	6.1	1.1
−50	2.2	"	−20	22.5	"	−30	12.3	"
−30	4.8	"	−10	38.4	"	−10	27	"
−10	12	"	− 5 ‡	49	1.1+SbBr₃	0	42.3	"
+10	29.2	"	+10	53.3	SbBr₃	+5 ‡	51.5	1.1+SbBr₃
20	46.3	"	20	57.1	"	20	56	SbBr₃
29 ‡	69.7	1.1+SbBr₃	40	66.2	"	40	64.1	"
50	78.2	SbBr₃	60	77.2	"	60	75	"
70	87.3	"	80	89.8	"	80	88.5	"
90	97.7	"	94	100	"	94	100	"

* m. pt. † Eutec. ‡ tr. pt.

1.1 = compound of equimolecular amounts of the two constituents in each case

RECIPROCAL SOLUBILITIES OF ANTIMONY TRIBROMIDE AND VARIOUS ORGANIC COMPOUNDS, DETERMINED BY THE "SYNTHETIC METHOD."

(Menschutkin, 1911.)

$SbBr_3$ + Cyclohexane.

t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
6.4 *	0	C_6H_{12}
6 †	0.3	$C_6H_{12}+SbBr_3$
20	1.4	$SbBr_3$
40	3.7	"
60	7.1	"
80	12.5	"
liquid layers formed		
92.5	17.4	97.6
110	25.8	96.5
130	36.4	95
150	47.8	92.7
170	62.3	86.3
175 ‡	74.0	

$SbBr_3$ + Pseudo Cymene.

t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−57.2 *	0	$C_6H_3(CH_3)_3$ 1, 2, 4
−58.8 †	9.7	" +1.1
−50	11	1.1
−30	16.2	"
−10	31	"
0	47.6	"
7 §	63.5	1.1+2.1
15	67.4	2.1
25	73	"
33 §	79.1	2.1+$SbBr_3$
50	82.8	$SbBr_3$
70	88.4	"
90	97.4	"

$SbBr_3$ + Mesitylene.

t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−54.4 *	0	$C_6H_3(CH_3)_3$ 1, 3, 5
−55.2 †	2.1	" +1.1
−30	3.6	1.1
−10	9	"
+10	25.4	"
20	35.5	"
29 ‡	46.5	1.1+2.1
40	54.2	2.1
50	61.7	"
60	70.2	"
69.5 *	85.8	"
69 †	87.7	2.1+$SbBr_3$
80	92.7	$SbBr_3$

$SbBr_3$ + Diphenylmethane.

t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
26 *	0	$CH_2(C_6H_5)_2$
22.5 †	12.8	"+2.1
40	22.8	2.1
50	29.5	"
60	37.5	"
70	47.8	"
80	60.2	"
90 *	81.1	"
85	89.6	"
82 †	92.2	2.1+$SbBr_3$
90	96.2	$SbBr_3$
94	100	"

$SbBr_3$ + Naphthalene.

t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
79.4 *	0	$C_{10}H_8$
75	23.7	"
70	37.4	"
65	48.6	"
57	61.2	" +2.1
60	68	2.1
65	81.3	"
66 *	84.9	"
65 †	86.7	2.1+$SbBr_3$
75	90.1	$SbBr_3$
85	94.9	"
90	97.7	"

$SbBr_3$ + α Nitronaphthalene.

t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
57 *	0.0	$\alpha C_{10}H_7NO_2$
50	23.2	"
40	42.6	"
33.5 †	50.5	"+1.1
37.5	62.6	1.1 ¶
38.2 *	67.6	"
38 †	68	1.1+$SbBr_3$
50	73.4	$SbBr_3$
70	83.8	"
90	96.4	"

$SbBr_3$ + Diphenyl.

t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
70.5 *	0	$C_6H_5C_6H_5$
60	35.7	"
50	54.3	"
47 †	57.4	"+2.1
55	68.5	2.1
60.5 *	82.7	"
70	86.5	$SbBr_3$
80	91.5	"
90	97.3	"
94	100	"

$SbBr_3$ + Phenol.

t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
41 *	0	C_6H_5OH
35	22.5	"
30	40	"
28.5 †	44.6	"+2.1
40	53	2.1
50	62.5	"
60	75.8	"
65	84.7	"
66.5 *	88.5	"
75	91.7	$SbBr_3$
85	95.8	"
90	98.1	"

$SbBr_3$ + Phenetol.

t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−28.6 *	0	$C_6H_5OC_2H_5$
−29 †	1.6	" +1.1
−10	4.8	1.1
+10	12.9	"
20	19.2	"
30	29.7	"
40	46.2	"
48.8 *	74.7	"
47 †	77.8	1.1+$SbBr_3$
60	83	$SbBr_3$
70	87.3	"
90	97.4	"

* m. pt. † Eutec. ‡ crit. t. § tr. pt.

¶ Not obtained regularly, in such cases, single eutectic at 23° and 61.5 per cent $SbBr_3$.

1.1 = compound of equimolecular amounts of the two constituents in each case.

2.1 = compound of 2 molecules of $SbBr_3$ with one molecule of the other constituent.

RECIPROCAL SOLUBILITIES OF ANTIMONY TRIBROMIDE IN VARIOUS ORGANIC COMPOUNDS, DETERMINED BY THE "SYNTHETIC METHOD."

(Menschutkin, 1910–12.)

$SbBr_3$ + α Bromnaphthalene.		$SbBr_3$ + α Chlornaphthalene.		$SbBr_3$ + β Chlornaphthalene.		$SbBr_3$ + Tetrahydrobenzene.	
t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.
3 *	0	−17 *	0	56 *	0	...	...
0	15.8	−21	13.8	50	26.1	−5	11.7
− 3.5 †	31.4	−24.5 †	22.6	45	38.5	15	15.1
15	38.7	−10	27.3	40	49	35	24.1
35	49.9	+10	35.5	37.5 †	53.6	55	41
45	56.9	30	46.7	45	58.8	65	55.1
55	64.7	50	61.6	55	66.8	70	64.5
65	72.9	60	69.9	65	75.2	75	76.2
75	81.8	70	78.6	75	83.8	80	84.4
80	86.3	80	87.5	80	88.1	85	90.7
85	90.8	90	96.6	85	92.4	90	95.8
90	95.4	94	100	90	96.7	94	100

Br

$SbBr_3$ + *o* Chlortoluene.		$SbBr_3$ + *m* Chlortoluene.		$SbBr_3$ + *p* Chlortoluene.		$SbBr_3$ + *m* Nitroluene.	
t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.
−36.2 *	0	−47.8 *	0	6.2 *	0	16 *	0
−38.5 †	10.7	−50 †	8.1	2.5 †	23.3	10	24.2
−20	15.4	−30	11.7	20	33	5	39
0	22.5	−10	17.5	30	39.3	0	46.6
+20	32.5	+10	25.8	40	47.2	− 9 †	56.8
30	38.8	30	37.5	50	56.3	+10	62.7
40	46.8	40	45.1	60	66.7	30	69.7
50	56	50	54.4	70	77.8	50	77.5
60	66.5	60	65	80	88.2	60	81.5
70	77.8	70	77	90	97	70	86.3
80	88.2	80	88.2	94	100	80	91.4
90	97	90	97			90	97.2

Molecular compounds are not formed in the above systems. The diagram in each case consists of two arms meeting at the eutectic.

$SbBr_3$ + Toluene.			$SbBr_3$ + *o* Nitrotoluene.			$SbBr_3$ + *p* Nitrotoluene.		
t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−93 *	0	$C_6H_5.CH_3$	− 8.5 *	0	*o* $NO_2.C_6H_4.CH_3$	52.5 *	0	*p* $NO_2.C_6H_4.CH_3$
−93.5 †	1.0	"+1.1	−13.5	19.5	" +1.1	45	29.8	"
−80	2.4	1.1	0	27.6	1.1	40	42.2	"
−60	6.2	"	10	35.6	"	35	50	"
−40	12.4	"	20	47.5	"	25	61	"
−20	25.7	"	25	55.7	"	16 †	67	" +$SbBr_3$
− 1 ‡	53.1	1.1+2.1	31 ‡	70	" +$SbBr_3$	30	71.6	$SbBr_3$
+20	69.4	2.1	40	73.5	$SbBr_3$	50	78.9	"
30 ‡	78	2.1+$SbBr_3$	50	77.5	"	60	82.9	"
40	80.6	$SbBr_3$	60	81.7	"	70	87.2	"
60	86.6	"	80	91.4	"	80	92	"
80	93.8	"	90	97.2	"	90	97.5	"
94	100	"						

* m. pt. † Eutec. ‡ tr. pt.

1.1 = compound of equimolecular amounts of the two constituents in each case.

2.1 = compound of 2 molecules of $SbBr_3$ with 1 molecule of the other constituent.

RECIPROCAL SOLUBILITIES OF ANTIMONY TRIBROMIDE AND VARIOUS ORGANIC COMPOUNDS, DETERMINED BY THE "SYNTHETIC METHOD."

(Menschutkin, 1910–11.)

$SbBr_3$ + Triphenylmethane.		$SbBr_3$ + *o* Xylene.		$SbBr_3$ + *m* Xylene.		$SbBr_3$ + *p* Xylene.	
t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.
92 *	0	−29 *	0	−57 *	0	14 *	0
85	18	−33 †	10.5	−59.2 †	5.5	12	16.6
80	30.1	−20	17	−45	10	10 †	28
70	47	−10	24.6	−35	14.2	20	36
60	58.2	0	34.5	−25	20	30	44.6
48 †	67.1	20	65.8	− 5	38.8	40	53.8
60	73.3	24 *	77.2	+ 5	56.6	50	63.5
70	79.5	22.5 †	78.6	12.5 ‡	75.4	60	74
80	86.4	30	80	25	77.6	67.5 *	87.3
90	95.2	50	84.7	45	82.3	66.5 †	88.3
94	100	70	90.1	65	87.9	75	91.4
		90	97.7	87	95.3	85	95.7

* m. pt. † Eutec. ‡ tr. pt.

In the case of each of the above xylenes the compound existing between the first and second eutectic consists of equimolecular amounts of $SbBr_3$ and xylene.

Br

Freezing-point data are given for:

$SbBr_3$ + $SbCl_3$ (Bernadis, 1912.)
" + $SnBr_4$ (Pusin and Makuc 1938.)
" + Br " " "
" + $AsBr_3$ (Pusin and Lowy, 1926.)
" + Azobenzene (Vanstone, 1914.)
" + Bibenzyl " "
" + Stilbene " "

$SbBr_3$ + Benzanilide (Vanstone, 1925.)
" + Erythrite (Rusin and Dezelic
" + Aniline (Kurakov, 1932.)
(Kurakov, Krotkov and Oksman, 1915.)
" + Benzophenone " " "
" + Toluene " " "
" + Triphenylmethane " " "

ANTIMONY Nitroso β Phenyl HYDROXYLAMINE(Cupferronate) $Sb[C_6H_5.N(NO).O]_3$

One liter sat. solution of the salt in water contain 0.000045 gm. atom (= 0.0055 gm.) $Sb[C_6H_5.N(NO).O]_3$ at 18°. (Pinkus and Martin, 1927.)

ANTIMONY THPHENYL $Sb(C_6H_5)_3$.

Freezing-point data are given for mixtures of antimony triphenyl and mercury diphenyl and for antimony triphenyl and tin tetraphenyl. (Cambi, 1912.)

ANTIMONY TRICHLORIDE $SbCl_3$.

SOLUBILITY IN WATER. SOLID PHASE $SbCl_3$.

(Meerburg — Z. anorg. Chem. 33, 299, 1903.)

t°.	Mols. $SbCl_3$ per 100 Mols. H_2O.	Gms. $SbCl_3$ per 100 g. H_2O.	t°.	Mols. $SbCl_3$ per 100 Mols. H_2O.	Gms. $SbCl_3$ per 100 g. H_2O.
0	47.9	601.6	35	91.6	1152.0
15	64.9	815.8	40	108.8	1368.0
20	72.4 74.1	910.1 931.5	50	152.5	1917.0
			60	360.4	4531.0
25	78.6	988.1	72	∞	∞
30	84.9	1068.0			

100 gms. sat. sol. of $SbCl_3$ in H_2O contain 90.90 gms. $SbCl_3$ at 25° (Miyake,
" " 10.55 % HCl " 90.07 " 1924, 1925.)

Data for the system $SbCl_3 + KCl + H_2O$ are given. The double salts $2\,KCl\,SbCl_3$ and $7\,KCl\,3\,SbCl_3$ were found but no mixed crystals as mentioned by Jordis, 1903.

Cl

SOLUBILITY OF ANTIMONY TRICHLORIDE IN AQUEOUS HYDROCHLORIC ACID. SOLID PHASE $SbCl_3$. TEMP. 20°.

(Meerburg.)

Mols. per 100 Mols. H_2O.		Gms. per 100 g. H_2O.		Mols. per 100 Mols. H_2O.		Gms. per 100 g. H_2O.	
HCl.	$SbCl_3$.	HCl.	$SbCl_3$.	HCl.	$SbCl_3$.	HCl.	$SbCl_3$.
0	72.4	0.0	910.1	9.1	68.9	18.41	866.4
2.4	71.2	4.86	895.4	11.7	68.1	23.68	856.3
6.1	69.9	12.34	879.0	28.7	62.8	58.08	789.8
8.3	68.2	16.80	857.6				

100 gms. absolute acetone dissolve 537.6 gms. $SbCl_3$ at 18°. d_{18} sat. sol. = 2.216. (Naumann, 1904.)

100 gms. ethyl acetate dissolve 5.9 gms. $SbCl_3$ at 18° *d* sat. sol. = 1.7968. (Naumann, 1910.)

100 gms. acetylene tetrachloride ($C_2H_2Cl_4$) dissolve 21.75 gms. $SbCl_3$ at 25°. (de Pauw, 1922, 1926)

100 gms. of a sat. solution of antimony pentachloride ($SbCl_5$) in Selenium oxychloride ($SeOCl_2$) contain 38.64 gms. $SbCl_5$ at 25°. (Wise, 1923)

RECIPROCAL SOLUBILITIES OF ANTIMONY TRICHLORIDE AND VARIOUS ORGANIC COMPOUNDS, DETERMINED BY THE "SYNTHETIC METHOD."

(Menschutkin, 1911.)

$SbCl_3$ + Acetic Acid.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
16.5 *	0	CH_3COOH
10	22.7	"
0	42.5	"
− 5	48.5	"
− 9 †	52.7	" +1.1
0	59	1.1
10	67.3	"
19 *	79.1	"
25	81.5	$SbCl_3$
45	87.4	"
65	95.3	"
73	100	"

$SbCl_3$ + Acetophenone

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
19.5 *	0	$C_6H_5COCH_3$
15	14.3	"
5	28.5	"
1 †	31.8	" +1.1
15	35.4	1.1
35	41.6	"
55	55.2	"
60.5 *	65.4	"
45	79.3	"
32 †	84	1.1+$SbCl_3$
50	89.3	$SbCl_3$
70	98.2	"

$SbCl_3$ + Anisol.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−34 *	0	$C_6H_5OCH_3$
−36.5 †	11.8	" +1.1
−30	16	1.1
−10	28.3	"
+10	43	"
20	52.8	"
25 ‡	63.6	" +2.1
35	70	2.1
41.5 *	80.9	"
40 †	84.5	"+$SbCl_3$
60	92	$SbCl_3$
70	98	"

$SbCl_3$ + Aniline.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
− 7.2 †	1	$C_6H_5NH_2$+1.4
+20	7	1.4
60	18.7	"
77 ‡	29.6	1.4+1.3
88 *	44.8	1.3
87 †	46.3	1.3+1.2
94.5 *	54.9	1.2
89.5 †	61.7	1.2+1.1
100.5 *	71	1.1
70	82.2	"
31 †	88	1.1+$SbCl_3$
60	94.9	$SbCl_3$

$SbCl_3$ + Benzaldehyde.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
10	43.5	1.1
20	47.5	"
30	52.4	"
40	60.2	"
43.5 *	68.1	"
40	74.2	"
30	80.6	"
25 †	83	1.1+$SbCl_3$
35	85	$SbCl_3$
45	87.5	"
65	95.2	"
73	100	"

$SbCl_3$ + Benzophenone.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
48 *	0	$C_6H_5COC_6H_5$
40	16.3	"
35 †	21.6	" +1.1
45	26.2	1.1
55	31.4	"
65	37.5	"
76 *	55.4	"
65	71.6	"
45	80.6	"
39 †	82.7	"+$SbCl_3$
50	87	$SbCl_3$
70	97.7	"

C1

1.1 = compound of equimolecular amounts of the two constituents in each case.

2.1 = compound of 2 molecules of $SbCl_3$ with 1 molecule of the other constituent.

1.2, 1.3 and 1.4 = compounds of 1 molecule of $SbCl_3$ with 2, 3 and 4 molecules of aniline.

$SbCl_3$ + Benzoic Acid.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.
120	0
110	23
100	38.8
90	50
80	59
70	66
60	71.6
46 †	78
60	89.2
70	97.5

$SbCl_3$ + Benzoyl Chloride.

t°	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.
− 5	17.8
−15	36.8
−23 †	45
− 5	50.7
+15	58.2
25	62.9
35	68.4
45	74.9
55	82.4
70	96.5

$SbCl_3$ + Benzene Sulphonic Acid.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.
52.5 *	0
45	18
25	43.7
5	56.1
−5 †	60.8
+5	49.8
25	56.7
45	69.2
65	90.2
73	100

$SbCl_3$ + Tetrahydrobenzene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.
−25	19.1
−15	24
− 5	39
+ 5	37.1
15	45.1
25	54.3
35	64.5
45	74
55	83.6
65	92.8

Molecular compounds are not formed in the above systems. The diagram in each case consists of two arms meeting at the eutectic.

* m. pt. † Eutec. ‡ tr. pt.

RECIPROCAL SOLUBILITIES OF ANTIMONY TRICHLORIDE AND VARIOUS ORGANIC COMPOUNDS, DETERMINED BY THE "SYNTHETIC METHOD."

(Menschutkin, 1910–'11.)

$SbCl_3$ + Benzene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
4*	7.3	C_6H_6
1	19.4	" +2.1
10	24.6	2.1
20	30.5	"
40	44.1	"
60	60.6	"
75	76.8	"
79 †	85.3	"
70	93.5	"
62 *	96	2.1 + $SbCl_3$
67.5	97.9	$SbCl_3$

$SbCl_3$ + Brombenzene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−31 †	0	C_6H_5Br
−32.5*	4.8	" +1.1
−30	6.8	1.1
−20	14.8	"
−10	23.9	"
0	34.3	"
+ 3 ‡	40.3	1.1 + $SbCl_3$
20	52	$SbCl_3$
40	68	"
60	85.8	"
73	100	"

$SbCl_3$ + Chlorbenzene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−45.2 †	0	C_6H_5Cl
−47 *	4.3	" +1.1
−40	7	1.1
−30	11.1	"
−15	20.5	"
− 5	32.5	"
0 ‡	44.2	"
20	56	"
40	72.1	"
60	88.2	"
73	100	"

$SbCl_3$ + Fluorbenzene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−39.2 †	0	C_6H_5F
−40.5 *	2.4	"+ 1.1
−25	11	1.1
−15	17.3	"
−10	21.4	"
− 5	26.4	"
0	34.1	"
+ 5.5 ‡	45.8	1 1 + $SbCl_3$
15	53.6	$SbCl_3$
25	61.6	"
45	77.7	"
65	93.8	"

$SbCl_3$ + Iodobenzene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−28.6 †	0	C_6H_5I
−35	12.8	"
−45 *	29.8	"+1.1
−34.5	11.7	1.1, unstable
−15	26.4	" "
− 3	49.1	" "
−35	32.5	1.1 + $SbCl_3$
−15	38.9	$SbCl_3$
+ 5	46.4	"
25	56	"
45	69.6	"
65	88.8	"

$SbCl_3$ + Nitrobenzene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
6 †	0	$C_6H_5NO_2$
− 2	20.4	"
−10	32	"
−16.5 *	38	" +1.1
−10.5	44	1.1
− 7.5	50	"
− 6 †	64.8	"
− 6.5 *	67.5	1.1 + $SbCl_3$
+ 5	69.6	$SbCl_3$
35	78.7	"
55	87.4	"
70	96.6	"

$SbCl_3$ + Ethylbenzene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−93 †	0	$C_6H_5.C_2H_5$
−93 5 *	0.3	" +1.1
−70	0.6	1.1
−50	1.1	"
−30	2.5	"
−10	7	"
+10	18.8	"
30	44.4	"
39 †	68.1	"
35 *	77.4	1.1 + 2.1
37 †	81.1	2.1
36.8 *	81.8	2.1 + $SbCl_3$
50	87.2	$SbCl_3$
70	98	"
...	...	...
33	80.4	1.1 + $SbCl_3$ (unstable)

$SbCl_3$ + Benzonitrile.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−13.2 †	0	C_6H_5CN
−16	10.2	"
−19 *	17.2	" +1.1
−10	21.9	1.1
0	28.5	"
10	38.7	"
15	47.4	"
20	62.6	"
21.5 †	68.7	"
20	72.4	"
15 *	78.9	"
25	81.6	"
45	87.6	"
65	95.6	"
73	100	"

$SbCl_3$ + Isoamylbenzene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−80	4	1.1
−60	11.7	"
−40	25.4	"
−33 ‡	32.7	1.1 + 2.1
−25	38.7	2.1
−15	47.2	"
− 5 ‡	56.8	2.1 + $SbCl_3$
0	57.4	$SbCl_3$
20	63.3	"
40	72.6	"
60	87.1	"
70	97.3	"
...	...	...
−25	44.4	unstable 1.1
−21 ‡	54.9	" 1.1 + $SbCl_3$
−10	56	" $SbCl_3$

* Eutec. † m. pt. ‡ tr. pt.

1.1 = compound of equimolecular amounts of the two constituents in each case.
2.1 = compound of 2 molecules of $SbCl_3$ with 1 molecule of the other constituent.

RECIPROCAL SOLUBILITIES OF ANTIMONY TRICHLORIDE AND VARIOUS ORGANIC COMPOUNDS, DETERMINED BY THE "SYNTHETIC METHOD."

(Menschutkin, 1910–11.)

$SbCl_3$ + *m* Dinitrobenzene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
90 *	0	*m* $C_6H_4(NO_2)_2$	20	72.8 unstable	1.1
80	18.6	"	15	76.2 "	"
70	31.3	"	10	78.6 "	"
60	40.7	"	5	80.8 "	"
50	48	"	0	82.7 "	"
40	53.6	"	−10	64.9 "	$SbCl_3$
30	58	"	+10	69 "	"
20	61.5 unstable	"	20	71.6 "	"
10	64.5 "	"	30	74.8	"
1 †	66.8 "	" +$SbCl_3$	40	78 7	"
−11	68.8 "	"	50	83.5	"
+27.5	52.5 "	1.1	60	89	"
28.5 *	58.2	"	70	96.4	"
27.5	63	"	73	100	"
25	67.5	"			

$SbCl_3$ + Propylbenzene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−70	c 6	2.1
−30	10.1	"
−10	26.6	"
0	40.4	"
7	57.5	"
8.5 ‡	68.2	"+$SbCl_3$
20	71.4	$SbCl_3$
40	78.5	"
65	92.5	"
...	...	...
−70	1.5	1.1 unstable
−30	16	" "
− 5	48.2	" "
+ 1.5 *	65.3	" "
1 †	66.3	" +$SbCl_3$ "
10	68.6	$SbCl_3$ "

$SbCl_3$ + *p* Dibrombenzene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.
88 *	0
85	5.7
80	15.4
70	35
60	52.8
55	59
49.5 †	64
65	71.8
60	79.3
70	95

$SbCl_3$ + *p* Dichlorbenzene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.
54.5 *	0
50	14
45	30
40	48
39.5 †	50.5
45	59.5
50	67.8
55	75.7
60	83
70	96.2

$SbCl_3$ + Cyclohexane.

C1

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	
6.4 *	0.0	
6 †	0.2	
20	1.2	
40	4.2	
60	9.7	
Two liquid layers formed		
70	13.7	97
80	19.5	96.1
100	32.3	92.7
120	57.1	83.2
124	58.9	76.7
125.5 §	68	

$SbCl_3$ + *p* Cymene,

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−75 *	0	*p* $C_6H_4CH_3C_3H_7$
−76.5 †	2	" +1.1
−50	7	1.1
−30	15	"
−10	30	"
− 3.5 ‡	41	1.1+2.1
10	46.1	2.1
30	60	"
40 ‡	76.4	2.1+$SbCl_3$
50	81.2	"
60	87	"
70	95.6	"

$SbCl_3$ + Pseudocymene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−57.4 *	0	$C_6H_3(CH_3)_3$ 1, 2, 4
−60 †	18.6	" +1.1
−45	23.6	1.1
−25	33.3	"
−10	45	"
− 5 ‡	50.7	" +2.1
+15	55.8	2.1
35	62.2	"
50	69.7	"
56 *	79.2	"
51 †	87.5	2.1+$SbCl_3$
65	93.9	$SbCl_3$

$SbCl_3$ + Diphenyl.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
70.5 *	0	$C_6H_5.C_6H_5$
65	14	"
55	33.4	"
50 †	40	"+2.1
55	45.2	2.1
60	51.4	"
70	70.7	"
71 *	74.6	"
65	85.5	"
57 †	88.9	2.1+$SbCl_3$
65	93.1	$SbCl_3$
70	97	"

* m. pt. † Eutec. ‡ tr. pt. § crit. t.

1.1 = compound of equimolecular amounts of the two constituents in each case.
2.1 = compound of 2 molecules of $SbCl_3$ with 1 molecule of the other constituent.

RECIPROCAL SOLUBILITIES OF ANTIMONY TRICHLORIDE AND VARIOUS ORGANIC COMPOUNDS, DETERMINED BY THE "SYNTHETIC METHOD."

(Menschutkin, 1910–11.)

$SbCl_3$ + Mesitylene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−54.4 *	0	$C_6H_3(CH_3)_3$ 1, 3, 5
−55.6	1.5	" +1.1
−40	3	1.1
−20	7	"
0	14.2	"
10	20.3	"
30	39.3	"
38 †	51.4	" +2.1
65	65.4	2.1
75.5 *	79.2	"
70	87	"
58.5	92.4	" +$SbCl_3$
63	94	$SbCl_3$
70	98	"

$SbCl_3$ + Diphenyl Methane.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
26 *	0	$CH_2(C_6H_5)_2$
22.5 ‡	7.9	" +2.1
40	15.1	2.1
60	26	"
70	33	"
80	41.6	"
90	52.7	"
95	59.8	"
100 *	72.9	"
95	82.2	"
90	86.7	"
80	91.5	"
67 ‡	95.7	2.1+$SbCl_3$
70	97	$SbCl_3$

$SbCl_3$ + Triphenyl Methane.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
92 *	0	$CH(C_6H_5)_3$
85	11.8	"
80	19.3	"
70	32	"
60	42.4	"
50	49.6	"
49 †	50	" +1.1
45	62.8	1.1
40	68.3	"
35 ‡	72	1.1+$SbCl_3$
45	76.6	$SbCl_3$
55	82.4	"
65	90.6	"
70	96.1	"

$SbCl_3$ + Naphthalene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
79.4 *	0	$C_{10}H_8$
75	15.2	"
65	35	"
59 ‡	42.8	" +2.1
65	48.4	2.1
75	58.8	"
80	65	"
86 *	78	"
80	88.7	"
70	93	"
65 ‡	94	2.1+$SbCl_3$
70	97.2	$SbCl_3$

$SbCl_3$ + α Chlornaphthalene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−17 *	0	α $C_{10}H_7Cl$
−21 ‡	8.1	" +2.1
0	14.4	2.1
10	18.7	"
20	24.6	"
30	33.5	"
40	47.7	"
45	61.5	"
46 *	73.6	"
45.5 ‡	75	2.1+$SbCl_3$
55	82.2	$SbCl_3$
70	96.5	"

$SbCl_3$ + β Chlornaphthalene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
56	0	β $C_{10}H_7Cl$
50	16.6	"
45	27.2	"
40	35.4	"
30	47.3	"
25 ‡	52.3	" +1.1
29.5 *	58.2	1.1
28 ‡	64	1.1+$SbCl_3$
35	68.3	$SbCl_3$
45	75.3	"
60	87.5	"
73	100	"

$SbCl_3$ + α Bromnaphthalene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
3 *	0	α $C_{10}H_7Br$
−1 ‡	8.3	" +1.1
10	12.8	1.1
25	24	"
33	38.5	"
34.5 *	52.4	"
33	62.1	"
31.5 ‡	64.7	1.1+$SbCl_3$
40	69.7	$SbCl_3$
50	76.2	"
60	84.5	"
70	94.8	"

$SbCl_3$ + α Nitronaphthalene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
57 *	0	α $C_{10}H_7NO_2$
50	13.6	"
40	27.3	"
30 ‡	35.8	" +1.1
35	43.2	1.1
37.5	49.3	"
39 *	56.7	"
37.5	64.9	"
34.5 ‡	72.8	1.1+$SbCl_3$
45	78	$SbCl_3$
60	87.4	"
70	96.6	"

* m. pt. † tr. pt. ‡ Eutec.

1.1 = compound of equimolecular amounts of the two constituents in each case.

2.1 = compound of 2 molecules of $SbCl_3$ with 1 molecule of the other constituent.

RECIPROCAL SOLUBILITIES OF ANTIMONY TRICHLORIDE AND VARIOUS ORGANIC COMPOUNDS, DETERMINED BY THE "SYNTHETIC METHOD."

(Menschutkin, 1910-12.)

$SbCl_3$ + Phenol.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
41 *	0	C_6H_5OH
35	16.2	"
30	25.6	"
20	38.7	"
10	48	"
5 †	52	" +2.1
15	58.6	2.1
30	70.6	"
37 *	83	"
36.5 †	83.7	2.1 + $SbCl_3$
55	90.6	$SbCl_3$
70	98.2	"

$SbCl_3$ + Phenetol.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−28.6 *	0	$C_6H_5OC_2H_5$
−29 †	1.4	" +1.1
−20	4.5	1.1
−10	8.1	"
+10	18.2	"
20	27.4	"
30	39.4	"
40	58	"
42.2 *	65	"
35 †	77.8	"
50	86.8	"
70	97.1	"

$SbCl_3$ + Toluene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−93 *	0	$C_6H_5.CH_3$
−94 †	1.1	" +1.1
−70	3.1	1.1
−30	15.8	"
0	41.5	"
11 ‡	57.8	" +2.1
20	62.8	2.1
40	78	"
42.5 *	83.1	"
40 †	85.8	2.1 + $SbCl_3$
50	89	$SbCl_3$
70	97.8	"

$SbCl_3$ + *o* Chlortoluene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−36.2 *	0	*o* $ClC_6H_4CH_3$
−37.5 †	6.9	" +1.1
−20	18.3	1.1
−10	29.2	"
− 5	37.1	"
− 0.5 ‡	47.0	1.1 + $SbCl_3$
+10	53.1	$SbCl_3$
20	58.2	"
30	64.6	"
40	71.8	"
60	88.4	"
73	100	"

$SbCl_3$ + *m* Chlortoluene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−47.8 *	0	*m* $ClC_6H_4CH_3$
−49 †	6.9	" +1.1
−40	12.3	1.1
−30	20.1	"
−20	31	"
−14 ‡	40	1.1 + $SbCl_3$
0	40.1	$SbCl_3$
10	51.6	"
20	57.4	"
40	72.8	"
60	89.1	"
73	100	"

$SbCl_3$ + *p* Chlortoluene.

t°	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
6.2 *	0	*p* $ClC_6H_4CH_3$
3	12.7	"
0	23.5	"
− 3	32.2	"
− 7.5 †	43.8	" + $SbCl_3$
0	47.2	$SbCl_3$
10	52.2	"
30	64.8	"
40	72.3	"
50	80.2	"
60	88.8	"
70	97.4	"

Cl

$SbCl_3$ + *o* Nitrotoluene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
− 8.5 *	0	*o* $NO_2C_6H_4CH_3$
−13.5	11.3	"
−18.5 †	18.5	" +1.1
−10	21.3	1.1
+10	31.1	"
20	39	"
30	50	"
34.5 *	62.3	"
33	68	"
27.5 †	74.6	" + $SbCl_3$
40	79.1	$SbCl_3$
50	84.5	"
70	97.5	"

$SbCl_3$ + *m* Nitrotoluene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
16 *	0	*m* $NO_2C_6H_4CH_3$
10	15	"
0	30.7	"
−10	39.2	"
−20	42.8	"
crystallization not obtained here		
0	67.2	$SbCl_3$
20	72.5	"
30	76.3	"
40	80.8	"
50	86	"
60	91.6	"
73	100	"

$SbCl_3$ + *p* Nitrotoluene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
52.5 *	0	*p* $NO_2C_6H_4CH_3$
45	18.5	"
35	33.6	"
30	38.8	"
20	46	"
7.5 †	52	" +1.1
7.5 *	62.3	1.1
5	60.1	"
3 †	68.5	1.1 + $SbCl_3$
10	70	$SbCl_3$
30	75.5	"
50	85	"
70	97.5	"

* m. pt. † Eutec. ‡ tr. pt.

1.1 = compound of equimolecular amounts of the two constituents in each case.

2.1 = compound of 2 molecules of $SbCl_3$ with 1 molecule of the other constituent.

Reciprocal Solubilities of Antimony Trichloride and Various Organic Compounds, Determined by the "Synthetic Method."

(Menschutkin, 1910.)

SbCl$_3$ + *o* Xylene.			SbCl$_3$ + *m* Xylene.			SbCl$_3$ + *p* Xylene.		
t°.	Gms. SbCl$_3$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. SbCl$_3$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. SbCl$_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−29	0	*o* $C_6H_4(CH_3)_2$	−57 *	0	*m* $C_6H_4(CH_3)_2$	14 *	0	*p* $C_6H_4(CH_3)_2$
−35 †	14	" +1.1	−60.5 †	7.5	" +1.1	11.7 †	11.7	" +1 1
−30	17.5	1.1	−45	15.8	1.1	20	17.5	1.1
−20	24.8	"	−25	29	"	40	37.3	"
−10	33 4	"	− 5	46.2	"	50	52.3	"
0	43.4	"	− 2 ‡	49.8	" +2.1	55 ‡	62.7	" +2.1
10	55	"	5	53.1	2.1	60	66.1	2.1
19.5 *	68.1	"	15	58.7	"	70 *	81	"
25	71.3	2.1	25	65.7	"	65	88.1	"
30	75.7	"	33	73.8	"	58 †	92	" +SbCl$_3$
33.5 *	81	"	38 *	81	"	69	97.2	SbCl$_3$
31.5 †	82.5	2.1+SbCl$_3$	36.5 †	83.7	2.1+SbCl$_3$	...	...	....
50	88	SbCl$_3$	50	87.7	SbCl$_3$	10	20.7	*p* $C_6H_4(CH_3)_2$ unstable
60	92.4	"	60	91.5	"	7 †	32.8	" +2 1 "
71	98.5		70	97.2	"	35	50.3	2.1 "
						55	62.7	" "

* m. pt. † Eutec. ‡ tr. pt.

1.1 = compound of equimolecular amounts of the two constituents in each case.

Cl 2.1 = compound of 2 molecules of SbCl$_3$ with 1 molecule of the other constituent.

Distribution of Antimony Tri and Pentachlorides between Aqueous HCl and Ether at Room Temperature

(Mylius, 1911.)

When 1 gm. of antimony as SbCl$_3$ or as SbCl$_5$ is dissolved in 100 cc. of aq. HCl of the following strengths and the solution shaken with 100 cc. of ether, an amount of metal, depending upon the concentration of the aq. acid solution, enters the ethereal layer.

With 1% SbCl$_3$ Solution.		With 1% SbCl$_5$ Solution.	
Per cent Conc. of HCl.	Per cent of Total Sb in Ether Layer.	Per cent Conc. of HCl.	Per cent of Total Sb in Ether Layer.
20	6	20	81
15	13	15	22
10	22	10	6
5	8	5	2.5
1	0.3	1	trace

Fusion-point data are given for:

SbCl$_3$ + SbCl$_5$ (1)
" - SbI$_3$ (2)
" + " + SbBr$_3$ (2)
" + SnCl$_2$ (3)
" - SnCl$_4$ (3)
" - Benzene (5)
" - Naphthalene (5)
" + Di phenyl Methane (5)
" + Tri phenyl Methane (5)

SbCl$_3$ + Azobenzene (4)
" + Benzil (4)
" + *s* di phenyl ethane (4)
" + Stilbene (4)
" + Benzanilide (6)
" + Benzaniline (6)
" - β Chlor Naphthalene (7)
" + α Nitro Naphthalene (7)

(1) Aten, 1909; (2) Bernadis, 1912; (3) Kendall, Crittenden and Muller, 1923; (4) Vanstone, 1914; (5) Kurnakov, Krotkov and Oksman, 1915; (6) Vanstone, 1925; (7) Vasiliev, 1917.

ANTIMONY PentaCHLORIDE $SbCl_5$.

Data for the freezing-points of mixtures of antimony pentachloride and antimony pentafluoride are given by Ruff (1909).

ANTIMONY OxyCHLORIDE $Sb_4O_5Cl_2$.

SOLUBILITY IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 25°.

(Lea and Wood, 1924.)

Hydrated antimonious oxide was added in excess to solutions of pure HCl of varying concentrations and the mixtures kept in a thermostat for two months. They were shaken from time to time by hand. Portions were removed for analysis and after another month other portions were removed for a duplicate analysis. The results agreed satisfactorily, thus indicating that equilibrium had been reached. The results gave a smooth curve, thus showing the absence of a transition point. The solid phase gradually took on a crystalline appearance and on analysis corresponded to $Sb_4O_5Cl_2$.

Gm. atoms per liter of sat. sol.		Gm. atoms per liter of sat. sol.		Gm. atoms per liter of sat. sol.	
Cl.	Sb.	Cl.	Sb.	Cl.	Sb.
0.194	0.00012	1.56	0.0116	2.81	0.177
0.402	0.000172	1.74	0.0194	3.36	0.309
0.601	0.000298	1.90	0.0299	3.85	0.440
0.799	0.000610	2.10	0.0522	4.79	0.745
1.02	0.00124	2.29	0.0755	5.93	1.13
1.32	0.00565	2.54	0.120		

ANTIMONY TriFLUORIDE SbF_3.

F

SOLUBILITY IN WATER.

(Rosenheim and Grünbaum, 1909.)

t°.	Gms. SbF_3 per 100 Gms.	
	Water.	Sat. Solution.
0	384.7	79.4
20	444.7	81.6
22.5	452.8	81.9
25	492.4	83.1
30	563.6	84.9

SOLUBILITY IN AQUEOUS SOLUTIONS OF SALTS AND OF HYDROFLUORIC ACID AT 0°.

Normality of Aq. Salt Solution.	Gms. SbF_3 per 100 Gms. H_2O present in Aq. Solutions of:							
	KCl.	KBr.	KNO_3.	K_2SO_4.	$K_2C_2O_4$.	$(NH_4)_2C_2O_4$.	$K_2C_4H_4O_6$.	HF.
1	461.8	448.7	458.2	419.9	465.7	...	461.4	432.5
0.5	448.3	450	451.9	408.5	481.2	431.9	430.5	404
0.25	431.9	455.6	418.3	406.6	451.3	442.3	430.8	...
0.125	407.3	417.2	401.4	...	405.2	433.3	435.2	*479.4

* (2 n HF.)

Celluloid flasks were used and all measuring apparatus provided with HF resistant coating. The SbF_3 was prepared in the form of rhombic transparent crystals from Sb_2O_3 and HF.

ANTIMONY Tri IODIDE SbI_3.

EQUILIBRIUM IN THE SYSTEM ANTIMONY TRI IODIDE, AMMONIUM IODIDE AND WATER.

(Francois, 1936.)

The results are presented only in the form of a diagram from which the following values were read.

Results at 11°

Gms. per 100 gms. H_2O SbI_3	Gms. per 100 gms. H_2O NH_4I	Solid Phase
0.0	165	NH_4I
20.0	178	"
40.0	188	"
55.0	198	"+1.4.3
65.0	194	1.4.3
85.0	192	"
110.0	194	" + ?
114.0	185	?
118.0	180	" + 1.1.2
105.	160	1.2.2
90.	130	"

1.4.3 = $SbI_3.4NH_4I.3H_2O$.
1.2.2 = $SbI_3.2NH_4I.2H_2O$

I

Results at 20°

Gms. per 100 gms. H_2O SbI_3	Gms. per 100 gms. H_2O NH_4I	Solid Phase
0.0	172	NH_4I
40.0	195	"
55.0	210	"+1.4.3
100	205	1.4.3
136	215	" + ?
142	212	?+1.2.2
120	180	1.2.2
100	130	"

Results at 35°

Gms. per 100 gms. H_2O SbI_3	Gms. per 100 gms. H_2O NH_4I	Solid Phase
0.0	185	NH_4I
95.0	234	"
120.	227	1.4.3
148	243	"+1.2.2
105	160	1.2.2

Results at 50°

Gms. per 100 gms. H_2O SbI_3	Gms. per 100 gms. H_2O NH_4I	Solid Phase
0.0	200	NH_4I
70.0	233	"
128	270	"+1.4.3
140	266	1.4.3
145	270	"+1.2.2
120	200	1.2.2

Results at 75°

Gms. per 100 gms. H_2O SbI_3	Gms. per 100 gms. H_2O NH_4I	Solid Phase
0.0	224	NH_4I
70.0	255	"
143	295	"+1.2.2
120	205	1.2.2

EQUILIBRIUM IN THE SYSTEM ANTIMONY TRI IODIDE SODIUM IODIDE AND WATER.

(Francois, 1936.)

The results are presented only in the form of a diagram from which the following approximate values were read.

Results at 15°

Gms. per 100 gms. H_2O SbI_3	Gms. per 100 gms. H_2O NaI	Solid Phase
0.0	174	NaI
10	178	" + 1.2.8
20	130	1.2.8
50	100	"
58	90	" + 1.1.6
70	60	1.1.6

Results at 35°

Gms. per 100 gms. H_2O SbI_3	Gms. per 100 gms. H_2O NaI	Solid Phase
0.0	197	NaI
25.0	200	" + 1.2.8
40	135	1.2.8
70	110	"
95	100	" + 1.1.6
105	80	1.1.6

Results at 60°

Gms. per 100 gms. H_2O SbI_3	Gms. per 100 gms. H_2O NaI	Solid Phase
0.0	257	NaI
50	263	"
85	270	" + 1.2.8
75	220	1.2.8
100	155	"
130	140	"
165	140	" + 1.1.6
170	120	1.1.6
200	105	" + SbI_3
150	85	SbI_3
100	50	"
55	25	"

1.2.8 = $SbI_3.2NaI.8H_2O$; 1.1.6 = $SbI_3.NaI.6H_2O$.

100 gms. Methylene Iodide, CH_2I_2, dissolve 11.3 gms. SbI_3 at 12° and the density of the solution is 3.453. (Retgers, 1893.)

Fusion-point data are given for:

$SbI_3 + AsI_3$ (Vasilev, 1912, 1921; Quercigh, 1912; Jaeger and Dornbosch, 1912.)
" $+ P_2O_5$ (Jaeger and Dornbosch, 1912.)
" $+ I$ (Quercigh, 1912.)
" $+ SnI_3$ (Vasilev, 1921.)

ANTIMONY TriOXIDE Sb_2O_3.

Freezing-point data are given for mixtures of antimony trioxide and antimony trisulfide. (Quercigh, 1912.)

ANTIMONY Tri SULFIDE Sb_2S_3.

1000 cc water dissolve 0.00175 gm. Sb_2S_3 at 18°. (Weigel, 1907.)

SOLUBILITY OF ANTIMONY TRI SULFIDE IN AQUEOUS SOLUTIONS OF AMMONIA.

(Dvik, 1932.)

The determinations were made by warming mixtures of sulfide and aqueous ammonia of different concentrations for five minutes over a Bunsen burner. The solutions thus obtained were analyzed for antimony and residual ammonia.

Percent concentration of NH_3 in solvent at beginning	Percent concentration of NH_3 in solvent at end	Gms. Sb_2S_3 dissolved per 100 cc solvent
1.0	0.88	0.127
2.0	1.7	0.206
5.0	4.0	0.420
10.0	7.4	0.730
15.0	9.2	0.870
25.0	13.4	1.280

The effect of time of heating and variation in excess of sulfide were studied. The gms. of sulfide per 100 cc of solvent was found to increase from 0.58 to 0.73 when the amount of sulfide per 1 gm. of NH_3 in the original solution varied from 0.05 to 0.15.

Fusion-point data are given for:

$Sb_2S_3 + CuS$ (Parravano and Cesaris, 1912.)
" $+ SnS$ " " "
" $+ Ag_2S$ (Jaeger and Van Klooster, 1912; Konno, 1919; Pelabon,
" $+ PbS$ " " " 1913; Jitsuka, 1919.)
" $+ BiS$ (Takahashi, 1919.)

ANTIMONY Tri Phenyl SULFIDE $Sb(C_6H_5)_3S$.

Fusion-point data are given by Pascal, 1923, for:

$Sb(C_6H_5)_3S + PO(C_6H_5)_3$ (Tri phenyl phosphine oxide.)
" $+ PS(C_6H_5)_3$ (Tri phenyl phosphine sulfide.)
" $+ AsS(C_6H_5)_3$ (Tri phenyl arsine sulfide.)
" $+ AsO(C_6H_5)_3$ (Tri phenyl arsine oxide.)

ANTIMONY SELENIDES SbSe, Sb_2Se.

Fusion-point data are given by Pelabon, 1908, for:

SbS + Ag_2Se and Sb_2Se + AgSe.

SCANDIUM OXALATE $Sc_2(C_2O_4)_3.5H_2O$.

SOLUBILITY IN AQUEOUS SOLUTIONS OF AMMONIUM OXALATE AND OF HYDROCHLORIC ACID.

In Aq. Ammonia Oxalate at 25°. (Wirth, 1914.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.
C_2O_3.	Sc_2O_3.	
1.624	0.3019	$Sc_2(C_2O_4)_3.5H_2O$
2.4	0.4012	"
4.478	0.7108	" $+(NH_4)_2C_2O_4$

In Aq. Hydrochloric Acid at 25° and at 50°. (Meyer, 1914.)

Normality of Aq. HCl.	Gms. $Sc_2(C_2O_4)_3$ per 100 Gms. Sat. Sol.	
	At 25°.	At 50°.
0.1	0.0299	0.0420
0.5	0.0650	0.0870
1	0.1020	0.1435
2	0.1716	0.2556
5	0.4170	0.6533

SOLUBILITY IN AQUEOUS SOLUTIONS OF SULFURIC ACID.

Results at 25°. (Wirth, 1914.)

COO

Normality of Aq. H_2SO_4.	Gms. $Sc_2(C_2O_4)_3$ per 100 Gms. Sat. Sol.	Solid Phase.
1	0.1148	$Sc_2(C_2O_4)_3.5H_2O$
2.1	0.2573	"
2.43	0.2904	"
3.57	0.4204	"
4.86	0.5834	"

Results at 25° and at 50°. (Meyer, 1914.)

Normality of Aq. H_2SO_4.	Gms. $Sc_2(C_2O_4)_3$ per 100 Gms. Sat. Sol.	
	At 25°.	At 50°.
0.1	0.0385	0.0562
0.5	0.0997	0.1481
1	0.1663	0.2493
2	0.3176	0.4429
5	0.7761	1.1280

100 gms. sat. solution of scandium oxalate in 2.43 *n* H_2SO_4 + 0.5 *n* oxalic acid contain 0.0284 gm. Sc_2O_3 at 25°. (Wirth, 1914.)

SCANDIUM SULFATE $Sc_2(SO_4)_3.5H_2O$.

SOLUBILITY IN WATER AND IN AQUEOUS SULFURIC ACID AT 25°. (Wirth, 1914.)

Solvent.	Gms. $Sc_2(SO_4)_3$ per 100 Gms. Sat. Sol.	Solid Phase.	Solvent.	Gms. $Sc_2(SO_4)_3$ per 100 Gms. Sat. Sol.	Solid Phase.
Water	28.52	$Sc_2(SO_4)_3.5H_2O$	4.86 *n* H_2SO_4	8.363	$Sc_2(SO_4)_3.5H_2O$
0.5 *n* H_2SO_4	29.29	"	9.73 *n* H_2SO_4	1.315	"
1 *n* H_2SO_4	19.87	"	22.35 *n* H_2SO_4	0.484	$Sc_2(SO_4)_3.3H_2O$

Scandium sulfuric acid double sulfate, $Sc_2(SO_4)_3.3H_2SO_4$. 100 gms. sat. sol. in conc. H_2SO_4 of *d* = 1.6 contain 0.8616 gm. of the double salt. (Wirth, 1914.)

100 cc. of aq. 66 % K OH solution dissolve 9.19 gms. Se. This corresponds to an atomic ratio of 39.15 gm. atoms K : 14.91 gms. atoms Se, which shows that not all of the selenium is in the form of selenide.

100 cc. of aq. 66 % Na OH solution dissolve 2.45 gms. Se.

100 cc. of sat. aq. Ba $(OH)_2$ solution dissolve 2.65 gms. Se after being kept several days at 80°. (Calcagni, 1923.)

SOLUBILITY OF SELENIUM IN CARBON DISULFIDE. (Moles and Jimeno, 1915.)

Carefully prepared amorphous red selenium was used. The saturated solutions were analyzed by evaporating at ordinary temperature and weighing the residue after heating to 110°. The solubility of selenium varies with the time which elapses after its preparation and with the time of exposure to light. Amorphous selenium in contact with carbon disulfide is transformed to crystalline selenium. The variations in solubility are probably due to this transformation. It is necessary to admit the existence of many varieties of red crystalline selenium with different solubilities. These varieties owe their origin to the action of the solvent or of light and may be identical with the two monoclinic modifications studied by Muthmann. Some of the solubility results obtained by the authors are as follows :

t°.	Gms. Se per 100 gms. Se+CS_2.	Conditions of the determination.
?	0.0573	Solubility 1 hour after preparation of sample
?	0.0475	» 24 hours » » » »
?	0.0190	» 1436 » » » » »
3	0.00191	Solution prepared in the dark : 3 hours
12	0.00247	» » » » » » »
12	0.00662	» » » » » 72 »
9	0.0251	Same solution after 48 hours exposure to sunlight
44	0.1586	Solution in boiling CS_2
0	0.0184	The above solution cooled for 20 hours

100 gms. selenium monochloride saturated with selenium by shaking in a thermostat at 25° for a very long time contain 9.73 gms. Se. (Lenher and Kao, 1926.)

SOLUBILITY IN CARBON DISULFIDE.

(Marc, 1906.)

100 cc. CS_2 dissolve 0.065 gm. amorphous Se at room temperature. Se which is heated to 180° for 6–7 hours is insoluble in CS_2. Se crystallized from the melt at 200° is insoluble in CS_2. Se heated once quickly to 140° is very slightly soluble in CS_2.

100 cc. CS_2 dissolve at the boiling-point 3–3.4 mgs. Se which has been heated to 140° for 1 hr.

100 cc. CS_2 dissolve at the boiling-point 2 mgs. Se which has been heated to 195° for 2 days. (Marc, 1907.)

100 gms. methylene iodide (CH_2I_2) dissolve 1.3 gms. Se at 12°. (Retgers, 1893.)

SOLUBILITY OF MIX CRYSTALS OF SELENIUM AND SULFUR IN CARBON DISULFIDE AT 25°. (Ringer, 1902.)

Mols. per 100 Mols. Solution.			Mol. Per Cent Se in Crystals.	Mols. per 100 Mols. Solution.			Mol. Per Cent Se in Crystals.
CS_2.	Se.	S.		CS_2.	Se.	S.	
43.1	0	56.9	0	58.24	2.35	39.41	55.67
45.1	0.93	53.97	3.54	64.66	1.58	33.76	68.38
44.98	1.03	53.99	3.81	81.11	2.4	16.49	58.7
47.84	2.07	50.59	8.69	88.41	2.17	9.42	61.5
49.54	2.19	48.27	16.4*	91.38	1.68	6.94	65
47.62	2.16	50.22	14.2*	99.51	0.49	0	100†
46.12	1.485	52.39	29.35*	99.14	0.86	0	100‡

* Mix crystals homogeneous in all except these solutions.

† = Solubility of hexagonal selenium. ‡ = Solubility of amorphous selenium.

Fusion-point curves for mixtures of selenium and other metals are given by Pelabon (1909). Results for Se + Te are given by Pellini and Vio (1906).

Freezing-point data for mixtures of Se + S, Se + Te and Se + S + Te are given by Losana, 1923.

Diphenyl **SELENIUM BROMIDE** $(C_6H_5)_2SeBr_2$.

RECIPROCAL SOLUBILITY OF DIPHENYL SELENIUM BROMIDE AND DIPHENYL TELLURIUM BROMIDE IN WATER AT 25°.

(Pellini, 1906a.)

Gms. per 1000 cc. Sat. Sol.		Mol. % $(C_6H_5)_2SeBr_2$ in Cryst. Mixture.	Gms. per 1000 cc. Sat. Sol.		Mol. % $(C_6H_5)_2SeBr_2$ in Cryst. Mixture.
$(C_6H_5)_2TeBr_2$.	$(C_6H_5)_2SeBr_2$.		$(C_6H_5)_2TeBr_2$.	$(C_6H_5)_2SeBr_2$.	
18.614	0	0	10.224	14.608	44.89
17.400	1.448	4.91	7.544	19.876	51.18
16.152	4.172	10.51	6.780	18.984	94.25
15.030	6.210	18.21	3.184	17.392	95.82
13.320	8.148	24.98	0	18.984	100
11.940	11.420	34.94			

SELENIUM DIOXIDE $SeO_2.H_2O$.

SOLUBILITY OF SELENIUM DIOXIDE IN WATER, DETERMINED BY THE FREEZING-POINT METHOD. (Manchot and Ortner, 1922.)

t°.	Gms. SeO_2 per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. SeO_2 per 100 gms. sat. sol.	Solid Phase.
− 0.2	0.99	Ice	−20	53.60	Ice
− 1.1	4.88	"	−23 (eutec.)	57.00	" $+SeO_2.H_2O$
− 5.0	21.83	"	−21	58.0	$SeO_2.H_2O$
− 8.2	33.00	"	−12.5	61.6	"
− 9.9	37.64	"	− 7.0	63.4	"
−11.3	40.65	"	+ 7.0	68.32	"
−13.0	44.00	"	22.0	72.52	"
−14.9	47.03	"	42.0	77.50	"
−16.5	49.10	"	65.0	82.50	"

Results for the system SeO_2 + HBr between 0° and 30° are given by Parker and Robinson, 1931.

SOLUBILITY OF SELENIUM DIOXIDE IN SEVERAL SOLVENTS.

(de Coninck, 1906.)

Solvent.	t°.	Gms SeO_2 per 100 cc Solvent.
Water	11.3-15	38.5
Ethyl Alcohol (93%)	14.1	10.2
Methyl Alcohol	11.8	6.66
Acetone	15.3	4.35
Acetic Acid (Glacial)	12.9	1.11

Solubility in Lead, in Zinc and in Silver.

(Moissan and Siemens, 1904.)

In Lead.		In Zinc.		In Silver.	
t°.	Gm. Si per 100 Gms Lead.	t°.	Gm. Si per 100 Gms. Zinc.	t°.	Gm. Si per 100 Gms. Silver.
1250	0.024	600	0.06	970	9.22 (58.02)
1330	0.070	650	0.15	1150	14.89 (27.66)
1400	0.150	730	0.57	1250	19.26 (19)
1450	0.210	800	0.92	1470	41.46 (16)
1550	0.780	850	1.62		

The silicon which crystallized from the saturated solution in silver was found to be incompletely soluble in HF. The figures in parentheses show the percentage soluble in HF in each case.

Freezing-point data for mixtures of silicon tetraphenyl and tin tetraphenyl are given by Pascal (1912).

SILICON Tetra BROMIDE $SiBr_4$.

Fusion-point data are given for $SiBr_4 + SiCl_2$ and $SiBr_4 + SiI_4$ by Raeder, 1933.

SILICON Tetra CHLORIDE $SiCl_4$.

Cl

Reciprocal Solubility of Silicon Tetra Chloride and Sulfur Dioxide, Determined by the Synthetic Method.

(Bond and Stephens, 1929.)

t°	Gms. $SiCl_4$ per 100 gms. mixture	t°	Gms. $SiCl_4$ per 100 gms. mixture	t°	Gms. $SiCl_4$ per 100 gms. mixture
-76.5	1.09	-16.6	19.34	- 6.3	72.07
-77.0	1.97	-12.9	23.18	-12.8	83.12
-79.1	1.97	- 9.2	28.75	-20.1	88.46
-70.2	2.83	- 8.1	30.67	-38.6	94.66
-57.0	4.36	- 6.1	37.44	-46.9	96.03
-46.6	6.33	- 5.1	45.29	-72.4	98.70
-38.4	8.35	- 4.9	52.55	-77.0	98.84
-32.4	10.27	- 4.8	56.71	-79.2	98.84
-27.5	12.37	- 4.8	60.72	-76.5	98.98
-22.0	15.40	- 5.5	68.00	-67.7	100.00

Fusion-point data for:

$SiCl_4 + SiI_4$ (Raeder, 1933.)
" $+ TlCl_4$ (Nasu, 1933, 1934.)

F

SILICON Tetra FLUORIDE SiF_4.

Solubility of Silicon Tetra Fluoride in Organic Solvents at 27-33° and a Total Pressure of 750-760mm.

(Tarbutton, Egan and Frary, 1939.)

Solvent	Gms. SiF_4 per 100		Solvent	Gms. SiF_4 per 100	
	cc solvent	gms. sat. sol.		cc solvent	gms. sat. sol.
Methyl Alcohol (abs.)	—	32.8	Amyl Alcohol	20.9	17.3
Ethyl " (96.1wt.%)	—	39.0	Glycol	—	26.2
" " (abs.)	57.2	36.4	Di ethylene glycol	—	17.6
" " (96.1wt.%)	60.8	37.8	Glycerol	—	5.7
" " (94.3wt.%)	61.5	38.1	Acetone (anhydrous)	3.2	3.1
" " (92.6wt.%)	63.4	38.8	Acetic Acid (glacial)	1.1	1.1
" " (91.0wt.%)	63.9	39.0	Pyruvic Acid (38-45%)	—	4.4
Iso propyl alcohol (98%)	39.4	23.2			

SILICON Potassium Hexa **FLUORIDE** SiK_2F_6.

100 cc. sat. sol. of silicon potassium hexafluoride in water contain 0.00544 gm. SiK_2F_6 at 17°5. (von Hevesy, Christiansen and Berglund, 1925.)

SILICON IODIDES Si_2I_6, SiI_4.

SOLUBILITY IN CARBON DISULFIDE.

(Friedel and Lachburg, 1869; Friedel, 1869.)

100 gms. CS_2 dissolve 19 gms. Si_2I_6 at 19°.
100 gms. CS_2 dissolve 26 gms. Si_2I_6 at 27°.
100 gms. CS_2 dissolve 2.2 gms. SiI_4 at 27°.

SILICA SiO_2.

SOLUBILITY IN WATER AND IN AQUEOUS SOLUTIONS OF ACIDS.

0 (Lenher and Merrill, 1917.)

A platinum bottle and stirrer were used. The silica was prepared by adding silicon tetrachloride to water. The gel thus formed was washed until free of HCl and dried between filter papers. Conductivity water was used and equilibrium was reached within 24 hours. The saturated solution was evaporated to dryness in a platinum dish. The residue was weighed and the silica volatilized with HFl + H_2SO_4. The difference was considered to show "the amount of silica which had changed from an unfilterable to a filterable state of division."

Results for Aq. HCl: At 25°.		Results for Aq. HCl: At 90°.		Results for Aq. H_2SO_4: At 90°.	
Per cent HCl.	Gm. SiO_2 per 50 cc. Sol.	Per cent HCl.	Gm. SiO_2 per 50 cc. Sol.	Per cent H_2SO_4.	Gm. SiO_2 per 50 cc. Sol.
0	0.0080	0	0.0213	3.9	0.0211
3	0.00665	2	0.0198	7.3	0.0186
6.3	0.00465	3	0.0186	15.6	0.0112
11.1	0.00245	5.4	0.0152	25.4	0.0058
18.9	0.0008	7.6	0.0115	36	0.0034
25.1	0.0006	10	0.0091	46.9	0.0013
34.6	0.0003	13.6	0.0056	55.6	0.0005
		18.6	0.0029	71	0.0004

At 90°, a slow current of CO_2 through the solutions did not affect the results. Ignited silica reaches equilibrium very slowly as compared with silica gel. The true solubility of ignited silica is probably the same as that of gelatinous silica.

SOLUBILITY OF SILICA IN MELTED CALCIUM CHLORIDE.

(Arndt and Lowenstein, 1909.)

t°.	Gms. SiO_2 per 100 Gms. Sat. Solution.
800	2.5
850	3.8
900	5.4
950	7.6

SILICA HYDRATE $3SiO_2.H_2O$.

SOLUBILITY OF SILICA HYDRATE IN 3.0 NORMAL AMMONIA AT 18°.

(Schwarz, 1916.)

The hydrate was prepared by conducting silicon fluoride into water. It was washed with water and dried at 150°. It contained 9.04 % H_2O. About 0.12 gm. quantities were shaken with 25 cc. portions of 3.0 *n* ammonia and allowed to stand. The amount dissolved per 25 cc. increased with the time of shaking from 0.0144 gm. after 4 hours to 0.0522 gm. after 228 hours. The curve drawn from the results showed that the maximum solubility was reached in about 200 hours. The solubility varies with the water content and modification of the silica. No ammonium silicate was formed.

SILICO TUNGSTIC ACID $H_8SiW_{12}O_{42}$.

100 gms. H_2O dissolve 961.5 crystallized silico tungstic acid at 18°, and the solution has Sp. Gr. 2.843.

TIN Sn

SOLUBILITY OF TIN IN RAW MILK.

(Quam, 1929.)

Highly polished 4 x 7.5 cm. strips of tin were each immersed in 50 cc portions of raw milk and rocked 46 times per minute for 30 minutes. The loss in weight of the Sn strips was determined and the results expressed as Mgs. Sn dissolved per sq. decimeter of surface exposed.

t°	Mg Sn dissolved per sq. dm. of surface
20-80	None
85	0.378
95	0.516

STANNOUS BROMIDE $SnBr_2$. Br

Fusion-point data are given for $SnBr_2$ + SnI_2 by Karantissis, 1927.

TIN Tetra BROMIDE $SnBr_4$.

SOLUBILITY OF TIN TETRA BROMIDE IN LIQUID SULFUR DIOXIDE.

(Bond and Beach, 1926.)

The synthetic method was used and a special procedure was divised to prevent contact with moisture.

t°.	Per cent $SnBr_4$.	Solid Phase.	t°.	Per cent $SnBr_4$.	Solid Phase.
29.45	100.00	$SnBr_4$	39.75	40.63	liquid layers
24.90	98.74	"	25.00	26.09	"
21.15	97.30	"	*18.42	21.67	"
18.80	96.24	"	16.3 Quad. pt.	21.67	" + SO_2
18.00	95.62	"	*16.6	20.39	"
16.60	94.12	"	*8.0, 13.2	16.55	" + SO_2
16.55 Quad. pt.	94.07	" + liquid layer	*1.8, 10.7	14.08	" "
18.33	93.67	liquid layer	*—17.8, 7.1	11.88	" "
23.60	92.75	"	5.45	10.61	SO_2
28.70	91.65	"	3.25	9.45	"
34.25	89.81	"	2.5	8.93	"
42.60	85.54	"	— 3.5	6.29	"
45.75	82.49	"	— 5.0	5.37	"
47.25	80.31	"	—17.1	2.97	"
47.70	78.97	"	—21.8	2.41	"
48.60	75.14	"	—24.0	1.88	"
48.6 crit. t.	71.38	"	—37.7	0.92	"
48.50	64.00	"	—45.7	0.58	"
46.30	52.83	"	—53.05	0.39	"
41.67	43.60	"			

* Unstable points.

Fusion-point data are given for $SnBr_4$ + $SnCl_4$ by Raeder, 1927.

STANNOUS Nitroso β Phenyl **HYDROXYLAMINE** $Sn[C_6H_5.N(NO).O]_2$.

STANNIC " " $Sn[C_6H_5.N(NO).O]_4$.

One liter H_2O dissolve 0.000035 gm. atom of the SnII compound (= 0.0042 gm.) at 18°.
One liter H O dissolve 0.000021 gm. atom of the Sn IV compound (= 0.0024 gm.) at 18°. (Pinkus and Martin, 1927.)

TIN Tetra**PHENYL** (Stannic) $Sn(C_6H_5)_4$.
Freezing-point data for $Sn(C_6H_5)_4 + Si(C_6H_5)_4$ are given by Pascal (1912).

TIN OXALATE (Stannous) $Sn(COO)_2$.
100 gms. 95 per cent formic acid dissolve 0.16 gm. $Sn(COO)_2$ at 19°. (Aschan, 1913.)

Cl **TIN CHLORIDE** (Stannous) $SnCl_2$.
100 gms. H_2O dissolve 83.9 gms. $SnCl_2$ at 0° and 269.8 gms. at 15°. Sp. Gr. of Solutions 1.532 and 1.827 respectively. (Engel, 1889; Michel and Krafft, 1851.)

SOLUBILITY OF STANNOUS CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIDE ACID AT 0°.

(Engel.)

Milligram Mols. per 10 cc. Solution.		Sp. Gr. of Solution.	Grams per 100 cc. Solution.	
HCl.	$\frac{1}{2}SnCl_2$.		HCl.	$SnCl_2$.
0	74.0	1.532	0.0	70.26
6.6	66.7	1.489	2.405	63.33
13.54	63.75	1.472	4.935	60.52
24.8	68.4	1.524	9.04	64.95
34.9	81.2	1.625	12.72	77.11
40.0	94.2	1.724	14.58	89.45
44.0	117.6	1.883	16.04	111.7
49.4	147.6	2.114	18.01	138.6
66.0	156.4	2.190	24.05	148.5
78.0	157.0	2.199	28.43	149.0

100 gms. acetone dissolve 55.6 gms. $SnCl_2$ at 18°. ($d_{18} = 1.6$.) (Naumann, 1904.)
100 gms. ether dissolve 11.4 gms. $SnCl_2.2H_2O$ at 0°-35.5°.
100 gms. ethyl acetate dissolve 31.2 gms. $SnCl_2.2H_2O$ at −2°, 35.53 gms. at +22° and 73.44 gms. at 82°. (von Laszynski, 1894.)
100 gms. ethyl acetate dissolve 4.46 gms. $SnCl_2$ at 18°. d_{18} of the sat. solution = 0.9215. (Naumann, 1910.)
100 gms. 95 per cent formic acid dissolve 4.1 gms. $SnCl_2$ at 19°. (Aschan, 1913.)
Freezing-point data for mixtures of $SnCl_2 + ZnCl_2$ are given by Herrmann (1911). Results for $SnCl_2 + SnI_2$ are given by Karantissis, 1927.

TIN CHLORIDE (Stannic) $SnCl_4$.

DISTRIBUTION OF STANNIC CHLORIDE BETWEEN WATER AND XYLENE.

(Smirnoff, 1907.)

Very concentrated aqueous stannic chloride solutions were agitated with xylene at various temperatures and the amount of $SnCl_4$, in terms of Cl, which entered the xylene layer was determined. The amount of Sn and Cl in the xylene was found to correspond to $SnCl_4$.

Results for Xylene + $SnCl_4.5H_2O$.

t°.	Gms. Cl per 100 Gms. Aq. Layer, c.	Gms. Cl per 100 Gms. Xylene Layer, c'.	$\frac{c}{c'}$.
66	40.35	0.08	504.4
80	39.95	0.18	228.5
97.5	40.24	0.33	122.1
111	40.27	0.68	59.3

Per cent Cl in $SnCl_4.5H_2O$ = 40.38.

Results for Xylene + $SnCl_4.4H_2O$.

t°.	Gms. Cl per 100 Gms. Aq. Layer, c.	Gms. Cl per 100 Gms. Xylene Layer, c'.	$\frac{c}{c'}$.
66	41.9	0.92	45.3
80	41.91	1.56	27
100	41.85	2.52	16.7
111	41.68	3.23	12.9

Per cent Cl in $SnCl_4.4H_2O$ = 42.37.

Results for Xylene + $SnCl_4.3H_2O$.

t°.	Gms. Cl per 100 Gms. Aq. Layer, c.	Gms. Cl per 100 Gms. Xylene Layer, c'.	$\frac{c}{c'}$.
80	43.2	9.93	4.4
94	42.54	9.32	4.6
100	42.64	10.56	4.1
111	42.31	10.03	4.2

Per cent Cl in $SnCl_4.3H_2O$ = 45.12.

DISTRIBUTION OF TIN BETWEEN AQUEOUS HYDROCHLORIC ACID AND ETHER AT ROOM TEMPERATURE. (Mylius, 1911.)

When 1 gm. of tin as the chloride, $SnCl_4$, is dissolved in 100 cc. of aqueous hydrochloric acid and shaken with 100 cc. of ether, the following per cents of the metal enter the ethereal layers. With 20% HCl, 17 per cent; with 15% HCl, 28 per cent; with 10% HCl, 23 per cent; with 5% HCl, 10 per cent and with 1% HCl, 0.8 per cent of the tin.

Additional data for the distribution of $SnCl_4$ between water and Ethyl Ether at 18° are given by Smyth, 1928.

Data in the form of a diagram for the system $SnCl_4$ + HCl are given by Chretien and Varger, 1935.

TIN Tetra CHLORIDE $SnCl_4$.

SOLUBILITY OF TIN TETRA CHLORIDE IN LIQUID SULFUR DIOXIDE.

(Bond and Beach, 1926).

t° of m. pt.	t° of solubility.*	Per cent $SnCl_4$.	t° of m. pt.	t° of solubility.	Per cent $SnCl_4$.
—32.7		100.00	—43.8	—45.0	67.47
—38.7		95.23	—43.8	—45.0	66.06
—40.6		92.66	—43.9	—45.1	61.54
—42.6	—52.0	86.16	—44.0	—45.3	58.54
—43.25	—46.8	82.41	—44.1	—45.9	55.24
—43.6	—45.7	79.43	—44.3	—46.3	50.76
—43.6	—45.7	79.05	—44.8	—48.8	44.27
—43.4	—45.6	76.07	—47.1	—57.5	31.96
—43.4	—45.4	75.76	—49.8		26.29
—43.6	—44.9	72.62	—63.0		11.78
—43.7	—44.9	71.75	—72.7		5.40

* The temperature of solubility is that at which metastable liquid layers separate.

100 gms. sat. solution of tin tetra chloride in selenium oxychloride ($SeOCl_2$) contain 13.74 gms. $SnCl_4$ at 25°. (Wise, 1923.)

Fusion-point data are given for:

$SnCl$ + SnI_4 (Raeder, 1927.)
" + $TiCl_4$ (Nasu, 1933.)
" + Formic Acid Ethyl Ester (1)(2)(3)
" + " " Methyl " (1) (2)
" + Benzoic Acid Ethyl Ester (1)(3)(4)

(1) Kurnakow, 1916; (2) Kurnakow and Kanov, 1924; (3) Kurnakow, Perelmutter and Kanov, 1915; (4) Kurnakow and Perelmutter, 1924.

Methyl, Ethyl, etc. TIN FLUORIDES.

F SOLUBILITY OF EACH SEPARATELY IN SEVERAL SOLVENTS. (Krause, 1918.)

Compound.	Formula.	t°.	Gms. compound per 100 gms.			
			CH_3OH.	C_2H_5OH.	H_2O.	C_6H_6.
Trimethyl Tin Fluoride	$(CH_3)_3SnF$	31.3	2.45	1.08	0.846	0.005
Triethyl »	$(C_2H_5)_3SnF$	32.3	4.39	2.20	0.182	0.034
Tri *n* propyl »	$(n\,C_3H_7)_3SnF$	31.3	4.26	2.73	0.020	0.118
Tri isobutyl »	$(i\,C_4H_9)_3SnF$	31.6	0.614	0.414	0.012	0.100
Tri isoamyl »	$(i\,C_5H_{11})_3SnF$	31.3	1.22	1.03	0.003	0.967
Diethyl *n* propyl »	$(C_2H_5)_2(n\,C_3H_7)SnF$	31.0	6.93	3.78	0.12	0.005
Dimethyl Tin Difluoride	$(CH_3)_2SnF_2$	30.7	0.33	0.081	4.66	–
Diethyl »	$(C_2H_5)_2SnF_2$	30.8	2.64	0.45	2.03	0.047
Di *n* propyl »	$(n\,C_3H_7)_2SnF_2$	32.0	1.91	0.93	0.22	–

TIN IODIDE (Stannous) SnI_2.

SOLUBILITY IN WATER AND IN AQUEOUS HYDRIODIC ACID.
(Young, 1897.)

I

t°.	Gms. SnI_2 per 100 Gms. Aqueous HI Solutions of:							
	0% = H_2O.	5.83%.	9.60%.	15.2%.	20.44%.	24.8%.	30.4%.	36.82%.
20	0.98	0.20	0.23	0.60	1.81	4.20	10.86	25.31
30	1.16	0.23	0.23	0.64	1.81	4.06	10.28	23.46
40	1.40	0.33	0.28	0.71	1.90	4.12	10.06	23.15
50	1.69	0.46	0.38	0.82	2.12	4.34	10.35	23.76
60	2.07	0.66	0.55	1.11	2.51	4.78	11.03	24.64
70	2.48	0.91	0.80	1.37	2.92	5.43	11.97	25.72
80	2.95	1.23	1.13	1.83	3.70	6.38	13.30	27.23
90	3.46	1.65	1.52	2.40	4.58	7.82	15.52	29.84
100	4.03	2.23	2.04	3.63	5.82	9.60	...	34.05

TIN IODIDE (Stannic) SnI_4.

SOLUBILITY IN ORGANIC SOLVENTS.
(McDermott, 1911.)

Solvent.	t°.	Sp. Gr. Sat. Sol.	Gms. SnI_4 per 100 Gms. Sat. Sol.
Carbon Tetrachloride	22.4	1.59	5.25
"	50	1.63	12.50
Chloroform	28	1.50	8.21
Benzene	20.2	0.95	12.65

Solubility of Stannic Iodide in Carbon Disulfide.

(Sneider, 1866; Arctowski, 1895–'96.)

	−114°.5.	−94°.	−89°.	−84°.	−58°.	Ord. temp.
Gms. SnI_4 per 100 Gms. Solution	9.41	10.65	9.68	10.22	16.27	59.2(S)

100 gms. methylene iodide, CH_2I_2, dissolve 22.9 gms. SnI_4 at 10°. Sp. Gr. of solution = 3.481. (Retgers, 1893.)

Solubility of Stannic Iodide in Several Solvents.

(Dorfman and Hildebrand, 1927.)

Solvent	Gms. SnI_4 per 100 gms. sat. solution at: 10°	25°	40°	Solvent	Gms. SnI_4 per 100 gms. sat. solution at: 10°	25°	40°
Heptane	2.02	3.36	5.24	Toluene	9.99	14.89	21.93
Ethyl Ether	3.64	4.80	6.36	m Xylene	8.62	13.42	20.00
CCl_4	3.56	5.69	9.04	Ethylene bromide	9.11	14.16	20.91
Chloroform.	4.94	8.28	12.91	CS_2	49.01	58.53	67.56
Benzene	9.76	15.17	23.02	Sulfur	(76.2) (104°)	(90.8) (130°)	–

Solubility of Stannic Iodide in Several Lequid Paraffins.

(Dice and Hildebrand, 1928.)

Results for:

I

t°	n Octane Mol. fraction SnI_4 in sat. sol.	t°	n Heptane Mol. fraction SnI_4 in sat. sol.	t°	n Hexane Mol. fraction SnI_4 in sat. sol.	t°	iso Octane Mol. fraction SnI_4 in sat. sol.
127.3	0.3602	127.6	0.2836	138.1	0.2531	183.4	0.3029
129.4	0.3824	130.9	0.3220	143.4	0.2887	191.6	0.3692
131.1	0.4454	134.8	0.3720	146.4	0.3225	194.9	0.4592
131.2	0.4541	136.4	0.4340	148.8	0.3714	*195.3	0.50
*132.0	0.52	136.8	0.48	*149.4	0.42	195.4	0.5193
132.3	0.5418	136.7	0.4861	148.7	0.4526	194.9	0.5380
131.5	0.5832	135.4	0.5606	145.4	0.5344	193.6	0.5920
130.2	0.6297	131.5	0.6105	138.2	0.5916	181.5	0.6922
129.4	0.6430	127.2	0.6818				

*= Critical solution temperature; iso Octane = 2.2.4 Tri methyl pentane.

Solubility of Stannic Iodide in Silicon Tetra Chloride.

(Hildebrand and Negishi, 1937.)

t°	Mol. fraction SnI_4 in sat. sol.		t°	Mol. fraction SnI_4 in sat. sol.	
0.2	0.155	Solid	139.4	32.53	Liquid
25.0	0.381	"	139.8	37.62	"
40.0	0.639	"	*139.9	39.00	"
81.3	2.36	"	139.7	43.16	"
112.1	6.43	"	139.5	43.54	"
115.6	7.40	"	139.1	45.06	"
131.0	65.36	"	138.8	46.95	"
130.9	21.56	Liquid	135.7	51.21	"
133.4	24.21	"	135.8	51.62	"
138.2	29.58	"	132.4	55.12	"

* Critical solution temperature.

Fusion-point data for the system $SnI(CH_3)_3 + C_6H_5NH_2$ are given by Baume and Perrot, 1914.

TIN HYDROXIDE (Stannous) $Sn(OH)_2$.

One liter of the saturated solution in water contains 0.0000135 gm. mols. $Sn(OH)_2$ at 25°. (Goldschmidt and Eckhardt, 1906.)

Solubility of Stannous Hydroxide in Aqueous Sodium Hydroxide Solutions at 25°.

(Goldschmidt and Eckhardt, 1906.)

The authors desired to ascertain whether the mono, $NaHSnO_2$, or the disodium salt, Na_2SnO_2, predominates in alkaline tin hydroxide solutions. Given amounts of carefully prepared tin chloride, made from tin and HCl, and sodium hydroxide solutions were mixed in vessels containing hydrogen. The mixtures were shaken at 25° and the clear supernatant solutions in contact with the precipitated $Sn(OH)_2$, analyzed.

OH

Gm. Mols. per Liter.			Gm. Mols. per Liter.		
Total Na.	$NaHSnO_2$.	NaOH.	Total Na.	$NaHSnO_2$.	NaOH.
0.00451	0.0009845	0.003525	0.02250	0.00838	0.01412
0.00680	0.00218	0.00462	0.02788	0.01038	0.01755
0.01149	0.003495	0.007995	0.02940	0.00874	0.02066
0.02143	0.006935	0.014495	0.03012	0.00865	0.02147
0.02143	0.00660	0.01483	0.03036	0.01082	0.01954
0.02186	0.00628	0.015575	0.03044	0.009405	0.021035

Solubility in Aqueous Sodium Hydroxide Solutions. Moist Tin Hydroxide Used. Ordinary Temperature.

(Rubenbauer, 1902.)

Gms. per 20 cc. Solution.		Mol. Dilution of the NaOH.	Gms. per 20 cc. Solution.		Mol. Dilution of the NaOH.
Na.	Sn.		Na.	Sn.	
0.2480	0.1904	1.86	0.8326	0.5560	0.55
0.3680	0.2614	1.25	0.9661	0.7849	0.48
0.6394	0.4304	0.72	2.1234	1.8934	0.23

STANNIC SULFIDE SnS_2.

Solubility of Stannic Sulfide in Aqueous Solutions of Ammonia.

(Volk, 1932.)

S

The determinations were made by boiling mixtures of sulfide and aqueous ammonia of various concentrations for 5 minutes over a Bunsen burner. The solutions thus obtained were analyzed for tin and the residual ammonia.

Percent concentration of NH_3 in solvent		Gms. SnS_2 dissolved per 100cc sat. sol.
at beginning	at end	
1.0	0.8	0.13
3.0	2.3	0.33
6.0	3.8	0.49
12.0	7.0	0.85
25.0	12.0	1.26

The effect of variation in time of heating and of the ratio of sulfide to ammonia was also studied.

TIN SULFATE (Stannous) $SnSO_4$.

100 gms. H_2O dissolve 18.8 gms. $SnSO_4$ at 19° and 18.1 gms. at 100°. (Marignac.)

STANNUM

EQUILIBRIUM IN THE SYSTEM STANNOUS OXIDE, SULFUR TRIOXIDE AND WATER.

(Denham and King, 1935.)

Results at 25°				Results at 50°			
d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	SnO	SO_3			SnO	SO_3	
1.004	0.30	0.20	1.2.4	1.018	1.04	0.68	1.2.2
1.030	2.21	1.36	"	1.037	2.53	1.53	" + 1.1
1.040	3.07	1.87	"	1.058	3.80	2.17	1.1
1.065	4.56	2.76	"	1.145	9.33	5.64	"
1.090	6.30	3.72	" + 1.1	1.230	14.00	8.30	"
1.120	8.02	4.85	1.1	1.245	14.81	8.74	" + $SnSO_4$
1.185	11.68	6.79	"	1.220	8.74	14.12	$SnSO_4$
1.250	15.15	8.87	"	1.263	7.42	19.66	"
1.270	16.30	9.50	"	1.326	5.06	28.43	"
1.300	17.56	10.37	" + $SnSO_4$				
1.265	14.64	10.52	$SnSO_4$				
1.240	11.83	10.64	"				
1.220	9.43	12.85	"				
1.210	6.39	15.92	"				
1.239	2.98	23.00	"				
1.307	1.50	31.30	"				
1.404	0.60	40.90	"				
1.508	0.36	49.63	"				

1.2.4 = $SnSO_4.2SnO.4H_2O$
1.2.2 = $SnSO_4.2SnO.2H_2O$
1.1 = $SnSO_4.SnO$

STRONTIUM ARSENATES $SrHAsO_4$, and $Sr(H_2AsO_4)_2$.

EQUILIBRIUM IN THE SYSTEM STRONTIUM OXIDE, ARSENIC PENTOXIDE AND WATER AT 25°.

(Tartar, Rice and Sweo, 1931.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	As_2O_5	SrO			As_2O_5	SrO	
1.001	0.18	0.14	$SrHAsO_4$	1.489	33.59	5.98	$Sr(H_2AsO_4)_2$
1.010	1.01	0.48	"	1.542	37.59	5.60	"
1.042	3.33	1.56	"	1.555	39.71	5.01	"
1.080	5.41	2.43	"	1.605	42.94	4.44	"
1.126	8.33	3.84	"	1.805	55.20	2.23	"
1.199	12.29	5.72	"	1.851	57.97	1.32	"
1.273	17.31	7.30	"+$Sr(H_2AsO_4)_2$	1.999	64.75	0.43	"
1.339	23.38	6.81	$Sr(H_2AsO_4)_2$	2.236	71.71	0.09	"
1.362	26.08	6.24	"				

STRONTIUM CACODYLATE $Sr[(CH_3)_2AsO_2]_2.13H_2O$.

SOLUBILITY OF STRONTIUM CACODYLATE IN WATER.

(Tiollais, 1936.)

t^0	Gms. $Sr[(CH_3)_2AsO_2]_2$ per 100 gms. sat. sol.	Solid Phase	t^0	Gms. $Sr[(CH_3)_2AsO_2]_2$ per 100 gms. sat. sol.	Solid Phase
0	44.11	$Sr[(CH_3)_2AsO_2]_2.13H_2O$	52	67.94	$Sr[(CH_3)_2AsO_2]_2.3H_2O$
8.5	46.71	"	57	68.42	$Sr[(CH_3)_2AsO_2]_2.H_2O$
17.0	50.34	"	60	69.01	"
19	52.60	"	62	69.25	"
22.5	54.90	"	67	69.50	"
27.0 m.pt.	60.70	"	72.5	69.97	"
31	62.01	$Sr[(CH_3)_2AsO_2]_2.3H_2O$	79	70.75	"
35	62.92	"	83	71.50	"
40.5	65.05	"	84	72.50	"
45	66.25	"	94	73.14	"
50	67.52	"	99	74.34	"

SOLUBILITY OF STRONTIUM CACODYLATE IN ALCOHOLS.

(Tiollais, 1936.)

Solvent	t^0	Gms. $Sr[(CH_3)_2AsO_2]_2$ per 100 gms. sat. sol.	Solid Phase
Methyl Alcohol	12	56.08	$Sr[(CH_3)_2AsO_2]_2.?H_2O$
Ethyl Alcohol (95%)	15	38.40	"
Ethyl Alcohol (abs.)	15	38.60	"

Br

STRONTIUM BROMIDE $SrBr_2.6H_2O$.

SOLUBILITY IN WATER.

(Average curve from results of Kremers, 1858, and Etard, 1894.)

t°.	Gms. $SrBr_2$ per 100 Gms. Solution.	Gms. $SrBr_2$ per 100 Gms. Water.	t°.	Gms. $SrBr_2$ per 100 Gms. Solution.	Gms. $SrBr_2$ per 100 Gms. Water.
0	46	85.2	40	55.2	123.2
10	48.3	93	50	57.6	135.8
20	50.6	102.4	60	60	150
25	51.7	107	80	64.5	181.8
30	52.8	111.9	100	69	222.5

Sp. Gr. of sat. solution at 20° approximately 1.70.

100 gms. abs. alcohol dissolve 64.5 gms. $SrBr_2$ at 0°. Sp. Gr. of solution = 1.21. (Fonzes-Diacon, 1895.)

SOLUBILITY OF STRONTIUM BROMIDE IN AQUEOUS SOLUTIONS OF HYDROBROMIC ACID AT 25°.

(Scott and Durham, 1930.)

Gms. per 100 gms. sat. sol. HBr	Gms. per 100 gms. sat. sol. $SrBr_2$	Solid Phase
0.0	49.93	$SrBr_2.6H_2O$
3.77	45.18	"
9.39	38.21	"
17.50	28.36	"

STRONTIUM BROMIDE $SrBr_2.6H_2O$.

FREEZING-POINTS OF AQUEOUS SOLUTIONS OF STRONTIUM BROMIDE. (Milikan, 1917.)

t°.	Gms. $SrBr_2$ per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. $SrBr_2$ per 100 gms. sat. sol.	Solid Phase.
— 1.7	6.9	Ice	—19.0	34.8	Ice
— 4.2	13.9	"	—28.0 (eutec.).	41.7	" $+SrBr_2.6H_2O$
— 8.4	23.2	"	0	46.8 (Kremers)	$SrBr_2.6H_2O$
—13.5	29.8	"			

SOLUBILITY OF STRONTIUM BROMIDE IN AQUEOUS SOLUTIONS OF STRONTIUM OXIDE AT 25° AND VICE VERSA. (Millikan, 1917.)

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
$SrBr_2$.	SrO.		$SrBr_2$.	SrO.	
49.79	0.0	$SrBr_2.6H_2O$	40.66	0.84	$SrBr_2.SrO.9H_2O+SrO.9H_2O$
49.78	0.21	"$+SrBr_2.SrO.9H_2O$	38.68	0.79	$SrO.9H_2O$
48.06	0.25	$SrBr_2.SrO.9H_2O$	35.83	0.73	"
47.65	0.28	"	27.33	0.66	"
44.24	0.47	"	21.46	0.65	"
42.76	0.61	"	16.27	0.66	"
41.78	0.64	"	0.0	0.85	"

SOLUBILITY OF STRONTIUM BROMIDE IN AQUEOUS SOLUTIONS OF STRONTIUM NITRATE AT 25°.

(Harkins and Pearce, 1916.)

Mols. per 1000 Gms. H_2O.		Gms. $SrBr_2$ per 1000 Gms. H_2O.	d_{25} of Sat. Sol.	Mols. per 1000 Gms. H_2O.		Gms. $SrBr_2$ per 1000 Gms. H_2O.	d_{25} of Sat. Sol.
$Sr(NO_3)_2$.	$SrBr_2$.			$Sr(NO_3)_2$.	$SrBr_2$.		
0	4.3080	1066.1	1.7002	0.30663	4.3180	1068.8	1.73766
0.036	4.3105	1066.95	...	0.61124	4.3190	1069.17	1.74866
0.07216	4.3125	1067.42	1.70325	1.8610	4.3390	1073.97	1.77368
0.14568	4.3170	1068.54	1.72844				

Data for equilibrium in the system strontium bromide, strontium oxide and water at 25° are given by Milikau (1916).

STRONTIUM BROMIDE $SrBr_2.6H_2O$.

The composition of the homogeneous mixture (Plait Point) of the system composed of Strontium Bromide, tertiary Butyl Alcohol and Water at 25° was found by Ginnings, Herring and Webb, 1933, to be

20.4 gms. $SrBr_2$ + 29.8 gms. ter. $(CH_3)_3COH$ + 49.8 gms. H_2O.

The original results for the remaining points on the binodal curve are not given but only the values of a series of constants calculated by means of empirical equations.

EQUILIBRIUM IN THE SYSTEM STRONTIUM BROMIDE, UREA AND WATER AT 11°.

(de Carli, 1932.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$SrBr_2$	$CO(NH_2)_2$		$SrBr_2$	$CO(NH_2)_2$	
47.20	0.0	$SrBr_2.6H_2O$	35.23	29.90	1.4.2
47.20	3.71	"	28.20	36.50	"
46.50	15.20	"	25.78	40.12	$CO(NH_2)_2$
46.18	19.50	" + 1.4.2	21.50	40.45	"
42.52	22.56	1.4.2	14.27	40.90	"
			—	40.84	"

1.4.2 = $SrBr_2.4CO(NH_2)_2.2H_2O$.

SOLUBILITY OF STRONTIUM BROMIDE IN PURE METHYL ALCOHOL AND IN PURE ETHYL ALCOHOL.

(Lloyd, Brown, Glynwyn, Bonnel and Jones, 1928.)

Results for Methyl Alcohol			Results for Ethyl Alcohol		
t°	Gms. $SrBr_2$ per 100 gms. CH_3OH	Solid Phase	t°	Gms. $SrBr_2$ per 100 gms. C_2H_5OH	Solid Phase
10	115.0	$SrBr_2.1\frac{1}{2}CH_3OH$	10	63.6	$SrBr_2.\frac{1}{2}C_2H_5OH$
20	119.4	"	20	63.9	"
30	123.4	"	30	64.9	"
40	125.5	"	40	73.5	"
50	129.6	$SrBr_2.\frac{1}{2}CH_3OH$	50	75.2	$SrBr_2$
60	136.1	"	60	75.5	"
70	144.6	"	80	75.8	"

100 cc Iso Amyl Alcohol (d=0.805) dissolve 30.5 gms. $SrBr_2$ at 25°. (Yagoda, 1930.)

STRONTIUM BROMIDE

SOLUBILITY OF STRONTIUM BROMIDE IN ABSOLUTE ACETONE.

(Bell, Rowlands, Bamford, Thomas and Jones, 1930.)

Br

t°	Gms. $SrBr_2$ per 100 gms. $(CH_3)_2CO$	Solid Phase	t°	Gms. $SrBr_2$ per 100 gms. $(CH_3)_2CO$	Solid Phase
0	0.869	$SrBr_2.1\frac{1}{2}O_3H_6O$	28.5	0.429	$SrBr_2.1\frac{1}{2}C_3H_6O$
10	0.753	"	35	0.359	$SrBr_2.C_3H_6O$
20	0.599	"	40	0.323	"
27	0.454	"	50	0.274	"

100 gms. liquid Ammonia (NH_3) dissolve 0.008 gm. $SrBr_2$ at 0°. (Linhard and Stephens, 1934.)

STRONTIUM BROMATE $Sr(BrO_3)_2$.

One liter of aqueous solution contains 0.9 gm. molecules or 309 gms. $Sr(BrO_3)_2$ at 18°. (Kohlrausch, 1897.)

STRONTIUM METHIONATE $SrCH_2O_6S_2$.

100 gms. H_2O dissolve 2.14 gm. $SrCH_2O_6S_2$ at 25°. (Backer and Terpstra, 1929.)

STRONTIUM FORMATE $Sr(HCOO)_2.2H_2O$.

CH

SOLUBILITY IN WATER. (Stanley, 1904.)

t°.	Gms. $Sr(HCOO)_2$ per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. $Sr(HCOO)_2$ per 100 Gms. H_2O.	Solid Phase.
0	7.02 (8.35)	$Sr(HCOO)_2.2H_2O$	67.5	20.62 (21.76)	$Sr(HCOO)_2.2H_2O$
11	8.08 (9.54)	"	81.5	26.14 (26.36)	"
28.6	11.62 (13.25)	"	86	27.58 (27.57)	$Sr(HCOO)_2.H_2O$
37.4	13.01 (14.68)	"	91.7	27.01 (27.07)	"
51.4	16.31 (17.83)	"	100	26.57 (26.72)	"

There appears to be an error in the calculation of the results as given by the author in his table. The figures given above in parentheses have, therefore, been calculated from the weights of $SrSO_4$ recorded in the original table and show the weight of $Sr(HCOO)_2$ per 100 gms. of saturated solution.

Later very careful determinations of the solubility of Strontium Formate in Water by Ashton, Houston and Saylor, 1933, are as follows.

t°	Gms. $Sr(HCOO)_2$ per 100 gms. H_2O	Solid	t°	Gms. $Sr(HCOO)_2$ per 100 gms. H_2O	Solid Phase
0	9.1	$Sr(HCOO)_2.2H_2O$	60	25.0	$Sr(HCOO)_2.2H_2O$
10	10.6	"	70	30.0	"
20	12.7	"	72	31.2	"
30	15.2	"	80	31.9	$Sr(HCOO)_2$
40	17.8	"	90	32.9	"
50	21.0	"	100	34.4	"

EQUILIBRIUM IN THE SYSTEM STRONTIUM FORMATE, FORMIC ACID & WATER AT 25°.

(Dunn and Philip, 1934.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
HCOOH	$Sr(HCOO)_2$		HCOOH	$Sr(HCOO)_2$	
0.0	12.52	$Sr(HCOO)_2.2H_2O$	61.5	20.51	$Sr(HCOO)_2$
18.01	13.30	"	63.3	20.74	"
34.24	14.17	"	64.7	20.94	"
41.5	15.28	"	68.7	21.3	" + $2Sr(HCOO)_2.HCOOH$
48.0	16.40	"	70.5	22.04	$2Sr(HCOO)_2.HCOOH$
53.4	18.27	"	72.3	22.54	"
57.3	20.07		74.3	23.07	"

STRONTIUM ACETATE $Sr(CH_3COO)_2.\frac{1}{2}H_2O$.

CH

SOLUBILITY IN WATER.

(Osaka and Abe, 1911.)

t°.	Gms. $Sr(CH_3COO)_2$ per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. $Sr(CH_3COO)_2$ per 100 Gms. H_2O.	Solid Phase.
0.05	36.93	$Sr(CH_3COO)_2.4H_2O$	25	40.19	$Sr(CH_3COO)_2.\frac{1}{2}H_2O$
5	39.91	"	35.03	38.82	"
10	43.61	"	50	37.35	"
8.4 tr. pt.	43.1	" + $Sr(CH_3COO)_2.\frac{1}{2}H_2O$	70	36.24	"
8	43.5	$Sr(CH_3COO)_2.\frac{1}{2}H_2O$	80	36.10	"
10	42.95	"	90	36.24	"
15	41.90	"	97	36.36	"

EQUILIBRIUM IN THE SYSTEM STRONTIUM ACETATE, ACETIC ACID AND WATER AT 25°.

(Dunn and Philip, 1934.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
CH_3COOH	$Sr(CH_3COO)_2$		CH_3COOH	$Sr(CH_3COO)_2$	
0.0	28.79	$2Sr(CH_3COO)_2.H_2O$	50.4	15.21	5.5.9
2.75	28.20	"	57.3	15.25	1.2.2
11.62	22.09	"	65.2	14.32	"
22.63	18.27	5.5.9	71.9	14.42	"
33.10	16.49	"	76.1	16.90	"
41.6	15.56	"			

5.5.9 = $5Sr(CH_3COO)_2.5CH_3COOH.9H_2O$; 1.2.2 = $Sr(CH_3COO)_2.2CH_3COOH.2H_2O$.

100 gms. pure Methyl Alcohol sat. with anhydrous strontium acetate contain 0.26 gm. $Sr(CH_3COO)_2$ at 15° and 0.18 gm. at 66° (b.pt.).

(Henstock, 1934.)

SOLUBILITY OF STRONTIUM ACETATE IN ANHYDROUS ACETIC ACID.

(Davidson and Chappell, 1933.)

t^0	Gm. Mol. Percent $Sr(CH_3COO)_2$ in sat. sol.	Solid Phase	t^0	Gm. Mol. Percent $Sr(CH_3COO)_2$ in sat. sol.	Solid Phase
16.6	0.0	CH_3COOH	66.5	5.89	Sr(CH COO).CH COOH
15.5	2.08	"	77.5	6.52	"
14.5	4.31	"	86.0	7.12	"
13.69	5.73*	"	101.1	8.57	"
13.02	7.15*	"	108.8	9.52	"
17.0	4.76	$Sr(CH_3COO)_2.CH_3COOH$	111.5	9.95	"
29.7	4.85	"	118.5	10.45	$Sr(CH_3COO)_2$(?)
50.0	5.2	"	121.8	10.76	"

STRONTIUM TARTRATE $SrC_4H_4O_6.3H_2O$.

SOLUBILITY IN WATER.

(Cantoni and Zachoder, 1905.)

CH

t°.	Gms. $SrC_4H_4O_6.3H_2O$ per 100 cc. Solution.	t°.	Gms. $SrC_4H_4O_6.3H_2O$ per 100 cc. Solution.	t°.	Gms. $SrC_4H_4O_6.3H_2O$ per 100 cc. Solution.
0	0.112	25	0.224	60	0.486
10	0.149	30	0.252	70	0.580
15	0.174	40	0.328	80	0.688
20	0.200	50	0.407	85	0.755

SOLUBILITY OF STRONTIUM TARTRATE IN AQUEOUS SOLUTIONS OF ACETIC ACID AT 26°-27°.

(Herz and Muhs, 1903.)

Normality of Acetic Acid.	Gms. per 100 cc. Solution.		Normality of Acetic Acid.	Gms. per 100 cc. Solution.	
	CH_3COOH.	$SrC_4H_4O_6.3H_2O$.		CH_3COOH.	$SrC_4H_4O_6.3H_2O$.
0	0	0.227	3.77	21.85	1.051
0.565	3.39	0.678	5.65	33.90	0.982
1.425	8.15	0.864	16.89	101.34	0.184
2.85	17.10	0.996			

STRONTIUM TARTRATE Active, $C_4H_4O_6Sr.4H_2O$; Racemic, $C_8H_8O_{12}Sr_2.8H_2O$.

SOLUBILITY OF ACTIVE AND OF RACEMIC STRONTIUM TARTRATE, EACH SEPARATELY, IN WATER. (Deboux and Cuttat, 1921.)

Saturation was secured by continuous agitation in a thermostat for 7 to 10 hours. The strontium was determined as carbonate and as sulfate.

Results for the Active salt.			Results for the Racemic salt.		
t°.	Gms. $C_4H_4O_6Sr$ per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. $C_4H_4O_6Sr$ per 100 gms. sat. sol.	Solid Phase.
0.0....	0.0942	$C_4H_4O_6Sr.4H_2O$	0.0....	0.0107	$C_8H_8O_{12}Sr_2.8H_2O$
12.5....	0.1285	"	12.5....	0.0202	"
25.0....	0 1765	"	25.0....	0.0297	"
37.5....	0 2395	"	37.5....	0.0392	"

STRONTIUM MALATE $SrC_4H_4O_5$.

SOLUBILITY IN WATER.
(Cantoni and Basadonna, 1906.)

t°.	Gms. per 100 cc. Solution.	t°.	Gms. per 100 cc. Solution.	t°.	Gms. per 100 cc. Solution.
20	0.448	40	1.385	55	2.460
25	0.550	45	1.743	60	2.821
30	0.752	50	2.098	65	3.148
35	1.036			70	3.360

STRONTIUM MALATE Active, $C_4H_4O_5Sr.4H_2O$; Racemic, $C_8H_8O_{10}Sr_2.5H_2O$.

SOLUBILITY OF ACTIVE AND OF RACEMIC STRONTIUM MALATE, EACH SEPARATELY, IN WATER. (Duboux and Cuttat, 1921.)

Saturation was secured by continuous rotation in a thermostat for 7 to 10 hours. The strontium was determined as carbonate and as sulfate.

Results for the Active Salt.

t°.	Gms. $C_4H_4O_5Sr$ per 100 gms. sat. sol.	Solid Phase.
0.0...	0.193	$C_4H_4O_5Sr.4H_2O$
12.5...	0.332	»
25.0...	0.490	»
37.5...	0.781	»

Results for the Racemic Salt.

t°.	Gms. $C_8H_8O_{10}Sr_2$ per 100 gms. sat. sol.	Solid Phase.
0.0...	0.290	$C_8H_8O_{10}Sr_2.5H_2O$
12.5...	0.325	»
25.0...	0.422	»
37.5...	0.550	»

SOLUBILITY OF STRONTIUM MALATE IN AQUEOUS SOLUTIONS OF STRONTIUM CHLORIDE AT 25°. (Walker, 1925.)

Constant agitation in a thermostat was employed for obtaining saturation. The results are expressed in terms of gram molecules of the saturating salt per 1000 gms. H_2O « corresponding to the weight molar concentration of the added salt ».

Gram. mols. per 1000 gms. H_2O		Gram. mols. per 1000 gms. H_2O	
Sr. malate.	$SrCl_2$.	Sr. malate.	$SrCl_2$.
0.03050	0.0000	0.02349	0.03103
0.02523	0.01828	0.02019	0.06149

CH

STRONTIUM MALONATE $CH_2(COO)_2Sr$.

SOLUBILITY IN WATER.
(Cantoni and Diotalevi, 1905.)

t°.	Gms. per 100 cc. Sat. Sol.	t°.	Gms. per 100 cc. Sat. Sol.	t°.	Gms. per 100 cc. Sat. Sol.
0	0.541	25	0.521	40	0.464
10	0.540	30	0.499	45	0.453
20	0.532	35	0.478	50	0.443

SOLUBILITY OF STRONTIUM MALONATE IN AQUEOUS SOLUTIONS OF STRONTIUM CHLORIDE AT 25°.
(Walker, 1925.)

Gms. per liter sat. sol.		Solid Phase
$SrCl_2$	$SrCH_2(COO)_2$	
0.0	5.783	$SrCH_2(COO)_2$(?)
2.898	4.784	"
4.919	4.454	"
5.747	3.828	"

STRONTIUM FUMARATE $SrC_4H_2O_4$.

100 gms. H_2O dissolve 0.29 gm. $SrC_4H_2O_4$ at 30°. (Weiss and Downs, 1923.)

STRONTIUM SUCCINATE $C_4H_4O_4Sr$.

100 gms. sat. solution in water contain 0.439 gm. $C_4H_4O_4Sr$ at 15° and 0.215 gm. at 100°. (Tarugi and Checchi, 1901.)

SOLUBILITY OF STRONTIUM SUCCINATE IN WATER.
(Cantoni and Diotalevi, 1905.)

t°.	Gms. $C_4H_4O_4Sr$ per 100 cc. Sat. Sol.	t°.	Gms. $C_4H_4O_4Sr$ per 100 cc. Sat. Sol.	t°.	Gms. $C_4H_4O_4Sr$ per 100 cc. Sat. Sol.
0	0.052	20	0.270	40	0.375
5	0.076	25	0.382	45	0.389
10	0.111	30	0.451	50	0.424
15	0.177	35	0.413		

SOLUBILITY OF STRONTIUM SUCCINATE IN AQUEOUS SOLUTIONS OF SODIUM SUCCINATE AT 25°. (Walker, 1925.)

Constant agitation in a thermostat was employed for obtaining saturation The results are expressed in terms of gram molecules of the saturating salt per 1000 gms. H_2O « corresponding to the weight molar concentration of the added salt ».

Gm. mols. per 1000 gms. H_2O.		Gm. mols. per 1000 gms. H_2O.	
$C_4H_4O_4Sr$.	$C_4H_4O_4Na_2$.	$C_4H_4O_4Sr$.	$C_4H_4O_4Na_2$.
0.02013	0.0000	0.01322	0.03751
0.01740	0.00938	0.01221	0.05582
0.01535	0.01875	0.01143	0.07457

CH

STRONTIUM CITRATE $Sr(C_6H_5O_7)_2.6H_2O$ and $Sr(C_6H_5O_7)_2.H_2O$.

SOLUBILITY OF EACH HYDRATE SEPARATELY, IN WATER. (Chatterjee and Dhar, 1924.)

t°.	Gms. $Sr(C_6H_5O_7)_2$ per liter of Aq. solution sat. with	
	$Sr(C_6H_5O_7)_2.6H_2O$.	$Sr(C_6H_5O_7)_2.H_2O$.
30	1.26	2.97
95	1.57	1.54

STRONTIUM PHENOLATE $(C_6H_5O)_2Sr.4H_2O$.

EQUILIBRIUM IN THE SYSTEM STRONTIUM HYDROXIDE, PHENOL AND WATER AT 25°.
(Van Meurs, 1916.)

Mols. per 100 mols sat. sol.			Mols. per 100 mols. sat. sol.		
$\frac{Sr(OH)_2}{2}$.	C_6H_5OH.	Solid Phase	$\frac{Sr(OH)_2}{2}$.	C_6H_5OH.	Solid Phase
0.30	0.0	$Sr(OH)_2.8H_2O$	6.82	9.67	$(C_6H_5O)_2Sr.4H_2O$
0.72	0.49	»	8.87	20.24	»
1.48	1.28	»	9.38	24.84	»
3.83	3.74	»	11.16	47.30	»
4.86	4.80	»	9.62	63.77	» + C_6H_5OH
5.58	5.52	»	6.17	65.46	C_6H_5OH
6.12	6.04	» + $(C_6H_5O)_2Sr.4H_2O$	3.54	69.91	»

At concentrations of $Sr(OH)_2$ less than 0.5 mol. per cent two liquid layers are formed. Analyses of these gave the following results.

Aqueous layer		Phenol layer	
Mol. % $\frac{Sr(OH)_2}{2}$.	Mol. % C_6H_5OH.	Mol. % $\frac{Sr(OH)_2}{2}$.	Mol. % C_6H_5OH.
0.12	2.05	0.31	24.41
0.17	2.37	0.43	21.12
0.22	2.72	0.50	18.72
0.34	4.50	0.55	12.95

STRONTIUM BENZOATE $Sr(C_7H_5O_2)_2.H_2O$.

SOLUBILITY IN WATER.

(Pajetta, 1906.)

t°.	15.7°.	24.7°.	31.4°.	40.9°.
Gms. $Sr(C_7H_5O_2)_2$ per 100 Gms. Solution	5.31	5.4	5.56	5.77

STRONTIUM BENZOATES.

SOLUBILITY OF SEVERAL STRONTIUM BENZOATES IN WATER AT 20°.

(Ephraim and Pfister, 1925.)

Compound.	Formula.	Gms. anhydrous compd. per 100 cc. sat. sol.
Strontium Benzoate...........	$(C_6H_5COO)_2Sr.H_2O$	4.953
» -4 Chloro Benzoate..	$(C_6H_4ClCOO)_2Sr.4H_2O$	1.341
» -4 Methoxy »	$(C_6H_4OCH_3COO)_2Sr.H_2O$	1.6975
» -4 Nitro »	$(C_6H_4NO_2COO)_2Sr.8H_2O$	1.340
» -4 Oxy »	$(C_6H_4OHCOO)_2Sr.H_2O$	11.098

SOLUBILITY OF STRONTIUM HALOGEN BENZOATES IN 94 PERCENT ACETONE AT ABOUT 20°.

(Baller, 1931.)

CH

Compound	Formula	Gm. mols. compound per liter
Strontium p Brom Benzoate	$(C_6H_4BrCOO)_2Sr$	0.00028
" p Chlor "	$(C_6H_4ClCOO)_2Sr$	0.0010
" p Iodo "	$(C_6H_4ICOO)_2Sr$	0.00026

STRONTIUM SALICYLATE $(C_6H_4OH.COO)_2Sr.2H_2O$.

100 gms. sat. solution in water contain 3.04 gms. $(C_6H_4OHCOO)_2Sr$ at 15° and 20.44 gms. at 100°. (Tarugi and Checchi, 1901.)

SOLUBILITY OF STRONTIUM SALICYLATE IN AQUEOUS ALCOHOL AT 25°.

(Seidell, 1909, 1910.)

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol	Gms. $(C_6H_4.OH.COO)_2Sr.2H_2O$ per 100 Gms. Sat. Sol.	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $(C_6H_4OH.COO)_2Sr.2H_2O$ per 100 Gms. Sat. Sol.
0	1.022	5.04	60	0.923	7.15
10	1.006	4.88	70	0.893	5.90
20	0.993	5.22	80	0.859	4.40
30	0.982	6.20	90	0.824	2.56
40	0.966	7.70	92.3	0.815	2.02
50	0.948	8.08	100	0.790	0.44

The solid phase was $(C_6H_4OH.COO)_2Sr.2H_2O$ in all cases except the solution in 100 per cent alcohol, in which partial dehydration and conversion of the crystalline salt to an amorphous bulky white powder occurred.

STRONTIUM MANDELATE (Racemic) $Sr(C_8H_7O_3)_2$.

EQUILIBRIUM IN THE SYSTEM RACEMIC STRONTIUM MANDELATE, RACEMIC MANDELIC ACID AND WATER AT 25°.

(Ross and Morrison, 1933.)

Gms. per 100 gms. sat. sol. $C_8H_8O_3$	Gms. per 100 gms. sat. sol. $Sr(C_8H_7O_3)_2$	Solid Phase	Gms. per 100 gms. sat. sol. $C_8H_8O_3$	Gms. per 100 gms. sat. sol. $Sr(C_8H_7O_3)_2$	Solid Phase
16.9	0.0	$C_8H_8O_3$	3.9	1.0	1.1
17.3	0.5	" + 1.1	1.4	2.2	"
14.7	0.6	1.1	1.0	2.9	
11.6	0.5	"	0.3	3.6	$Sr(C_8H_7O_3)_2$
10.7	0.6	"	0.1	3.7	"
6.8	0.0	"	0.0	3.8	"

1.1 = $Sr(C_8H_7O_3)_2.(C_8H_8O_3)_2$.

STRONTIUM MANDELATE (Laevo) $Sr(C_8H_7O_3)_2$.

EQUILIBRIUM IN THE SYSTEM LAEVO STRONTIUM MANDELATE, LAEVO MANDELIC ACID AND WATER AT 25°.

(Ross and Morrison, 1937.)

CH

Gms. per 100 gms. sat. sol. $C_8H_8O_3$	Gms. per 100 gms. sat. sol. $Sr(C_8H_7O_3)_2$	Solid Phase	Gms. per 100 gms. sat. sol. $C_8H_8O_3$	Gms. per 100 gms. sat. sol. $Sr(C_8H_7O_3)_2$	Solid Phase
10.1	0.0	$C_8H_8O_3$	6.0	2.9	1.1
10.3	0.9	"	4.8	3.2	"
10.4	1.8	"	2.0	5.0	"
10.7	2.4	"	1.2	6.1	"
12.7	2.6	1.1	1.3	7.4	"
11.2	2.5	"	1.6	7.7	"
9.8	2.6	"	0.8	7.0	$Sr(C_8H_7O_3)_2$
8.4	2.4	"	0.0	7.4	"
6.4	2.8	"			

1.1 = $Sr(C_8H_7O_3)_2.(C_8H_8O_3)_2$.

STRONTIUM CINNAMATE $(C_6H_5CH:CH.COO)_2Sr.2H_2O$.

100 gms. H_2O dissolve 1 gm. $(C_6H_5CH:CH.COO)_2Sr$ at 15°-20°. (Squire and Caines, 1905.)

100 gms. sat. aqueous solution contain 1.18 gm. $(C_6H_5CH:CH.COO)_2Sr$ at 15° and 3.11 gms. at 100°. (Tarugi and Checchi, 1901.)

STRONTIUM CINNAMATE $C_{18}H_{14}O_4Sr.4H_2O$.

100 cc. sat. solution of strontium cinnamate in water contain 1.4 gms. $C_{18}H_{14}O_4Sr$ at 20°. (Ephraim and Pfister, 1925.)

STRONTIUM SULFONATES

SOLUBILITY OF EACH SEPARATELY IN WATER.

(Ephraim and Pfister, 1925 *a*.)

Compound.	Formula.	t°.	Gms. anhydrous cmpd. per 100 cc. sat. sol.
Strontium Benzene sulfonate	$Sr(C_6H_5SO_3)_2.H_2O$	20	15.493
" Anthracene-1- "	$Sr(C_{14}H_9SO_3)_2.3H_2O$	20	0.1157
" Naphthalene-2- "	$Sr(C_{10}H_7SO_3)_2.H_2O$	16.5	0.88
" " -5-Chlor-1- "	$Sr(C_{10}H_6SO_3Cl)_2.3H_2O$	20	0.551
" " -6-Oxy-2- "	$Sr(C_{10}H_7SO_3)_2.6H_2O$	20	1.111
" 2,6,8, Naphthylamine disulfonate	$Sr(C_{10}H_5.NH_2.SO_3)_2.xH_2O$	15	20.80*
" 2,5,7 " "	"	15	29.48*

* Gms. anhydrous salt. per 100 gms. of saturated solution.

SOLUBILITY OF STRONTIUM BENZENE SULFONATE IN AQUEOUS SOLUTIONS OF BENZENE SULFONIC ACID AT 25°.

(Dunn and Philip, 1934.)

Gms. per 100 gms. sat. sol. $C_6H_5SO_3H$	Gms. per 100 gms. sat. sol. $Sr(C_6H_5SO_3)_2$	Solid Phase	Gms. per 100 gms. sat. sol. $C_6H_5SO_3H$	Gms. per 100 gms. sat. sol. $Sr(C_6H_5SO_3)_2$	Solid Phase
0.0	15.37	$Sr(C_6H_5SO_3)_2.H_2O$	28.49	2.39	$Sr(C_6H_5SO_3)_2.H_2O$
7.93	8.51	"	41.8	0.31	"
10.56	6.43	"	44.7	0.16	"
14.12	5.10	"	49.6	0.07	"
19.29	3.26	"			

STRONTIUM Anthraquinone SULFONATES

SOLUBILITY OF EACH SEPARATELY IN WATER.

(Fierz-David, Krebser and Anderau, 1927.)

Compound	Formula	t°	Gms. Anhydrous (?) compound per liter
Strontium Anthraquinone:			
1.5 Disulfonate	$Sr(C_{14}H_6O_2(SO_3)_2.3H_2O$	18°	28.0
1.8 "	$Sr(C_{14}H_6O_2(SO_3)_2.3\frac{1}{2}H_2O$	18	0.4
" "	"	100	2.0
-1- Sulfonate	$Sr(C_{14}H_7O_2SO_3)_2.3H_2O$	18	1.16
" "	"	100	7.05
-2- "	$Sr(C_{14}H_7O_2SO_3)_2.H_2O$	18	0.97
" "	"	100	5.08
2.6 Di Sulfonate	$SrC_{14}H_6O_2(SO_3)_2$	18	2.35
" "	"	100	3.80
2.7 "	$SrC_{14}H_6O_2(SO_3)_2.2H_2O$	18	6.5
"	"	100	13.2

CH

STRONTIUM CAMPHORATE *d* $C_{10}H_{14}O_4Sr.4H_2O$.

SOLUBILITY IN AQUEOUS SOLUTIONS OF CAMPHORIC ACID AT 16–17°.

(Jungfleisch and Landrieu, 1914.)

Gms. per 100 Gms. Sat. Sol. $C_8H_{14}(COOH)_2$.	Gms. per 100 Gms. Sat. Sol. $C_{10}H_{14}O_4Sr$.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. $C_8H_{14}(COOH)_2$.	Gms. per 100 Gms. Sat. Sol. $C_{10}H_{14}O_4Sr$.	Solid Phase.
1.25	1.413	$C_8H_{14}(COOH)_2$	1 20	17.99	$(C_{10}H_{15}O_4)_2Sr(C_{10}H_{16}O_4)_2$
1.03	1.7705	$(C_{10}H_{15}O_4)_2Sr(C_{10}H_{16}O_4)_2$	0	16.95	$C_{10}H_{14}O_4Sr.4H_2O$
1.13	6.525	"	0	16.56	"
1.20	12.452		0	12.86 (at 98°)	"

STRONTIUM HELIANTHATE $(C_{14}H_{14}N_3SO_3)_2Sr.4H_2O$.

1000 cc. H_2O dissolve 0.126 gm. $(C_{14}H_{14}N_3SO_3)_2Sr.4H_2O$ at 20-25°.

(Stark and Dehn, 1918.)

STRONTIUM CARBONATE $SrCO_3$.

One liter of water dissolves 0.00082 gm. at 8.8° and 0.0109 gm. at 24° by conductivity method. (Holleman, 1893; Kohlrausch and Rose, 1893.)

One liter of water saturated with CO_2 dissolves 1.19 gms. $Sr(HCO_3)_2$.

Data for the solubility of strontium carbonate in water containing CO_2 at pressures between 0.05 and 1.1 atmospheres are given by McCoy and Smith (1911). The equilibrium constant is $k = 1.29 \times 10^{-2}$ with an average deviation from the mean of 1.2 per cent. From this value, the solubility product is calculated to be $Sr \times CO_3 = k_1 = 1.567 \times 10^{-9}$.

Using the "polarographic" method (See remarks under Barium carbonate) Heyrovsky and Berezicky, 1929, found the solubility of Strontium carbonate in Water to be 0.00028 gm. equivalents per liter.

SOLUBILITY OF STRONTIUM CARBONATE IN WATER SATURATED WITH CARBON DIOXIDE AT PRESSURE OF ONE ATMOSPHERE AND OF THIRTY-FIVE ATMOSPHERES AT 18°.

(Haehnel, 1924.) (See Barium Carbonate, p. 1076.)

Pressure of Carbon Dioxide.	Gms. per 100 gms. sat. sol. Carbonate.	Bicarbonate.
1.0 atmosphere	0.12	0.17
35.0 atmosphere	0.38	0.57

The limit of solubility at 18° was at 25 atmospheres pressure of CO_2.

SOLUBILITY OF STRONTIUM CARBONATE IN AQUEOUS AMMONIUM CHLORIDE.

(Cantoni and Goguelia, 1905.)

Gms. NH_4Cl per 100 Gms. Solution.	Gms. $SrCO_3$ per 1000 cc. Sat. Solution.
5.35	0.179
10	0.259
20	0.358

The mixtures were allowed to stand at 12-18° for 98 days.
Fusion-point data for $SrCO_3 + SrCl_2$ are given by Sackur (1911-12).

CO

SOLUBILITY OF STRONTIUM CARBONATE IN AQUEOUS SOLUTIONS OF ALKALI CHLORIDES.

(Townley, Whitney and Felsing, 1937.)

Gm. Mol. Alkali Chloride per 1000 gms. H_2O in each case	Results at 25° Gm. Mol. $SrCO_3 \times 10^{-4}$ per 1000 gms. H_2O in aqueous			Results at 40° Gm. Mol. $SrCO_3 \times 10^{-4}$ per 1000 gms. H_2O in aqueous		
	LiCl	NaCl	KCl	LiCl	NaCl	KCl
0.0 (= H_2O alone)	0.5525	0.5525	0.5525	0.7026	0.7026	0.7026
0.02	0.957	0.737	0.672	1.164	0.888	0.975
0.05	1.203	0.965	0.835	1.494	1.140	1.190
0.10	1.455	1.320	1.055	1.845	1.505	1.415
0.20	1.750	1.965	1.375	2.260	2.195	1.690
0.30	1.925	2.485	1.570	2.525	2.780	1.870
0.40	2.040	2.915	1.685	2.717	3.280	1.980
0.50	2.135	3.285	1.756	2.870	3.710	2.055
1.00	2.440	4.415	1.900	3.390	5.145	2.205
3.0	3.405	6.855	2.176	5.060	8.665	2.480

STRONTIUM OXALATE $SrC_2O_4.H_2O$.

One liter of water dissolves 0.0328 gm. SrC_2O_4 at 1.35°, 0.0444 gm. at 15.9°, 0.0461 gm. at 18°, 0.0575 gm. at 31.7° and 0.0617 gm. at 37.3°, determined by the conductivity method. (Kohlrausch, 1908.)

One liter of sat. aqueous solution contains 0.057 gm. SrC_2O_4 at 0°, 0.077 gm. at 20° and 0.093 gm. at 40°. (Cantoni and Diotalevi, 1905.)

SOLUBILITY OF STRONTIUM OXALATE IN AQUEOUS ACETIC ACID SOLUTIONS AT 26°-27°.

(Herz and Muhs, 1903.)

Normality of Acetic Acid.	Gms. per 100 cc. Solution.		Normality of Acetic Acid.	Gms. per 100 cc Solution.	
	CH_3COOH.	$SrC_2O_4.H_2O$.		CH_3COOH.	$SrC_2O_4.H_2O$.
0	0	0.009	3.86	23.16	0 0598
0.58	3.48	0.0526	5.79	34.74	0.0496
1.45	8.70	0.0622	16.26	97.56	0.0060
2.89	17.34	0.0642			

One liter sat. aq. solution of $SrC_2O_4.H_2O$ contains 0.0589 gm. SrC_2O_4 at 18°, as determined by conductivity measurements. (Scholder, Gadenne and Niemann, 1927.)

Using the "polarographic" method (See remarks under Barium carbonate) Heyrovsky and Berezicky, 1929, found the solubility of Strontium Oxalate in Water to be 0.00056 gm. equivalents per liter.

EQUILIBRIUM IN THE SYSTEM STRONTIUM OXALATE, URANYL OXALATE AND WATER.

COO

(Colani, 1934.)

Results at 15°

Gms. per 100 gms. sat. sol.		Solid Phase
$UO_2C_2O_4$	SrC_2O_4	
0.470	0.0	$UO_2C_2O_4 \cdot 3H_2O$
0.616	0.093	"
0.771	0.164	$SrUO_2(C_2O_4)_2 \cdot 4H_2O$
0.742	0.158	"
0.701	0.160	"
0.549	0.163	"
0.481	0.147	$SrC_2O_4 \cdot H_2O$
0.266	0.086	"
0.087	0.033	"

Results at 50°

Gms. per 100 gms. sat. sol.		Solid
$UO_2C_2O_4$	SrC_2O_4	
1.00	0.0	$UO_2C_2O_4 \cdot 3H_2O$
1.23	0.121	"
1.75	0.343	"
1.92	0.412	"
2.10	0.521	"
1.99	0.508	$SrUO_2(C_2O_4)_2 \cdot 4H_2O$
1.82	0.500	"
1.45	0.477	"
1.32	0.435	$SrC_2O_4 \cdot H_2O$
0.524	0.189	
0.349	0.128	"
0.176	0.074	"

STRONTIUM CHLORIDE $SrCl_2.6H_2O$.

FREEZING-POINTS OF DILUTTE SOLUTIONS OF STRONTIUM CHLORIDE.

(Klein and Svanberg, 1920.)

t° of f. pt.	−0.485.	−1.223.	−2.384.
Normality of aq. $SrCl_2$ solution	0.10	0.25	0.50

STRONTIUM CHLORIDE $SrCl_2.6H_2O$.

Solubility in Water.

(Average curve from the results of Mulder; Etard; see also Tilden, 1884.)

t°.	Gms. $SrCl_2$ per 100 Gms. Solution.	Gms. $SrCl_2$ per 100 Gms. Water.	Solid Phase.	t°.	Gms. $SrCl_2$ per 100 Gms. Solution.	Gms. $SrCl_2$ per 100 Gms. Water.	Solid Phase.
−20	26.0	35.1	$SrCl_2.6H_2O$	60	45.0	81.8	$SrCl_2.6H_2O$
0	30.3	43.5	"	70	46.2	85.9	$SrCl_2.2H_2O$
10	32.3	47.7	"	80	47.5	90.5	"
20	34.6	52.9	"	100	50.2	100.8	"
25	35.8	55.8	"	120	53.0	112.8	"
30	37.0	58.7	"	140	55.6	125.2	"
40	39.5	65.3	"	160	58.5	141.0	"
50	42.0	72.4	"	180	62.0	163.1	"

Transition temperature about 62.5°. Sp. Gr. of sat. solution at 0° = 1.334; at 15° = 1.36.

More recent determinations of the solubility of Strontium Chloride in Water, made by Menzies, 1936, by a modification of the synthetic method which permitted varying at will the amount of solvent in contact with the solute, are as follows.

Cl

t°	Gm. Mols. $SrCl_2$ per 1000 gms. H_2O	Solid Phase	t°	Gm. Mols. $SrCl_2$ per 1000 gms. H_2O	Solid Phase
20	3.33	$SrCl_2.6H_2O$	100	6.39	$SrCl_2.2H_2O$
25	3.50	"	110	6.74	"
30	3.69	"	120	7.17	"
40	4.10	"	130	7.74	"
50	4.62	"	134.4	8.06	" + $SrCl_2.H_2O$
60	5.35	"	140	8.20	$SrCl_2.H_2O$
61.4	5.50	" + $SrCl_2.2H_2O$	150	8.60	"
70	5.65	$SrCl_2.2H_2O$	160	8.74	"
80	5.86	"	180	9.39	"
90	6.10	"	200	10.29	"

Solubility of Strontium Chloride in 98.1% Deuterium Water.

(Miles and Menzies, 1937.)

t°	Gm. Mols. $SrCl_2$ per 1000 gms. D_2O	Solid Phase	t°	Gm. Mols. $SrCl_2$ per 1000 gms. D_2O	Solid Phase
0	2.78	$SrCl_2.6H_2O$	80	5.76	$SrCl_2.2H_2O$
10	2.91	"	90	6.02	"
20	3.36	"	100	6.34	"
25	3.54	"	110	6.72	"
30	3.73	"	120	7.18	"
40	4.17	"	128.5	7.64	" + $SrCl_2.H_2O$
50	4.76	"	130	7.68	$SrCl_2.H_2O$
56.4	5.28	" + $SrCl_2.2H_2O$	135	7.82	"
60	5.35	$SrCl_2.2H_2O$	140	7.97	"
70	5.54	"	145	8.14	"

SOLUBILITY OF STRONTIUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 25°. (Milikan, 1918.)

Gms. per 100 gms. sat. sol.		
Sr Cl₂.	H Cl.	Solid Phase.
35.60	0.0	$SrCl_2.6H_2O$
33.97	0.66	»
27.55	4.57	»
9.86	16.12	»
6.68	18.89	$SrCl_2.6H_2O$
2.11	27.14	» + $SrCl_2.2H_2O$
1.29	28.23	$SrCl_2.2H_2O$
0.13	37.66	»

EQUILIBRIUM IN THE SYSTEM STRONTIUM OXIDE, HYDROCHLORIC ACID AND WATER AT 25°. (Milikan, 1918.)

Gms. per 100 gms. sat. sol.		
Sr O.	H Cl.	Solid Phase.
0.08	37.72	$SrCl_2.2H_2O$
0.10	36.59	»
0.84	28.82	»
1.38	28.16	» + $SrCl_2.6H_2O$
1.46	28.10	$SrCl_2.6H_2O$
4.37	21.96	»
6.44	20.66	»
18.01	17.24	»
22.20	16.29	»
23.27	16.38	$SrCl_2.6H_2O$
23.83	16.19	» + $SrCl_2.SrO.9H_2O$
24.15	16.40	» »
22.88	15.33	$SrO.9H_2O$ + »
23.06	15.46	» »
22.94	15.37	» »
15.19	10.16	$SrO.9H_2O$
9.04	5.76	»
0.85	0.0	»

EQUILIBRIUM IN THE SYSTEM STRONTIUM CHLORIDE, STRONTIUM OXIDE AND WATER. (Milikan, 1917.)

Gms. per 100 gms. sat. sol.		
Sr Cl₂.	Sr O.	Solid Phase.
	Results at 0°.	
30.68	0.0	$SrCl_2.6H_2O$
30.55	0.31	» + $SrO.9H_2O$
29.03	0.30	$SrO.9H_2O$
23.74	0.29	»
0.0	0.35	»
	Results at 25°.	
35.60	0.0	$SrCl_2.6H_2O$
35.65	0.85	» + 1.1.9
33.41	1.09	1.1.9 + $SrO.9H_2O$
22.09	0.75	$SrO.9H_2O$
12.52	0.86	»
0.0	0.85	»
	Results at 40°.	
39.62	0.0	$SrCl_2.6H_2O$
39.26	1.36	» + 1.1.9
36.62	1.73	1.1.9
36.08	1.76	»
34.13	2.03	»
32.97	2.10	»
32.07	2.47	» + $SrO.9H_2O$
29.01	1.91	$SrO.9H_2O$
28.84	1.90	»
18.48	1.42	»
0.0	1.48	»

1.1.9 = $SrCl_2,SrO.9H_2O$.

C1

100 gms. sat. solution of strontium chloride in selenium oxychloride ($SeOCl_2$) contain 5.17 gms. $SrCl_2$ at 25°. (Wise, 1923.)

SOLUBILITY OF STRONTIUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 0°. (Engel, 1888.)

Mg. Mols. per 10 cc. Solution.		Sp. Gr. of Solution.	Grams per 100 cc. Solution.	
½SrCl₂.	HCl.		SrCl₂.	HCl.
51.6	0	1.334	40.9	0.0
44.8	6.1	1.304	35.5	2.22
37.85	12.75	1.269	30.0	4.65
27.2	23.3	1.220	21.56	8.49
22.0	28.38	1.201	17.44	10.35
14.0	37.25	1.167	11.09	13.58
4.25	52.75	1.133	3.37	19.23

SOLUBILITY OF STRONTIUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROBROMIC AND OF HYDROCHLORIC ACIDS AT 25°.

(Harkins and Paine, 1916.)

In Aqueous HBr.			In Aqueous HCl.		
Gms. Equiv. HBr per 1000 Gms. H_2O.	d_{25} of Sat. Sol.	Gms. $SrCl_2$ per 100 Gms. Sat. Sol.	Gms. Equiv. HCl per 1000 Gms. H_2O.	d_{25} of Sat. Sol.	Gms. $SrCl_2$ per 100 Gms. Sat. Sol.
0	1.4015	35.80	0.1551	1.3953	35.17
0.06817	1.4020	35.47	0.5162	1.3788	33.60
0.4191	1.4010	33.92	1.017	1.3563	31.42
0.9716	1.3992	31.52	2.165	1.3065	26.33
1.154	1.3995	20.78	9.205	1.1498	3.055

SOLUBILITY OF STRONTIUM CHLORIDE IN AQUEOUS SOLUTIONS OF ACIDS AND OF SALTS AT 25°.

(Harkins and Paine, 1916.)

Aqueous Solution of:	Gms. Equiv. added Salt per 1000 Gms. H_2O.	d_{25} of Sat. Sol.	Gms. $SrCl_2$ per 100 Gms. Sat. Sol.	Aqueous Solution of:	Gms. Equiv. added Salt per 1000 Gms. H_2O.	d_{25} of Sat. Sol.	Gms. $SrCl_2$ per 100 Gms. Sat. Sol.
$CuCl_2$	0.7134	1.4200	34.005	KNO_3	0.09790	1.4107	35.86
"	2.276	1.4595	30.40	"	0.4755	1.4349	35.90
HI	0.1041	1.4058	34.850	HNO_3	0.1771	1.4038	35.52
"	0.4462	1.4121	33.28	"	0.3521	1.4059	35.40
"	0.7539	1.4196	31.52	"	1.277	1.4175	34.04
KI	0.09199	1.4093	35.45	$NaNO_3$	0.3021	1.4216	35.63
"	0.5401	1.4466	33.79	"	0.5010	1.4588	35.60
"	0.6015	1.4513	33.60	"	3.553	1.5214	30.88
"	1.445	1.5154	30.90	"	6.856	1.5581	25.53
KCl	0.0719	1.4032	35.62	$Sr(NO_3)_2$	0.1372	1.4113	35.42
"	0.433	1.4085	34.80	"	0.5766	1.4336	34.47
"	0.8570	1.4152	33.89	"	1.0988	1.4636	33.30
"	1.594	1.4266	32.40	"	3.318	1.6664	28.97

SOLUBILITY OF STRONTIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM PERMANGANATE AT 25°.

(Herz and Hiebenthal, 1929.)

Gm. Mols. per liter		Solid Phase
1/5 $KMnO_4$	1/2 $SrCl_2$	
0.0	6.24	$SrCl_2.6H_2O$.
0.02	6.22	"
0.41	6.14	"
0.82	6.12	"
+1.36	5.90	"

EQUILIBRIUM IN THE SYSTEM STRONTIUM CHLORIDE, STRONTIUM NITRATE AND WATER AT 25°.

(Ehret, 1932.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$Sr(NO_3)_2$	$SrCl_2$			$Sr(NO_3)_2$	$SrCl_2$	
1.476	44.28	0.0	$Sr(NO_3)_2 4H_2O$	1.523	27.25	18.63	$Sr(NO_3)_2$
1.492	48.69	6.32	"	1.537	22.75	23.07	"
1.488	38.57	5.54	"	1.565	19.62	28.45	"
1.508	35.14	10.79	"	1.568	18.79	28.97	" + $SrCl_2 6H_2O$
1.510	34.29	10.87	"	1.563	18.00	29.23	$SrCl_2 6H_2O$
1.513	33.71	12.11	$Sr(NO_3)_2$	1.520	14.10	30.75	"
1.515	30.15	15.10	"	1.483	9.97	32.51	"
							"

100 gms. abs. methyl alcohol dissolve 63.3 gms. $SrCl_2.6H_2O$ at 6°.
100 gms. abs. ethyl alcohol dissolve 3.8 gms. $SrCl_2.6H_2O$ at 6°. (de Bruyn, 1892.)

Solubility of Strontium Chloride in Aqueous Ethyl Alcohol Solutions at 18°.

(Gerardin, 1865.)

Sp. Gr. of Aq. Alcohol at 0°.	Wt. per cent Alcohol.	Gms. $SrCl_2$ per 100 Gms. Alcohol.	Sp. Gr. of Aq. Alcohol at 0°.	Wt. per cent Alcohol.	Gms. $SrCl_2$ per 100 Gms. Alcohol.
0.990	6	49.81	0.939	45	26.8
0.985	10	47.0	0.909	59	19.2
0.973	23	39.6	0.846	86	4.9
0.966	30	35.9	0.832	91	3.2
0.953	38	30.4			

100 gms. 95% formic acid dissolve 23.8 gms. $SrCl_2$ at 19°. (Aschan, 1913.)
100 cc. anhydrous hydrazine dissolve 8 gms. $SrCl_2$ at room temp. (Welsh and Broderson, 1915.)

The composition of the homogeneous mixture (plait point) of the system Strontium Chloride, tertiary Butyl Alcohol and Water at 25°, was found by Ginnings, Herring and Webb, 1933, to be 6.3 percent $SrCl_2$, 33.1 percent ter. $(CH_3)_3COH$ and 60.6 percent H_2O. The original results for the remaining points on the binodal curve are not given but only the values of a series of constants calculated by means of empirical equations. Cl

The binodal curve for the system Strontium Chloride, Allyl Alcohol and Water at 25 has been determined by Ginning and Dees, 1935, but the authors give only the values of a series of constants calculated from their experimental results by means of an empirical equation.

Solubility of Strontium Chloride in Anhydrous Acetic Acid.

(Davidson and Chappell, 1938.)

t°	Gm. Mol. Percent $SrCl_2$ in sat. sol.	Solid Phase	t°	Gm. Mol. Percent $SrCl_2$ in sat. sol.	Solid Phase
16.60	0.0	CH_3COOH	19.0	6.11	$SrCl_2$
16.32	0.55	"	30.0	5.12	"
16.05	1.09	"	45.0	4.04	"
15.68	1.81	"	60.0	3.28	"
15.05	3.07	"	83.0	2.22	"
14.00	3.93	"	98.9	1.67	"
13.65	5.11	"			

Fusion-point data for $SrCl_2 + SrF_2$ are given by Plato (1907). Results for $SrCl_2 + SrO$ and $SrCl_2 + SrSO_4$ by Sackur (1911–12). Results for $SrCl_2 + TlCl$ by Korreng (1914) and results for $SrCl_2 + ZnCl_2$ by Sandonnini (1912a, 1914).

STRONTIUM CHLORATE $Sr(ClO_3)_2$.

100 gms. H_2O dissolve 174.9 gms. $Sr(ClO)_2$, or 100 gms. sat. solution contain 63.6 gms. at 18°. Sp. Gr. of solution is 1.839. (Mylius and Funk, 1897.)

STRONTIUM Per CHLORATE $Sr(ClO_4)_2$.

SOLUBILITY OF ANHYDROUS STRONTIUM PERCHLORATE IN SEVERAL SOLVENTS AT 25°.

(Willard and Smith, 1930)

Solvent.	d_{4}^{25} of solvent.	d_{4}^{25} of sat. sol.	Gms. $Sr(ClO_4)_2$ per 100 gms. sat. sol.	Gms. $Sr(ClO_4)_2$ per 100 gms. solvent.
Water	–	2.0837	75.59	309.67
Methyl alcohol	0.78705	1.6771	67.95	212.01
Ethyl alcohol	0.78517	1.5539	64.37	180.66
n Propyl alcohol	0.7989	1.4266	58.40	140.38
n Butyl alcohol	0.8059	1.3394	53.16	113.49
iso » »	0.7981	1.2022	43.78	77.87
Acetone	0.7852	1.4984	60.01	150.06
Ethyl acetate	0.89457	1.4717	52.10	136.93

Strontium perchlorate crystallized from water at about 0° apparantly contained 4 H_2O. At about 25° a dihydrate, 2 H_2O, was obtained. Above 40° the crystals corresponded to the formula $3\,Sr(ClO_4)_2.2\,H_2O$. The transition point between this compound and the dihydrate was at about 37°. Evidence was also obtained of the possible existence of a monohydrate.

STRONTIUM Hexa Antipyrine Per CHLORATE $[Sr(COC_{10}H_{12}N_2)_6](ClO_4)_2$.

100 cc sat. solution of Strontium Hexa Antipyrine Perchlorate in Water contain 9.68 gms. $[Sr(COC_{10}H_{12}N_2)_6](ClO_4)_2$ at 20°. (Wilke-Dörfurt and Schliephake, 1929.)

CrO STRONTIUM CHROMATE $SrCrO_4$.

SOLUBILITY OF STRONTIUM CHROMATE IN WATER.

(Davis and Ricci, 1939.)

Equilibrium is approached with such extreme slowness that the following results may be subject to slight revision.

t°	Gms. $SrCrO_4$ per liter
15	0.879 (?)
25	0.91
75	0.62
100	0.43

SOLUBILITY OF STRONTIUM CHROMATE IN SEVERAL SOLVENTS AT 15°.

(Fresenius, 1891.)

Solvent.	Gms. $SrCrO_4$ per 100 Gms. Solvent.	Solvent.	Gms. $SrCrO_4$ per 100 Gms. Solvent.
Water	0.12	Aq. Ethyl Alcohol (29%)	0.0132
Aq. NH_4Cl (5%)	0.195	Aq. Ethyl Alcohol (53%)	0.002
Aq. CH_3COOH (1%)	1.57		

STRONTIUM FLUORIDE SrF_2.

One liter of water dissolves 0.1135 gm. SrF_2 at 0.26°, 0.1173 gm. at 17.4° and 0.1193 gm. at 27.4°, determined by the conductivity method. (Kohlrausch, 1908.)

One liter sat. solution of Strontium Fluoride in Water contains 0.39 gm. SrF_2 at 25°, determined gravimetrically and the pH of the solution is 6.2. (Carter, 1928.)

SOLUBILITY OF STRONTIUM FLUORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 25° (?).

(Tananaew and Tchrelachwili, 1936.)

Normality of aq. HCl	Gm. Mol. SrF_2 dissolved per liter	pH of sat. sol.
0.01	0.0038	2.20
0.10	0.0220	1.03
1.0	0.1240	0.07

STRONTIUM Hexa Antipyrine Boro FLUORIDE $Sr(COC_{10}H_{12}N_2)_6(BF_4)_2$

F

100 cc sat. solution of Strontium Hexa Antipyrine Boro fluoride in Water contain 3.8 gms. $Sr(COC_{10}H_{12}N_2)_6(BF_4)_2$ at 20°. (Wilke-Dörfurt and Mureck, 1929.)

STRONTIUM Phospho FLUORIDE $SrPO_3F.H_2O$.

One liter sat. solution of Strontium Phospho Fluoride in Water contains 0.055 gm. mols. $SrPO_3F$ at 20°. (Lange, 1929.)

STRONTIUM Silico FLUORIDE $SrSiF_6$.

100 gms. of a sat. solution of strontium silico fluoride in a solvent composed of 135 cc. H_2O + 9.0 cc. of 1.0 *n* HCl + 1.5 gm. $(NH_4)_2SiF_6$ + 48 cc. C_2H_5OH contain 1.061 gm. $SrSiF_6$ at 18°.5. (Leo, 1923.)

STRONTIUM IODIDE $SrI_2.6H_2O$.

I

SOLUBILITY IN WATER.

(Average curve from the results of Kremers, 1858; and Etard, 1874.)

t°.	Gms. SrI_2 per 100 Gms. Solution.	Gms. SrI_2 per 100 Gms. Water.	Solid Phase.	t°.	Gms. SrI_2 per 100 Gms. Solution.	Gms. SrI_2 per 100 Gms. Water.	Solid Phase.
0	62.3	165.3	$SrI_2.6H_2O$	90	78.5	365.2	$SrI_2.2H_2O$
20	64.0	177.8	"	100	79.3	383.1	"
40	65.7	191.5	"	120	80.7	418.1	"
60	68.5	217.5	"	140	82.5	471.5	"
80	73.0	270.4	"	175	85.6	594.4	"

Transition temperature about 90°. Sp. Gr. of sat. solution at 20° = 2.15

100 gms. sat. solution of strontium iodide in absolute alcohol contain 2.6 gms. SrI_2 at −20°, 3.1 gms. at +4°, 4.3 gms. at 39°, and 4.7 gms. at 82°. (Etard, 1874.)

Data for equilibrium in the system strontium iodide, strontium oxide and water at 25° are given by Milikau (1916).

EQUILIBRIUM IN THE SYSTEM STRONTIUM IODIDE, STRONTIUM OXIDE AND WATER AT 25°. (Milikan, 1917.)

Gms. per 100 gms. sat. sol. SrI_2.	Gms. per 100 gms. sat. sol. SrO.	Solid Phase.
64.70	0.0	$SrI_2.6H_2O$
64.04	0.16	" $+SrI_2.2SrO.9H_2O$
60.77	0.18	$SrI_2.2SrO.9H_2O$
55.58	0.46	"
55.09	0.51	"
54.16	0.60	"
53.04	0.72	$SrI_2.2SrO.9H_2O$
49.37	0.74	" $+SrO.9H_2O$
39.50	0.55	$SrO.9H_2O$
29.98	0.53	"
22.36	0.57	"
0.0	0.85	"

100 gms. sat. solution of Strontium Iodide in liquid Ammonia contain 0.308 gm. SrI_2 at 0°. (Linhard and Stephan, 1934.)

STRONTIUM PerIODIDE SrI_4.

I Data for the formation of strontium periodide in aqueous solution at 25° are given by Herz and Bulla (1911). The experiments were made by adding iodine to aqueous solutions of SrI_2 and agitating with carbon tetrachloride. From the iodine content of the CCl_4 layer the amount of iodine in the aqueous layer can be calculated on the basis of the distribution ratio of iodine between water and CCl_4. This furnishes the necessary data for calculating the amount of the strontium periodide existing in the aqueous layer.

STRONTIUM IODATE $Sr(IO_3)_2$.

100 gms. H_2O dissolve 0.026 gm. at 15°, and 0.72–0.91 gm. at 100°. (Gay-Lussac; Rammelsberg, 1838.)

STRONTIUM Mercuric IODIDE $SrI_2HgI_2.8H_2O$.

A saturated aqueous solution prepared by adding SrI_2 and HgI_2 in excess to warm water and filtering when the temperature had fallen to 16.5° was found to have the composition $1.0 SrI_2.1.24 HgI_2.18.09 H_2O$. The $d_{16.5}$ was 2.5 (Dubois, 1906.)

MnO **STRONTIUM PERMANGANATE** $Sr(MnO_4)_2$.

100 gms. of the sat. solution in water contain about 2.5 gms. $Sr(MnO_4)_2$ at 0°. (Patterson, 1906.)

STRONTIUM MOLYBDATE $SrMoO_4$.

100 gms. H_2O dissolve 0.0104 gm. $SrMoO_4$ at 17°. (Smith and Bradbury, 1891.)

STRONTIUM NITRIDE $Sr(N_3)_2$.

100 gms. sat. solution of Strontium Nitride in Water contain 31.43 gms. $Sr(N_3)_2$ at 16°. (Curtius and Rissom, 1898.)

STRONTIUM NITRITE $Sr(NO_2)_2.H_2O$.

SOLUBILITY OF STRONTIUM NITRITE IN WATER.

(Oswald, 1912, 1914.)

t°.	Gms. $Sr(NO_2)_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $Sr(NO_2)_2$ per 100 Gms. Sat. Sol.	Solid Phase.
− 1.3	11.3	Ice	35	43.1	$Sr(NO_2)_2.H_2O$
− 3.1	19.6	"	52.5	46.5	"
− 7.7	35.5	"	60.5	49.3	"
− 6.8	32.8	" $+Sr(NO_2)_2.H_2O$	65.5	50.7	"
− 2.3	33.4	$Sr(NO_2)_2.H_2O$	82.5	54	"
− 0.3	34.5	"	92	56.6	"
+19	39.3*	"	98	58.1	"

* d = 1.4461.

100 cc. sat. solution in water contain 62.83 gms. $Sr(NO_2)_2.H_2O$ at 19.5°.
" " " " 90% alcohol " 0.42 " " " 20°.
" " " " abs. alcohol " 0.04 " " " 20°.

(Vogel, 1903.)

STRONTIUM NITRATE $Sr(NO_3)_2$.

SOLUBILITY IN WATER.

(Berkeley and Appleby, 1911.)

t°.	d_t of Sat. Sol.	Gms. $Sr(NO_3)_2$ per 100 Gms. H_2O.	Solid Phase.	t°.	d_t of Sat. Sol.	Gms. $Sr(NO_3)_2$ per 100 Gms. H_2O.	Solid Phase.
0.58	1.28561	40.124	$Sr(NO_3)_2.4H_2O$	39.74	1.51282	90.086	$Sr(NO_3)_2$
14.71	1.39380	60.867	"	47.73	1.51150	91.446	"
26.40	1.48831	82.052	"	61.34	1.51048	93.856	"
29.06	1.51098	87.648	"	68.96	1.51057	95.576	"
29.3*	...	...	" $+Sr(NO_3)_2$	78.98	1.51091	97.865	"
30.28	1.51441	88.577	$Sr(NO_3)_2$	88.94	1.51174	100.136	"
32.58	1.51408	88.943	"				

*The determinations were made with very great accuracy.

More recent determinations by Sieverts and Petzold, 1933, showing results for the ice curve and the metastable* region are as follows.

t^0	Gms. $Sr(NO_3)_2$ per 100 gms. sat. sol.	Solid Phase	t^0	Gms. $Sr(NO_3)_2$ per 100 gms. sat. sol.	Solid Phase
- 0.8	5.0	Ice	-14.5	44.4*	Ice
- 1.4	7.5	"	+ 0.1	28.2	$Sr(NO_3)_2.4H_2O$
- 2.5	12.7	"	20	40.7	"
- 4.55	21.7	"	28	45.8	"
- 5.4	24.7	" $+Sr(NO_3)_2.4H_2O$	29.3	47.0	" $+ Sr(NO_3)_2$
- 6.6	28.9*	"	35.0	47.2	$Sr(NO_3)_2$
- 7.6	31.4*	"	60	48.3	"
- 8.8	35.1*	"	80	49.2	"
- 9.8	37.3*	"	105	51.2	"
-13.2	41.9*	"	13.7	46.6*	"
-13.9	42.6*	"	- 5.0	45.7*	"

EQUILIBRIUM IN THE SYSTEM STRONTIUM NITRATE, NITRIC ACID AND WATER.

(Sieverts and Petzold, 1933a.)

t°	Gms. per 100 gms. sat. sol. $Sr(NO_3)_2$	HNO_3	Solid Phase
-25	1.14	24.66	Ice + Sr.4
"	0.69	31.4	Sr.4
"	0.57	35.1	"
-10	4.35	12.0	Ice
"	8.01	10.8	"
"	9.93	9.89*	"
"	9.73	10.43	" + Sr.4
"	5.99	15.6	Sr.4
"	3.54	20.4	"
"	2.49	25.45	"
0	23.1	3.20	"
"	16.9	7.4	"
"	10.6	13.4	"
"	5.39	21.6	"
"	3.12	29.5	"
"	2.18	35.2	"
"	2.02	36.9	" + $Sr(NO_3)_2$
"	1.46	39.25	$Sr(NO_3)_2$
"	0.56	44.8	"
"	0.08	63.6	"
15	25.4	8.1	Sr.4
"	18.5	13.4	"
"	13.3	18.6	"
"	10.9	21.7	"
15	8.34	25.95	Sr.4
"	7.83	27.04	" + $Sr(NO_3)_2$
"	3.79	33.2	$Sr(NO_3)_2$
"	2.22	37.4	"
25	41.4	1.88	Sr.4
"	37.65	4.36	"
"	34.6	6.29	"
"	33.0	7.37	"
"	29.2	10.05	"
"	27.2	11.6	" + $Sr(NO_3)_2$
"	24.85	13.1	$Sr(NO_3)_2$
"	14.3	21.9	"
"	10.0	25.3	"
"	5.03	31.8	"
"	4.48	32.9	"
"	3.44	35.1	"
"	2.16	38.45	"
"	1.36	40.2	"
50	39.55	4.99	$Sr(NO_3)_2$
"	28.9	11.8	"
"	14.5	22.65	"
"	6.03	32.7	"
"	2.40	40.8	"
"	1.15	46.0	"
"	0.07	63.4	"

NO

Sr.4 = $Sr(NO_3)_2.4H_2O$.
Similar results are also given for the temperatures -15°, -8°, -5°, and +20°.

SOLUBILITY OF STRONTIUM NITRATE IN AQUEOUS ALCOHOL AT 25°.

(D'Ans and Siegler, 1913.)

Wt. % C_2H_5OH in Solvent.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
	C_2H_5OH.	$Sr(NO_3)_2$.	
0	0	44.25	$Sr(NO_3)_2.4H_2O$
4	1.7	42.8	"
6	2.6	42.1	"
10.8	4.95	40.4	"
16	7.95	37.6	"
20*	12.35	34.3	" $+Sr(NO_3)_2$
0	0	46.6	$Sr(NO_3)_2$ (unstable)
6	3.45	42.7	" "
10	6	40.05	$Sr(NO_3)_2$ (unstable)
15.05	9.5	36.7	" (unstable)
18.8*	12.35	34.3	" $+Sr(NO_3)_2.4H_2C$
20.6	13.8	33.2	$Sr(NO_3)_2$
40.65	32.35	20.5	"
59.9	53.6	10.5	"
79.2	77.15	2.6	"
99.4	99.38	0.02	"

* Tr. pt.

100 cc. anhydrous hydrazine dissolve 5 gms. $Sr(NO_3)_2$ at room temp.

(Welsh and Broderson, 1915.)

100 cc. Pyridine dissolve 0.64 gm. Sr $(NO_3)_2$ at 0° and 0.7 gm. at 25°.

(Müller R., 1924.)

100 gms. abs. Ethyl Alcohol dissolve 0.0062 to 0.0086 gm. $Sr(NO_3)$ at 25°.
" " " -2- Propanol " 0.0014 to 0.0023 " " " "

(Ferner and Mellon, 1934.)

STRONTIUM NITRATE

SOLUBILITY OF STRONTIUM NITRATE IN LIQUID AMMONIA.

(Portnow and Schurawlew, 1936.)

t°	Gms. $Sr(NO_3)_2$ per 100 gms. NH_3	Solid Phase	t°	Gms. $Sr(NO_3)_2$ per 100 gms. NH_3	Solid Phase
-90	4.7	(?)NH_3+$Sr(NO_3)_2.8NH_3$	25	87.08(2)	$Sr(NO_3)_2$
-65	6.36	$Sr(NO_3)_2.8NH_3$	31	85.80	"
-19.5	10.89	"	33	87.44	"
- 3.0	37.99	$Sr(NO_3)_2.4NH_3$	36	101.6	"
0.0	40.39(1)	"	37	101.4	"
-14.0	59.46	$Sr(NO_3)_2.2NH_3$(?)	42	120.4	"
22.0	68.65	$Sr(NO_3)_2$	43.5	128.7	"

(1) = Linhard and Stephan, 1934; (2) = Hunt and Boncyk, 1933.

Fusion-point data are given for mixtures of $Sr(NO_3)_2$ + $Sr(OH)_2$ by Wolf, 1935.

STRONTIUM OXIDE SrO.

Fused $SrCl_2$ dissolves 18.3 gms. SrO per 100 gms. of the fused melt at 910°. (Arndt., 1907.)

STRONTIUM HYDROXIDE $Sr(OH)_2.8H_2O$. OH

SOLUBILITY IN WATER. (Scheibler, 1883.)

t°.	Grams per 100 Grams Solution.		Grams per 100 cc. Solution.	
	SrO.	$Sr(OH)_2.8H_2O$.	SrO.	$Sr(OH)_2.8H_2O$.
0	0.35	0.90	0.35	0.90
10	0.48	1.23	0.48	1.23
20	0.68	1.74	0.68	1.74
30	1.00	2.57	1.01	2.59
40	1.48	3.80	1.51	3.87
50	2.13	5.46	2.18	5.59
60	3.03	7.77	3.12	8.00
70	4.35	11.16	4.55	11.67
80	6.56	16.83	7.02	18.01
90	12.0	30.78	13.64	34.99
100	18.6	47.71	22.85	58.61

Later determinations agreeing closely with the above are given by Grube and Nussbaum, 1928, and Ahrens, 1930.

The following results by Klinkenberg, 1929; and Reinders and Klinkinberg, 1929, differ considerably from those of other investigators at the higher temperatures.

t°	Gms. SrO per 100 gms. sat. sol.	Solid Phase	t°	Gms. SrO per 100 gms. sat. sol.	Solid Phase
25	0.85	$Sr(OH)_2.8H_2O$	70	5.00	$Sr(OH)_2.8H_2O$
30	1.02	"	80	8.38	" "
40	1.48	"	85	12.08	"+$Sr(OH)_2.H_2O$
50	2.20	"	90	11.61	$Sr(OH)_2.H_2O$
60	3.29	"	100	10.83	"

MUTUAL SOLUBILITY OF STRONTIUM HYDROXIDE AND STRONTIUM NITRATE IN WATER AT 25°. (Parsons and Perkins, 1910.)

d_{25} of Sat. Sol.	Gms. per 100 Gms. H_2O. SrO as $Sr(OH)_2$.	Gms. per 100 Gms. H_2O. $Sr(NO_3)_2$.	Solid Phase.	d_{25} of Sat. Sol.	Gms. per 100 Gms. H_2O. SrO as $Sr(OH)_2$.	Gms. per 100 Gms. H_2O. $Sr(NO_3)_2$.	Solid Phase.
1.481	0	79.27	$Sr(NO_3)_2$	1.267	1.11	37.81	$Sr(OH)_2.8H_2O$
1.492	0.38	79.47	"	1.217	1.01	28.80	"
1.494	0.78	80.83	"	1.178	0.95	23.83	"
1.506	1.76	81.06	$Sr(OH)_2.8H_2O$	1.148	0.91	17.96	"
1.490	1.71	74.27	"	1.108	0.84	12.78	"
1.419	1.51	63.71	"	1.079	0.81	8.96	"
1.381	1.41	56.30	"	1.059	0.79	6.29	"
1.327	1.27	46.97	"	1.033	0.78	4.45	"

OH

SOLUBILITY OF STRONTIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF STRONTIUM SULFHYDRATE AND VICE VERSA. (Terres and Bruckuer, 1920.)

Gms. per 100 gms. sat. sol. $Sr(OH)_2$.	Gms. per 100 gms. sat. sol. $Sr(SH)_2$.
Results at 0°.	
0.41	0.00
0.30	1.56
0.25	6.68
0.22	12.65
0.20	14.80
0.16	18.20
0.15	19.05
0.10	23.40
0.10	24.80
0.20	27.5
0.00	27.50
Results at 20°.	
0.82	0.0
0.72	5.9
0.70	11.4
0.62	15.8
0.60	18.3
0.55	20.3
1.00	24.0
0.25	26.0
0.20	26.8
0.15	27.5
0.00	29.7
Results at 40°.	
1.75	0.00
1.65	1.40
1.60	4.87
1.60	10.83
1.55	15.93
1.50	20.00
1.10	24.10
0.80	26.20
0.42	28.30
0.30	29.25
0.10	31.60
0.00	31.60
Results at 60°.	
3.63	0.00
3.15	1.60
3.04	6.08
3.16	11.85
3.15	16.72
1.75	25.0
1.75	26.6
0.60	30.8
0.10	33.6
0.00	33.2
Results at 80°.	
7.78	0.00
5.60	5.60
5.00	9.50
4.88	15.50
4.10	19.60
2.70	27.50
2.10	28.00
1.40	30.40
0.05	35.60
0.00	35.60
Results at 100°.	
23.20	0.00
14.00	7.40
0.15	37.80
0.00	37.80

These results when plotted give curves composed of two branches corresponding respectively to the solid phases $Sr(OH)_2.8H_2O$ and $Sr(SH)_2.4H_2O$.

SOLUBILITY OF STRONTIUM HYDROXIDE IN AQUEOUS SOLUTIONS AT 25°.

(Rothmund, 1910.)

Aqueous Solution of:	Mols. $Sr(OH)_2 \cdot 8H_2O$ per Liter.	Gms. $Sr(OH)_2$ per Liter.	Aqueous Solution of:	Mols. $Sr(OH)_2 \cdot 8H_2O$ per Liter.	Gms. $Sr(OH)_2$ per Liter.
Water alone	0.0835	10.16	0.5 *n* Glycol	0.0922	11.21
0.5 *n* Methyl Alcohol	0.0820	9.97	" Glycerol	0.1094	13.31
" Ethyl Alcohol	0.0744	9.05	" Mannitol	0.1996	24.29
" Propyl Alcohol	0.0708	8.61	" Urea	0.0820	9.97
" Amyl Alcohol (tertiary)	0.0630	7.66	" Ammonia	0.0785	9.55
" Acetone	0.0692	8.42	" Dimethylamine	0.0586	7.13
" Ether	0.0645	7.85	" Pyridine	0.0694	8.44

Data for equilibrium in the system strontium hydroxide, phenol and water at 25° are given by van Meurs (1916).

OH

SOLUBILITY OF STRONTIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF CANE SUGAR.

(Sidersky, 1921.)

The mixtures were agitated from time to time during 24 hours. The dissolved strontium hydroxide was determined by titration with 1.0 *n* H Cl, and the sugar by polarization. The determinations were plotted and the following table constructed from the curves.

Wt per cent of Sugar in solution.	Gms SrO per 100 gms sat. sol. at				Gms. $Sr(OH)_2 \cdot 8H_2O$ per 100 gms. sat. sol. a			
	3°.	15°.	25°.	40°	3°.	15°.	25°.	40°.
0.0...	0.39	0.57	0.80	1.48	0.98	1.46	2.05	3.80
1.0...	0.45	0.65	0.90	1.68	1.15	1.67	2.30	4.31
5.0...	0.79	1.03	1.40	2.51	2.03	2.64	3.58	6.47
10.0...	1.21	1.48	2.03	3.55	3.10	3.79	5.20	9.10
15.0...	1.64	1.94	2.66	4.58	4.21	4.97	6.81	11.75
18.0...	1.90	2.21	3.05	5.20	4.89	5.67	7.78	13.33
20.0...	2.08	2.39	3.30	–	5.33	6.13	8.45	–
25.0...	2.51	2.85	3.90	–	6.44	7.31	10.00	–

STRONTIUM HYDROXIDE

EQUILIBRIUM IN THE SYSTEM STRONTIUM HYDROXIDE, SUCROSE AND WATER.

(Klinkenberg, 1929; Reinders and Klinkenberg, 1929.)

Gms. per 100 gms. sat. sol.		Solid Phase
SrO	$C_{12}H_{22}O_{11}$	
Results at 25°		
0.86	0.0	$Sr(OH)_2.8H_2O$
1.58	4.10*	" + 2.1
1.45	3.63	" + 1.1.6
2.27	9.39	$Sr(OH)_2.8H_2O$
3.23	14.3	"
4.50	20.2	"
5.80	25.5	"
6.40	28.1	"
1.33	4.20	1.1.6
1.29	8.19	"
1.38	12.1	"
1.82	23.5	"
0.0	67.89	$C_{12}H_{22}O_{11}$
Results at 35°		
1.23	0.0	$Sr(OH)_2.8H_2O$
1.6	1.9	" + 2.1
1.8	6.7	1.1.6 + "
2.11	4.20*	" + $Sr(OH)_2.8H_2O$
0.0	69.55	$C_{12}H_{22}O_{11}$
Results at 45°		
1.81	0	$Sr(OH)_2.8H_2O$
1.95	0.6	" + 2.1
2.35	14.0	1.1.6 + "
3.0	5.1*	" + $Sr(OH)_2.8H_2O$
4.0	72.0	" + $C_{12}H_{22}O_{11}$
0.0	71.3	$C_{12}H_{22}O_{11}$
1.51	2.50†	1.2
2.42	8.0†	1.1.6
Results at 55°		
2.68	0	$Sr(OH)_2.8H_2O$
3.25	2.16	
Results at 55° (con.)		
3.80	4.09	$Sr(OH)_2.8H_2O$
5.17	8.13	"
2.75	0.32	" + 2.1
1.51	2.56	2.1
2.15	12.7	"
3.57	28.1	"
3.44	11.57	1.1.6
3.26	16.2	"
3.45	24.6	"
3.80	36.9	"
4.42	63.6	"
0.01	73.1	$C_{12}H_{22}O_{11}$
2.57	73.5	"
Results at 75° (1)		
5.78	0.0	$Sr(OH)_2.8H_2O$
5.99	0.2	2.1
4.16	0.13	"
2.27	0.55	"
1.63	3.74	"
1.88	7.72	"
2.38	14.92	"
3.25	23.65	"
4.25	33.35	"
5.60	46.80	"
4.15	31.31	" + 1.1
3.68	32.2	1.1
3.95	44.56	"
3.41	53.69	"
2.94	65.43	"
2.33	75.5	"
2.26	78.63	" + $C_{12}H_{22}O_{11}$
1.06	79.25	$C_{12}H_{22}O_{11}$
0.0	78.58	"

* = Metastable

† = Congruently saturated

2.1 = $2SrO.C_{12}H_{22}O_{11}$; 1.1.6 = $SrO.C_{12}H_{22}O_{11}.6H_2O$; 1.1 = $SrO.C_{12}H_{22}O_{11}$.

(1) Niskizawa and Hackihama, 1929.

The results upon this system by Grube and Nussbaum, 1928, are considered by Reinders and Klinkenberg to be in error.

STRONTIUM PHOSPHATES (Mono) $SrH_4(PO_4)_2$, (Di) Sr_2HPO_4.

EQUILIBRIUM IN THE SYSTEM STRONTIUM OXIDE, PHOSPHORUS PENTOXIDE AND WATER AT 25°.

(Tartar and Lorah, 1929.)

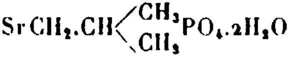
d. of sat. sol.	Gms. per 100 gms. sat. sol. SrO	P_2O_5	Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol. SrO	P_2O_5	Solid Phase
1.687	0.05	61.97	$SrH_4(PO_4)_2$	1.351	9.25	23.58	$SrH_4(PO_4)_2$
1.594	0.13	56.49	"	1.294	7.84	20.79	Sr_2HPO_4
1.527	0.44	51.07	"	1.278	7.52	19.81	"
1.455	1.78	43.80	"	1.230	6.53	16.66	"
1.418	3.24	38.73	"	1.194	6.32	13.41	"
1.410	4.61	35.90	"	1.169	5.11	12.70	"
1.394	6.52	31.65	"	1.112	4.13	7.80	"
1.379	8.08	27.63	"	1.083	3.18	6.02	"
1.360	8.42	25.92	"	1.074	2.67	5.68	"
1.357	8.88	24.71	"				

STRONTIUM Methyl, Ethyl, etc. PHOSPHATES.

PO

SOLUBILITY OF EACH SEPARATELY IN WATER. (Bailly, 1919.)

Constant agitation was not employed for securing saturation. The solutions were analyzed by evaporating to dryness and weighing the residues.

	Compound		Formula	t°.	Gms hydrated cmpd. per 100 gms. sat. sol.
Strontium	Methyl	Phosphate	$SrCH_3PO_4.H_2O$	14	1.24
"	"	"	"	50	0.75
"	"	"	"	100	0.38
"	"	" (Acid Salt)	$Sr[CH_3HPO_4]_2.H_2O$	17	27.15
"	Ethyl	"	$Sr.C_2H_5PO_4.2H_2O$	20	1.29
"	Propyl	"	$Sr.C_3H_7PO_4.2H_2O$	18.5	1.96
"	Allyl	"	$Sr.CH_2CH:CH_2PO_4.H_2O$	20	1.80
"	Iso propyl	"	 $SrCH\langle{}^{CH_3}_{CH_3}PO_4.2H_2O$	20	0.40
"	Iso butyl	"	 $SrCH_2.CH\langle{}^{CH_3}_{CH_3}PO_4.2H_2O$	18	0.89

STRONTIUM Glycero PHOSPHATES.

SOLUBILITY OF EACH SEPARATELY IN WATER. (Bailly, 1916, Bailly and Gaumé, 1924.)

	Compound			Formula.	t°.	Gms. anhy cmpd. per 100 gms. sat. sol
Strontium	α glycerophosphate	(cryst.)		$Sr(C_3H_5)(OH)_2PO_4$	16....	1.73
"	β	"	"	$Sr(C_3H_5)(OH)_2PO_4.2H_2O$	17....	2.31
"	neutral	"		$SrC_3H_5(OH).PO_4H_2O$	16....	1.28
"	"	"		"	55....	0.58

100 gms. H_2O dissolve 2.69 gms. anhydrous strontium neutral glycerophosphate at 18°. (H. Rogier, *These*, Paris, 1912.)

100 gms. sat. solution of $Sr(C_3H_5)(OH)_2PO_4.2H_2O$ in water contain 2.09 gm. $Sr(C_3H_5)(OH)_2PO_4$ at 18° and 0.8 gm. at 65°. (Rogier and Fiore, 1913.)

STRONTIUM SULFATE $SrSO_4$.

One liter of water dissolves 0.1133 gm. $SrSO_4$ at 2.85°, 0.1143 gm. at 17.4° and 0.1143 gm. at 32.3°, determined by the conductivity method. (Kohlrausch, 1908.)

Using the "Polarographic" method (see remarks under Barium Carbonate) Heyrovsky and Berezicky, 1929, found the solubility of Strontium Sulfate in water and dilute aqueous HCl to be:

Normality of aq. HCl	Gm. Equiv. $SrSO_4$ dissolved per liter
0.0 (= H_2O)	0.0015
0.001	0.0011
0.01	0.0018

Solubility of Precipitated Strontium Sulfate and of Calcined "Celestina" (96.67% $SrSO_4$) in Water.

(Gallo, 1935.)

SO

t°	Gms. $SrSO_4$ per 100 cc sat. sol. Solid Phase Pptd. $SrSO_4$	Gms. $SrSO_4$ per 100 cc sat. sol. Solid Phase "Celestina"	t°	Gms. $SrSO_4$ per 100 cc sat. sol. Solid Phase Pptd. $SrSO_4$	Gms. $SrSO_4$ per 100 cc sat. sol. Solid Phase "Celestina"
5	0.0121	0.0119	60	0.0131	0.0125
10	0.0129	0.0123	70	0.0123	0.0119
20	0.0132	0.0132	80	0.0116	0.0111
30	0.0138	0.0136	90	0.0115	0.0107
40	0.0141	0.0136	95	0.0113	0.0108
50	0.0135	0.0128			

Solubility of Precipitated Strontium Sulfate and of "Celestina" in Aqueous Solutions of Ammonium Sulfate at 25°.

(Gallo, 1936.)

Gms. $(NH_4)_2SO_4$ per 100 gms. aqueous solvent	Gms. $SrSO_4$ per 100 cc sat. sol. Solid Phase Pptd. SrSO cc	Gms. $SrSO_4$ per 100 cc sat. sol. Solid Phase "Celestina"
2.9	0.0100	0.0097
8.5	0.0082	0.0079
15.0	0.0074	0.0074

Solubility of Strontium Sulfate in Aqueous Salt Solutions.

(Gallo. 1936.)

Solvent, Aqueous 10% solution of:	Gms. $SrSO_4$ per 100 cc sat. sol. at: 20°	Gms. $SrSO_4$ per 100 cc sat. sol. at: 98°
$CaCl_2$	0.0313	0.0358
NH_4Cl	0.0639	0.0690
NH_4NO_3	0.0701	0.0809
NaCl	0.0630	0.0691
$NaNO_3$	0.0703	0.0842

SOLUBILITY OF STRONTIUM SULFATE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC, NITRIC, CHLORACETIC AND FORMIC ACIDS.

(Banthisch, 1884.)

cc. of Aq. Acid containing 1 Mg. Equiv. in each case.	In Aq. HCl Gms. per 100 cc. Sol.		In Aq. HNO_3 Gms. per 100 cc. Sol.		In Aq. $CH_2ClCOOH$ Gms. per 100 cc. Sol.		In Aq. HCOOH Gms. per 100 cc. Sol.	
	HCl.	$SrSO_4$.	HNO_3.	$SrSO_4$.	CH_2Cl COOH.	$SrSO_4$.	HCOOH.	$SrSO_4$.
0.2	18.23	0.161	31.52	0.381	...	...	...	...
0.5	7.29	0.207	12.61	0.307	...	...	...	...
1.0	3.65	0.188	6.30	0.217	94.47	0.026	46.02	0.024
2.0	1.82	0.126	3.15	0.138	47.23	0.022	...	...
10.0	0.36	0.048	0.63	0.049	...	...	...	...

100 gms. 95 per cent formic acid dissolve 0.02 gm. $SrSO_4$ at 18.5°. (Aschan, 1913).

SOLUBILITY OF STRONTIUM SULFATE IN SULFURIC ACID SOLUTIONS.

t°.	Conc. of H_2SO_4.	Gms. $SrSO_4$ per 100 Gms. Acid.	Authority.
ord.	concentrated	5.68	(Sturve, 1870.)
"	fuming	9.77	"
"	91%	0.08	(Varenne and Pauleau, 1881.)
70	Sp. Gr. 1.843=99%	14	(Garside, 1875.)
ord.	Absolute H_2SO_4	21.7*	(Bergius, 1910.)

* per 100 cc. Sat. Sol.

SOLUBILITY OF STRONTIUM SULFATE IN AQUEOUS SALT SOLUTIONS.

(Virck, 1862.)

SO

In Aq. NaCl.		In Aq. KCl.		In Aq. $MgCl_2$.		In Aq. $CaCl_2$.	
(a.)	(b.)	(a.)	(b.)	(a.)	(b.)	(a.)	(b.)
8.44	0.165	8.22	0.193	1.59	0.199	8.67	0.176
15.54	0.219	12.54	0.193	4.03	0.206	16.51	0.185
22.17	0.181	18.08	0.251	13.63	0.242	33.70	0.171

(*a*) = Gms. salt per 100 gms. aq. solution. (*b*) = Gms. $SrSO_4$ per 100 gms. solvent.

SOLUBILITY OF STRONTIUM SULFATE IN AQUEOUS SOLUTIONS OF AMMONIUM ACETATE AT 25°.

(Marden, 1916.)

Gms. per 100 Gms. Sat. Sol.		Gms. per 100 Gms. Sat. Sol.	
CH_3COONH_4.	$SrSO_4$.	CH_3COONH_4.	$SrSO_4$.
0	0.0151	10.68	0.0942
2.13	0.0451	21.37	0.115
5.34	0.0732		

SOLUBILITY OF STRONTIUM SULFATE IN AQUEOUS CALCIUM NITRATE AT ROOM TEMPERATURE

(Raffo and Rossi, 1915.)

Analyzed solutions of $Sr(NO_3)_2$, $Ca(NO_3)_2$ and $CaSO_4$ were mixed at 60° and allowed to stand at room temperature 1 to 2 days. The resulting $SrSO_4$ was determined and the difference between the amount found and the amount which would have resulted if all the $Sr(NO_3)_2$ had been converted to $SrSO_4$, was taken as the amount of $SrSO_4$ dissolved. Gradually increasing concentrations of $Ca(NO_3)_2$ were used.

Gms. per 100 cc. Sat. Sol.		Gms. per 100 cc. Sat. Sol.	
$Ca(NO_3)_2$.	$SrSO_4$.	$Ca(NO_3)_2$.	$SrSO_4$.
0.5	0.0483	4	0.1489
1	0.0619	5	0.1698
2	0.1081	6	0.1955
3	0.1275		

SOLUBILITY OF STRONTIUM SULFATE IN AQUEOUS SODIUM CARBONATE AT 25°.

(Herz, 1910.)

Freshly prepared and dried $SrSO_4$ was shaken 5 days with aqueous sodium carbonate solutions and the supernatant clear solutions analyzed.

Normality of Aqueous Na_2CO_3 $\left(\frac{Na_2CO_3}{2}\right)$.	Gm. Mols. per Liter Sat. Sol. $\frac{Na_2CO_3}{2}$.	Gm. Mols. per Liter Sat. Sol. $\frac{Na_2SO_4}{2}$.
0.6025	0.0382	0.5643
1.205	0.076	1.129
2.41	0.153	2.257

STRONTIUM SULFATE $SrSO_4$.

SOLUBILITY OF STRONTIUM SULFATE IN AQUEOUS SOLVENTS AT 19°.

(Kolthoff and Vogelenzang, 1919.)

Solvent.	Gms. $SrSO_4$ per liter.
Aq. 25 % Ethyl alcohol	0.019
» 50 % » »	0.000
» 50 % » » + 0.1 n HCl	0.120
» 50 % » » + 0.1 n NH_4Cl	0.040

SO STRONTIUM THIOSULFATE $SrS_2O_3.5H_2O$.

SOLUBILITY OF STRONTIUM THIO SULFATE IN WATER.

(Portillo, 1929.)

t°	Gms. SrS_2O_3 per 100 gms. sat. sol.	Solid Phase
0	8.78	$SrS_2O_3.5H_2O$
12.8	13.82	"
27.5	21.10	"
40.0	26.80	"

100 gms. of a saturated solution of strontium thiosulfate in a solvent composed equal volumes of water and acetone contain 0.35 gm. SrS_2O_3 at 18°.5. (Leo, 1923.)

STRONTIUM Di THIONATE $SrS_2O_6.4H_2O$.

100 gms. sat. solution of strontium dithionate in water contain 4.51 gms. SrS_2O_6 at 0°, 7.37 gms. at 10°, 10.8 gms. at 20° and 14.9 gms. at 30°. (de Baat, 1926.)

SOLUBILITY OF STRONTIUM DITHIONATE IN AQUEOUS ETHYL ALCOHOL AT 30°.

(de Baat, 1926.)

Gms. per 100 gms. sat. sol. SrS_2O_6.	Gms. per 100 gms. sat. sol. C_2H_5OH.	Solid Phase.	Gms. per 100 gms. sat. sol. SrS_2O_6.	Gms. per 100 gms. sat. sol. C_2H_5OH	Solid Phase.
14.90	0.0	$SrS_2O_6.4H_2O$	0.08	60.39	$SrS_2O_6.4H_2O$
5.40	14.48	»	0.0012	76.13	»
0.68	37.22	»	0.000	98.53	»

STRONTIUM Tetra THIONATE $SrS_4O_6.6H_2O$.

SOLUBILITY OF STRONTIUM TETRA THIONATE IN WATER.
(Portillo, 1929.)

t^0	Gms. SrS_4O_6 per 100 gms. sat. sol.	Solid Phase
0	19.91	$SrS_4O_6.6H_2O$
12.9	26.33	"
30.0	38.98	"

STRONTIUM (Di) TUNGSTATE $SrW_2O_7.3H_2O$.

100 cc. H_2O dissolve 0.35 gm. at 15°. (Lefort, 1878.)

TANTALUM Potassium FLUORIDE TaK_2F_7.

SOLUBILITY IN AQUEOUS HYDROFLUORIC AND POTASSIUM FLUORIDE SOLUTIONS.
(Ruff and Schiller, 1911.)

The tantalum salt was purified by repeated crystallizations from pure anhydrous HF . After drying at 120°, it was shaken in platinum flasks for 3 hour periods at constant temperature with HF or KF solutions or both together. The saturated solutions were filtered by means of a platinum funnel and subjected to analysis.

F

Mixture Shaken in Pt. Flask.	t°.	Gms. per 100 Gms. Sat. Sol.			Solid Phase.
		TaF_5.	KF.	HF.	
$K_2TaF_7+H_2O$	18	0.25	0.12	0.029	$K_2Ta_2O_2F_6+K_2TaF$
" +aq. 4.77%KF	18	0.10	4.79	0.074	"
" +aq. 7.35% KF	16	0.09	6.73	0.015	"
" +aq. 4.47% HF	18	1.33	0.56	4.47	K_2TaF_7
" +aq. 4.2 %HF	18.5	1.24	0.52	4.2	"
" +aq. 24.3%HF	18	5.35	2.25	24.3	"
" +aq. 10.44% HF+ 21.92% KF	18	0.036	21.93	10.44	"
" $+H_2O$	85	2.18	1.69	0.85	$K_2Ta_2O_2F_6+K_2TaF_7$
" +aq. 4.77% KF	85	0.96	5.27	1.17	"
" +aq. 4.47% HF	90	5.73	2.41	4.47	K_2TaF_7
" +aq. 4.2% HF	90	6	2.52	4.2	"
" +aq. 23.3% HF	90	10.9	4.59	24.3	"
" +aq. 21.92% KF+ 10.44% HF	90	1.18	22.42	10.44	"

The solid phases were identified only by their crystal forms and it is possible that still others may be present.

TERBIUM BROMATE $Tb(BrO_3)_3.9H_2O$.

SOLUBILITY OF TERBIUM BROMATE IN WATER.
(James et. al., 1927.)

t^0	Gms. per 100 gms. sat. sol.		Solid Phase	t^0	Gms. per 100 gms. sat. sol.		Solid Phase
	$Tb(BrO_3)_3.9H_2O$	$Tb(BrO_3)_3$			$Tb(BrO_3)_3.9H_2O$	$Tb(BrO_3)_3$	
0	39.91	30.73	$Tb(BrO_3)_3.9H_2O$	25	57.11	43.97	$Tb(BrO_3)_3.9H_2O$
5	43.61	33.58	"	30	60.29	46.42	"
10	47.28	36.41	"	35	63.35	48.78	"
15	50.59	38.95	"	40	66.45	51.17	"
20	53.93	41.53	"	45	69.44	53.47	"

TERBIUM Di methyl **PHOSPHATE** $Tb[(CH_3)_2PO_4]_2$.

SOLUBILITY OF TERBIUM DIMETHYL PHOSPHATE IN WATER.
(Marsh, 1939.)

t°	Gms. $Tb[(CH_3)_2PO_4]_2$ per 100 gms. H_2O	Solid Phase
0	24.2	$Tb[(CH_3)_2PO_4]_2$
25	12.6	"
50	8.07	"

TERBIUM SULFATE $Tb_2(SO_4)_3.8H_2O$.

SO 100 gms. H_2O dissolve 3.561 gms. $Tb_2(SO_4)_3.8H_2O$ at 20° and 2.51 gms. at 40°. (Jackson and Riennacker, 1930.)

TELLURIUM Te.

100 gms. methylene iodide, CH_2I_2, dissolve 0.1 gm. Te at 12°. (Retgers, 1893)

DISTRIBUTION OF TELLURIUM BETWEEN AQUEOUS HYDROCHLORIC ACID AND ETHER AT ROOM TEMPERATURE.
(Mylius, 1911.)

When 1 gm. of tellurium as the chloride, $TeCl_4$, is dissolved in 100 cc. of aqueous HCl and shaken with 100 cc. of ether, the following per cents of the metal enter the ethereal layers. With 20% HCl, 34 per cent; 15% HCl, 12 per cent; 10% HCl, 3 per cent; 5% HCl, 0.2 per cent and with 1% HCl, only a trace of the tellurium.

Fusion-point curves for mixtures of tellurium and each of the following metals are given by Pelabon (1909): Sb, Sn, Pb, Ag, Au and As. Results for mixtures of Te and Zn are given by Kobayashi (1911–12).

Results for mixtures of Te + Br and Te + I are given by Damiens, 1920, 1921.

TELLURIC ACID $H_2TeO_4.2H_2O$.

SOLUBILITY IN WATER.
(Mylius, 1901.)

t°.	Gms. H_2TeO_4 per 100 Gms. Sol.	Mols. H_2TeO_4 per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. H_2TeO_4 per 100 Gms. Sol.	Mols. H_2TeO_4 per 100 Mols. H_2O.	Solid Phase.
0	13.92	1.51	$H_2TeO_4.6H_2O$	30	33.36	4.67	$H_2TeO_4.2H_2O$
5	17.84	2.03	"	40	36.38	5.33	"
10	26.21	3.31	"	60	43.67	7.04	"
15	32.79	4.55	"	80	51.55	9.93	"
10	25.29	3.15	$H_2TeO_4.2H_2O$	100	60.84	14.52	"
18	28.90	3.82	"	110	67	19	"

TELLURIUM DOUBLE SALTS

SOLUBILITY OF TELLURIUM DOUBLE BROMIDES AND CHLORIDES IN AQUEOUS HYDROCHLORIC AND HYDROBROMIC ACIDS AT 22°.
(Wheeler, 1893a.)

Tellurium Double Salt.	Formula.	Solvent.	Gms. Double Salt per 100 Gms. Solvent of 1.40 Sp. Gr.	Gms. Double Salt per 100 Gms. Solvent of 1.08 Sp. Gr.
Te Caesium Bromide	$TeBr_4.2CsBr$	Aq. HBr	0.02	0.13
Te Potassium Bromide	$TeBr_4.2KBr$	"	6.57	52.90
Te Rubidium Bromide	$TeBr_4.2RbBr$	"	0.25	3.88
Te Caesium Chloride	$TeCl_4.2CsCl$	Aq. HCl*	0.05	0.78
Te Rubidium Chloride	$TeCl_4.2RbCl$	"	0.34	13.09

* Sp. Gr. of Aq. HCl solutions 1.2 and 1.05 respectively.

TELLURIUM TetraIODIDE TeI_4.

SOLUBILITY IN MIXTURES OF AQUEOUS HYDRIODIC ACID AND IODINE AT 25°.

(Menke, 1912.)

Weighed amounts of TeI_4 + I + 65 wt. % HI solution were shaken in sealed glass tubes for 10 days. Both the clear saturated solution and the solid phase were analyzed.

Composition of Original Mixture in Gms.			Gms. per 100 Gms. Solution.		Solid Phase.
TeI_4.	I.	64% HI.	TeI_4.	I.	
3	1.5	19.25	12	11.7	Small amt. $TeI_4.HI.8H_2O$
2	0.5	9.61	13	0	much "
2	0.5	9.61	13.5	8.2	" "
3	3	8.99	20	21.8	small amt. "
Excess	None	5 (cc.)	9	0.19	$TeI_4.HI.8H_2O$
2	9	9.10	10	52.4	Iodine
4	10	9.27	15	47.7	"
3	7	9.02	17.5	47.9	"
None	Excess	5 (cc.)	None	61.1	"

TELLURIUM OXIDE TeO_2.

SOLUBILITY OF TELLURIUM OXIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 18°. (Kasarnawsky, 1924.)

The determinations were made by the conductivity method.

Mols. HCl per liter.	Mols. TeO_2 per liter.	Solid Phase.	Mols. HCl per liter	Mols. TeO_2 per liter.	Solid Phase.
0.10	$0.57.10^{-3}$	TeO_2	0.46	$3.70.10^{-3}$	TeO_2
0.22	1.20 "	"	0.92	9.10 "	"

SOLUBILITY OF TELLURIUM DIOXIDE IN AQUEOUS SOLUTIONS OF HYDROBROMIC AND OF HYDROCHLORIC ACIDS AT 12°.

(Parker and Robinson, 1931.)

Results for Aq. HBr				Results for Aq. HCl			
Gm. Mols. per liter		Gm. Mols. per liter		Gm. Mols. per liter		Gm. Mols. per liter	
TeO_2	HBr	TeO_2	HBr	TeO_2	hBr	TeO_2	HBr
0.0199	0.735	0.471	3.140	0.019	0.83	1.86	7.34
0.070	1.115	0.569	3.496	0.14	1.70	2.42	8.22
0.103	1.396	0.852	5.082	0.52	4.69	3.42	12.38
0.144	1.719	1.137	6.320	0.82	6.80	4.53	16.65
0.265	2.298	1.667	9.170	1.30	6.30	3.13	15.07

In the case of the aq. HBr solutions the solid phase showed a progressive increase in Br content but did not reach that required for tellurium tetra bromide. The course of the reaction with HBr is different from that with HCl.

SOLUBILITY OF TELLURIUM DIOXIDE IN AQUEOUS SOLUTIONS OF HYDROFLUORIC ACID AT 10°.

(Prideaux and Millott, 1929.)

Gms. per 100 gms. sat. sol. HF	Gms. per 100 gms. sat. sol. TeO_2	Solid Phase	Gms. per 100 gms. sat. sol. HF	Gms. per 100 gms. sat. sol. TeO_2	Solid Phase
0.22	0.12	TeO_2	15	42	TeO_2
2.5	5.0	"	17.5	52.5	"
5.0	10.0	"	20.0	65	"
7.5	16.0	"	24	42.6	$TeF_4.TeO_2.2H_2O$
10.0	22.5	"	26.4	45.7	" + $TeF_4.TeO_2.H_2O$
12.5	30.0	"	28.5	58.0	$TeF_4.TeO_2.H_2O$

The authors' quite irregular results for solutions in contact with TeO_2 were plotted and the above values taken from the average curve drawn through them.

α Di Methyl TELLURONIUM Di IODIDE $Te(CH_3)_2I_2$.

I

SOLUBILITY OF α DI METHYL TELLURONIUM DI IODIDE IN SEVERAL SOLVENTS AT 25°.

(Lowry and Gilbert, 1929.)

Solvent	Gms. $Te(CH_3)_2I_2$ per 100 cc solvent	Solvent	Gms. $Te(CH_3)_2I_2$ per 100 cc solvent
Acetone	9.97	Ethyl Alcohol	2.18
Benzene	7.09	Carbon Tetrachloride	0.58
Chloroform	5.51	Cyclo Hexane	0.10
Acetonitrile	5.21		

THORIUM EMANATIONS.

Data for the solubility of thorium emanations are given by Klaus (1905).

THORIUM Th

The solubility of Thorium in Mercury was found by ParKS and Prime, 1936, to be 0.0154 weight percent (= 0.0136 atomic percent) at 25°.

THORIUM BORATE.

The precipitate which results when thorium nitrate is added to a solution of borax is not a stable compound. Solubility determinations made by four successive extractions of it at 18° with water, gave the following gms. of material per 100 gms. H_2O; 0.5366, 0.1250, 0.0611 and 0.0560. After the fourth extraction, the residue then contained 10.14% B_2O_3 and after boiling 10 gms. with 100 cc. of H_2O for 6 hrs. and repeating this four times, it contained 9.63–9.81% B_2O_3. (Karl, 1910.)

THORIUM Chloro**ACETATES.**

SOLUBILITY IN WATER AT 25°. (Karl, 1910.)

Name of Salt.	Formula.	Gms. Salt per 100 Gms. H_2O.
Basic Thorium Monochloroacetate	$(ClCH_2COO)_2Th(OH)_2.H_2O$	0.0663
Basic Thorium Dichloroacetate	$(Cl_2CHCOO)_2Th(OH)_2$	0.0887
Basic Thorium Trichloroacetate	$(Cl_3C.COO)_2Th(OH)_2$	0.0091

THORIUM *m* Nitrobenzene **SULFONATE** $Th(C_6H_4.NO_2.SO_3)_4.7H_2O$.

100 gms. H_2O dissolve 61 gms. of the anhydrous salt at 15°. (Holmberg, 1907.)

THORIUM PICRATE $Th(C_6H_2N_3O_7)_4.10H_2O$.

100 gms. H_2O dissolve 0.3052 gm. of the salt at 25°. (Karl, 1910.)

THORIUM HIPPURATE $Th(C_6H_5.CO.CH_2.NH.COO)_4$.

100 gms. H_2O dissolve 0.0318 gm. of the salt at 25°. (Karl, 1910.)

THORIUM OXALATE $Th(C_2O_4)_2.6H_2O$.

SOLUBILITY OF THORIUM OXALATE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID.

Results at 17°. (Colani, 1913.) Gms. per 100 Gms. Sat. Sol.		Results at 25°. (Hauser and Wirth, 1912.)			Results at 50°. (Colani, 1913.) Gms. per 100 Gms. Sat. Sol.	
HCl.	$Th(C_2O_4)_2$.	Conc. of Aq. HCl in Per cent.	Gm. ThO_2 per 1000 Gms. Sat. Sol.	Solid Phase.	HCl.	$Th(C_2O_4)_2$.
0	0.0017	24.8	0.100	$3Th(C_2O_4)_2ThCl_4.2H_2O$	0	0.0017
1.2	0.0035	37	3.450	"	4.1	0.010
3.6	0.0061	37.6	3.492	"	8.4	0.028
4.6	0.0094				12.4	0.057
8.4	0.017				16.1	0.103
13.1	0.028				18	0.134
16.2	0.038				19.9	0.169
19.8	0.064				21.6	0.232

Data are also given for the solubility of thorium oxalate in aqueous solutions of mixtures of hydrochloric and oxalic acids at the above temperatures.

SOLUBILITY OF THORIUM OXALATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°.

(Hauser and Wirth, 1909a, 1912; Wirth, 1912.)

Normality of Aq. H_2SO_4.	Gms. ThO_2 per 1000 Gms. Sat. Sol.	Solid Phase.	Normality of Aq. H_2SO_4.	Gms. ThO_2 per 1000 Gms. Sat. Sol.	Solid Phase.
0.25	0.07	$Th(C_2O_4)_2.6H_2O$	4.32	1.10	$Th(C_2O_4)_2.6H_2O$
0.5	0.14	"	4.9	1.32	"
1	0.26	"	6.175	1.513	"
2.1	0.418	"	6.885	1.794	"
3.2	0.71	"	8.45	2.473	"

SOLUBILITY OF THORIUM OXALATE AT 25° IN AQUEOUS SOLUTIONS OF :

(Spitzer, 1917.)

Sulfuric Acid.				Hydrochloric Acid.		Nitric Acid.	
Normality of Aq. H_2SO_4.	Gm. ThO_2 per liter.	Normality of Aq. H_2SO_4.	Gm. ThO_2 per liter.	Normality of Aq. HCl.	Gm. ThO_2 per liter.	Normality of Aq. HNO_3.	Gm. ThO_2 per liter.
0.007	0.0008	0.49	0.053	0.04	0.0006	0.016	0.0003
0.02	0.0020	0.50	0.055	0.09	0.0017	0.06	0.0013
0.03	0.0030	0.58	0.060	0.23	0.0047	0.24	0.0045
0.06	0.0069	0.90	0.090	0.38	0.0070	0.47	0.0101
0.10	0.0120	0.98	0.108	0.48	0.0085	0.50	0.0110
0.20	0.0180	(1.00)	(0.120)	0.50	0.012	0.78	0.0144
0.40	0.0430	1.18	0.120	0.64	0.016	1.00	0.0330
0.48	0.0460			0.82	0.021		
				1.00	0.024		

The thorium oxalate was prepared from thorium nitrate by precipitation in a hot solution of oxalic acid and washing with hot water.

SOLUBILITY OF THORIUM OXALATE AT 25° IN AQUEOUS SOLUTIONS OF SULFURIC ACID SATURATED WITH CERIUM OXALATE $(Ce_2(C_2O_4)_3.10H_2O)$. (Spitzer, 1917.)

Normality of Aq. H_2SO_4.	Gm. ThO_2 per liter.	Normality of Aq. H_2SO_4.	Gm. ThO_2 per liter.
0.014	0.0009	0.47	0.015
0.050	0.0030	0.63	0.019
0.100	0.0040	0.90	0.043

SOLUBILITY OF THORIUM OXALATE IN AQUEOUS SOLUTIONS OF AMMONIUM OXALATE AT 25°.

(Hauser and Wirth, 1909, 1912.)

Gm. Mols. per 1000 Gms. Sat. Sol.		Solid Phase.	Normality of Aq. $(NH_4)_2C_2O_4$	Gms. ThO_2 per 1000 Gms. Sat. Sol.	Solid Phase.
$(NH_4)_2C_2O_4$.	$Th(C_2O_4)_2$.				
0.00033	0.00005	$Th(C_2O_4)_2.6H_2O$	0.01	0.040	$Th(C_2O_4)_2.6H_2O$
0.00072	0.00012	"	0.10	2.203	"
0.00120	0.000208	"	0.5*	7.660	$[Th_2(C_2O_4)_5](NH_4)_2.7H_2O$
0.00153	0.00026	"	0.5*	10.63	"
0.601†	0.195	$[Th(C_2O_4)_3](NH_4)_2.3H_2O$	0.5*	15.90	"
1.181†	0.427	"	0.5*	17.60	"
1.420†	0.540	"	0.5*	17.75	"
1.480†	0.563	"			

COO

* In these cases the greater part of the ammonium salt entered the solid phase complex and it was, therefore, necessary to add additional ammonium oxalate until constant results were obtained.

† In these cases the solvent was saturated ammonium oxalate solutions containing an excess of the crystals.

A thorium ammonium oxalate of the composition $Th(C_2O_4.NH_4)_4.4H_2O$ is described by Brauner (1898). It is partially hydrolytically decomposed in aqueous solution and a solubility determination made by analyzing the solution from which the nearly pure salt began to crystallize, showed that 100 gms. H_2O contain 90.3 gms. $Th(C_2O_4.NH_4)_4.4H_2O$ and 9.3 gms. of $(NH_4)_2C_2O_4$ (= an additional ½ mol. wt.)

SOLUBILITY OF THORIUM OXALATE IN AQUEOUS SOLUTIONS OF AMMONIUM OXALATE AT 25°. (Spitzen, 1917.)

Constant mechanical shaking was employed. In the case of dilute solutions two liters of solvent were used and for the more concentrated, 100 to 200 cc. A period of six hours shaking was found to be sufficient.

Gm. mols. $(NH_4)_2C_2O_4$ per liter.	Gm. ThO_2 per liter.	Gm. mols. $(NH_4)_2C_2O_4$ per liter.	Gm. ThO_2 per liter.	Gm. mols. $(NH_4)_2C_2O_4$ per liter.	Gm. ThO_2 per liter.
0.00(= water)	0.00007	0.0075	0.070	0.0300	0.600
0.0006	0.0023	0.0100	0.100	(0.0410)	(0.410)
0.0010	0.0040	0.0150	0.180	0.0500	1.000
0.0025	0.010	0.0200	0.340	(0.0900)	(5.550)
0.0050	0.040	0.0250	0.450		

SOLUBILITY OF THORIUM OXALATE IN VARIOUS AQUEOUS SOLUTIONS AT 25°.

(Spitzen, 1917.)

Aq solvent.	Gm. ThO_2 per liter	Aq solvent.	Gm. ThO_2 per liter.	Aq. solvent.	Gm. ThO_2 per liter.
0.1 *n* NH_4Cl . . .	0.0003	0.5 *n* HBr	0.0115	0.5 *n* $C_4H_6O_6$ . .	0.0040
0.1 *n* $(NH_4)_2SO_4$.	0.0010	0.5 *n* HI	0.0112	0.5 *n* CCl_3COOH . .	0.0120
0.1 *n* $NaCl$	0.0002	0.5 *n* H_2CrO_4 . . .	0.0110	0.5 *n* $KHSO_4$ . . .	0.0300
0.1 *n* Na_2SO_4 . . .	0.0006	0.5 *n* $HClO_4$	0.0130	1.0 *n* » . .	0.0770
		0.5 *n* H_3BO_3 . . .	0.0001		

Solubility of Thorium Chlorooxalate, $3Th(C_2O_4)_2ThCl_4.2H_2O$, in Aqueous Hydrochloric Acid.

(Colani, 1913.)

t°.	Gms. per 100 Gms. Sat. Sol.		t°.	Gms. per 100 Gms. Sat. Sol.	
	HCl.	$Th_4(C_2O_4)_6Cl_4$.		HCl.	$Th_4(C_2O_4)_6Cl_4$.
12	23	0.12	50	21.2	0.29
15	26.3	0.17	50	23	0.34
12	29.9	0.27	50	26.8	0.46
15	32.5	0.48	50	29.8	0.75
12	33.1	0.53	50	32.3	1.51
15	35	1.03	50	34.6	2.59

Results are also given showing the effect of oxalic acid upon the solubility of the above salt in aqueous hydrochloric acid.

Solubility of Thorium Oxalate in Aqueous Oxalic Acid Solutions.

Results at 25°.

(Hauser and Wirth, 1912.)

Normality of Aq. $H_2C_2O_4$.	Gm. ThO_2 per 1000 Gms. Sat. Sol.	Solid Phase.
1	0.0015	$Th(C_2O_4)_2.6H_2O$
Sat. Solution	0.0030	" $+H_2C_2O_4.2H_2O$

Results at 50°.

(Colani, 1913.)

Gms. per 100 Gms. Sat. Sol.	
$H_2C_2O_4$.	Th.
1.7	0.0002
9.3	0.001
93	0.003

THORIUM Hexa Antipyrine Per **CHLORATE** $[Th(COC_{10}H_{12}N_2)_6](ClO_4)_4$. ClO

100 cc sat. solution of Thorium Hexa Antipyrine Per Chlorate in Water contain 0.6 gm. $[Th(COC_{10}H_{12}N_2)_6](ClO_4)_4$ at 20°. (Wilke-Dörfurt and Schliephake, 1929.)

THORIUM CHROMATE $Th(CrO_4)_2.3H_2O$.

Equilibrium in the System Thorium Oxide, Chromic Anhydride and Water at 25°. (Britton, 1923.)

The solutions were saturated by constant stirring in a thermostat. The solid phases were identified by analysis according to the « rest method ».

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
ThO_2.	CrO_3.	Solid Phase.	ThO_2.	CrO_3.	Solid Phase.
0.044	0.033	$Th(CrO_4)_2.3H_2O$	23.04	40.23	$Th(CrO_4)_2.CrO_3.3H_2O$
0.452	1.376	»	21.59	41 56	»
3.09	4.58	»	17 08	44.20	»
3.08	7.15	»	7.91	52.60	»
6.52	13.09	»	7.52	56.79	»
11.27	21.75	»	9.09	57.57	»
15.62	28.00	»	17.65	61.38	» + CrO_3
22 87	37.27	»	6.27	61.84	CrO_3
23.25	37.45	»	0.0	62.87	»
24.22	39.49	» $+Th(CrO_4)_2.CrO_3.3H_2O$			

THORIUM FLUORIDE $ThF_4.4H_2O$. F

1000 cc. sat. solution of thorium fluoride in water contain 0.17 gm. ThO_2 at 25°. (Spitzen, 1917.)

THORIUM Potassium FLUORIDE $ThK_2F_6.4H_2O$.

1000 cc. sat. sol. of thorium potassium fluoride in water contain 0.4 gm. ThO_2 at 25°. (Spitzen, 1917.)

THORIUM NITRATE

EQUILIBRIUM IN THE SYSTEM THORIUM NITRATE, ETHYL ETHER AND WATER AT 0° AND AT 20°.

(Misciattelli, 1929.)

Two liquid layers are formed at concentration of ether greater than about 4 percent of the saturated solution at 0° and 2 percent at 20°.

NO

H_2O rich layer			$(C_2H_5)_2O$ rich layer			
Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.			Solid
$(C_2H_5)_2O$	H_2O	$Th(NO_3)_4$	$(C_2H_5)_2O$	H_2O	$Th(NO_3)_4$	Phase
Results at 0°						
0.0	35.0	65.0	—	—	—	$Th(NO_3)_4.6H_2O$
4.5	28.5	67.0	41.36	13.99	44.65	$Th(NO_3)_4.H_2O$
5.21	28.89	65.90	41.27	12.78	45.95	"
—	—	—	54.50	10.50	35.0	"
—	—	—	94.2	—	5.8	$Tl(NO_3)_4$
5.0	36.50	58.50	70.0	7.0	23.0	None
4.84	46.26	48.90	87.50	4.50	8.0	"
4.99	52.63	42.40	96.08	3.33	0.33	"
4.42	54.39	41.09	98.42	1.45	0.08	"
4.53	62.35	33.10	99.56	0.41	0.02	"
4.39	72.33	23.28	99.49	0.49	0.02	"
8.3	79.66	12.09	99.92	0.07	0.01	"
11.6	88.4	—	99.0	1.0	—	"
Results at 20°						
0.0	35.0	65.00	—	—	—	$Th(NO_3)_4.6H_2O$
1.92	32.50	65.52	54.10	8.40	37.50	$Th(NO_3)_4.H_2O$
—	—	—	62.47	7.33	30.3	"
—	—	—	72.5	5.0	22.5	"
—	—	—	88.58	2.19	9.22	$Th(NO_3)_4$
—	—	—	92.54	0.50	6.96	"
—	—	—	88.01	—	1.9	"
2.08	37.62	60.30	66.90	7.0	26.10	None
1.90	43.0	55,00	89.20	3.3	7.50	"
2.08	51.2	46.82	99.00	1.00	0.0	"
2.50	51.60	45.90	98.50	1.50	0.0	"
2.00	57.49	40.51	98.00	2.00	0.0	"
2.27	62.22	35.51	98.20	1.80	0.0	"
2.04	65.00	32.18	98.33	1.67	0.0	"
3.90	71.52	20.58	98.08	1.92	0.0	"
6.5	93.52	—	99.0	1.0	0.0	"

Experiments in the extraction of Thorium Nitrate from aqueous solutions of nitric acid by means of ether are described by Imrie, 1927.

100 cc of a saturated wolution of Thorium Nitrate in Ethyl Ether, prepared by frequent agitation and allowing to stand over night at about 20°, contain 11.22 gms. ThO_2. A saturated ethereal soloution prepared as above but using Thorium Nitrate dehydrated at 150°, contain only 3.67 gm. TeO_2 per 100 cc. (Wells, 1930.)

THORIUM NITRATE $Th(NO_3)_4.6H_2O$.

SOLUBILITY OF THORIUM NITRATE IN WATER.

(Misciatelli, 1930.)

t°	Gms. $Th(NO_3)_4$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Th(NO_3)_4$ per 100 gms. sat. sol.	Solid Phase
- 0.2	1.0	Ice	-35	60.6	Ice
- 1.5	9.0	"	-40.6	62.0	"
- 4.0	20.0	"	-43.5	64.0	$Th(NO_3)_4.6H_2O$
- 6.0	33.0	"	-22	64.2	
- 9.0	41.0	"	0	65.0	"
-15.0	47.7	"	+10	65.2	"
-25	55.7	"	20	65.6	"

EQUILIBRIUM IN THE SYSTEM THORIUM NITRATE, URANYL NITRATE AND ETHYL ETHER.

(Misciattelli, 1929.)

t°	Gms. per 100 gms. sat. sol. $UO_2(NO_3)_2$	$Th(NO_3)_2$	$(C_2H_5)_2O$	Solid Phase	t°	Gms. per 100 gms. sat. sol. $UO_2(NO_3)_2$	$Th(NO_3)_2$	$(C_2H_5)_2O$	Solid Phase
0	22	0	78	$UO_2(NO_3)_2$	20	0.0	1.5	98.5	$Th(NO_3)_2$
"	22.5	1.02	76.48	"	"	3.1	1.0	95.9	"
"	24	3.5	72.57	"+$Th(NO_3)_2$	"	5.5	0.5	94	"
"	19.2	4.5	76.3	$Th(NO_3)_2$	"	8.78	0	91.22	"+$UO_2(NO_3)_2$
"	18	5	77	"	16	17.7	1.7	80.6	"+ "
"	16.5	5.6	77.9	"	19	10.5	0.4	89.1	"+ "
"	12.2	7.0	81.0	"	22	8.0	—	92	"+ "
"	8.2	8.3	82.5	"	25	7.37	—	92.63	"+ "
"	3.0	8	89	"					
"	0	5.8	94.2	"					

NO

THORIUM OXIDE ThO_2.

SOLUBILITY OF THORIUM OXIDE IN VARIOUS AQUEOUS SOLUTIONS AT 25°

(Spitzer, 1917)

Aq. solvent.	Gm. ThO_2 per liter.	Aq. solvent.	Gm. ThO_2 per liter.
Water	less than 0.00002	Aq. 0.8 *n* $C_4H_8O_4$	0.0003
Aq. 1.0 *n* K_2CO_3	" " 0.00002	Aq. 1.0 *n* HCl	0.0005
Aq. 1.0 *n* Na_2CO_3	" " 0.00003	Aq. 1.0 *n* HNO_3	0.0006
Aq. 1.0 *n* NaOH	" " 0.00005	Aq. 1.0 *n* H_2SO_4	0.0020

O

THORIUM PHOSPHATE $ThP_2O_8.11H_2O$.

SOLUBILITY OF THORIUM PHOSPHATE IN AQUEOUS SOLUTIONS AT 25°.

(Spitzer, 1917.)

Aq. solvent.	Gm. ThO_2 per liter.	Aq. solvent.	Gm. ThO_2 per liter.
Aq. 1.0 *n* HNO_3	0.012	Aq. 1.0 *n* H_2SO_4	0.053
Aq. 1.0 *n* HCl	0.024	Aq. 1.0 *n* K_2CO_3	0.250

EQUILIBRIUM IN THE SYSTEM THORIUM OXIDE, PHOSPHORIC ACID AND WATER AT 25°.

(D'Ans and Dawihl, 1929.)

Gms. per 100 gms. sat. sol. P_2O_5	Gms. per 100 gms. sat. sol. ThO_2	Solid Phase	Gms. per 100 gms. sat. sol. P_2O_5	Gms. per 100 gms. sat. sol. ThO_2	Solid Phase
4.5	trace	$Th_3(PO_4)_4$	30	5.0	1.2.2
9.61	0.1	"	46.1	9.34	"
16.0	0.2	"	49.0	13.3	"
20.0	0.5 (?)	" + $Th(HPO_4)_2.H_2O$	50.8	19.1	"
27.1	3.3	$Th(HPO_4)_2.H_2O$	52.0	19.8	"
43.0 (?)	22.0 *	"			

PO

* = Metastable.
1.2.2 = $ThHPO_4.2H_2PO_4.2H_2O$.

The authors also give the following results for solutions simultaneously saturated with Thorium Phosphate Sulphate and Thorium Sulfate on the one hand and with Thorium Phosphate on the other at 45°.

Gms. per 100 gms. sat. sol. ThO_2	Gms. per 100 gms. sat. sol. P_2O_5	Gms. per 100 gms. sat. sol. SO_3	Solid Phase		
0.59	0.72	13.0	$Th(SO_4)_2.4H_2O$	+	$ThSO_4.HPO_4.4H_2O$
0.71	0.73	15.1	"	+	"
0.65	0.77	21.4	"	+	"
0.26	2.1	6.29	$Th_3(PO_4)_4$	+	"
2.5	6.8	10.8	"	+	"
2.9	7.6	11.2	"	+	"

THORIUM SULFATE $Th(SO_4)_2$.

SOLUBILITY IN WATER.

(Roozeboom, 1890; Demarcay, 1883.)

SO

t°.	Gms. $Th(SO_4)_2$ per 100 Gms. H_2O.		Solid Phase.	t°.	Gms. $Th(SO_4)_2$ per 100 Gms. H_2O.		Solid Phase.
0	0.74 (R)	0.88 (D)	$Th(SO_4)_2.9H_2O$	0	1.50 (R)		$Th(SO_4)_2.6H_2O$
10	0.98	1.02	"	15	1.63		"
20	1.38	1.25	"	30	2.45		"
30	1.995	1.85	"	45	3.85		"
40	2.998	2.83	"	60	6.64		"
50	5.22 (51°)	4.86	"	17	9.41 (D)		$Th(SO_4)_2.4H_2O$
55	6.76	6.5±	"	40	4.04 (R)	4.5 (35° D)	
0	1.0		$Th(SO_4)_2.8H_2O$	50	2.54	1.94 (55°)	"
15	1.38			60	1.63	...	"
25	1.85		"	70	1.09	1.32 (75°)	"
44	3.71		"	95	...	0.71	"

Additional results for the $.8H_2O$ and the $.9H_2O$ salt, in fair agreement with the above, are given by Wyrouboff (1901).

100 gms. sat. solution of $Th(SO_4)_2.8H_2O$ in Water contain 2.1 gms. $Th(SO_4)_2$ at 30°. (Caven, 1932.)

SOLUBILITY OF THORIUM SULFATE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AND OF NITRIC ACID AT 30°.

(Koppel and Holtkamp, 1910.)

In Aq. Hydrochloric Acid.			In Aq. Nitric Acid.		
Wt. % HCl in Solvent.	Gms. $Th(SO_4)_2$ per 100 Gms. Sat. Sol.	Solid Phase.	Wt. % HNO_3 in Solvent.	Gms. $Th(SO_4)_2$ per 100 Gms. Sat. Sol.	Solid Phase.
0	2.15	$Th(SO_4)_2.8H_2O$	0	2.15	$Th(SO_4)_2.8H_2O$
4.55	3.541	"	5.17	3.68	"
6.95	3.431	"	10.04	4.20	"
12.14	2.811	"	16.68	4.84	"
15.71	2.360	"	21.99	4.47	"
18.33	2.199	"	28.33	3.96	"
20	2.110	$Th(SO_4)_2.4H_2O$	28.51	3.88	"
20	2.141	"	33.17	3.34	$Th(SO_4)_2.4H_2O$
23.9	1.277	"	38.82	2.51	"

SOLUBILITY OF THORIUM SULFATE IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE.

(Barre, 1911.)

Results at 16°.			Results at 75°.	
Gms. per 100 Gms. H_2O.		Solid Phase.	Gms. per 100 Gms. H_2O.	
K_2SO_4.	$Th(SO_4)_2$.		K_2SO_4.	$Th(SO_4)_2$.
0	1.39	$Th(SO_4)_2.9H_2O$	0	0.9248
0.424	1.667	$Th(SO_4)_2.K_2SO_4.4H_2O$	0.865	1.137
1.004	2.193	"	1.167	1.173
1.152	3.191	"	1.172	1.121
1.224	2.514	"	1.270	0.907
1.283	2.222	"	1.296	0.495
1.348	1.706	"	1.852	0.297
1.378	1.637	$Th(SO_4)_2.2K_2SO_4.2H_2O$	3.117	0.201
1.487	0.870	"	4.659	0.256
1.844	0.370	"	5.348	0.170
3.092	0.070	"	5.932	0.123
4.050	0.027	$Th(SO_4)_2.3\frac{1}{2}K_2SO_4$	7.177	0.031
4.825	0.003	"	9.706	0.022

SOLUBILITY OF THORIUM SULFATE IN AQUEOUS SOLUTIONS OF:

Ammonium Sulfate at 16°. (Barre, 1911.)			Lithium Sulfate at 25°. (Barre, 1912.)	
Gms. per 100 Gms. H_2O.		Solid Phase.	Gms. per 100 Gms. H_2O.	
$(NH_4)_2SO_4$.	$Th(SO_4)_2$.		Li_2SO_4.	$Th(SO_4)_2$.
2.13	3.361	$Th(SO_4)_2.9H_2O$	0	1.722
4.80	5.269	"	2.57	4.13
10.02	8.947	"	4.93	6.20
16.56	13.330	" +1.1.4	6.98	7.95
28	10.359	1.1.4	9.23	9.68
35.20	9.821	" +1.2.2	11.13	11.05
45.14	6.592	1.2.2	13.18	12.54
49.05	5.750	"	16.12	14.52
52.88	4.583	1.3.3	20.49	16.02
69.74	1.653	"	25.18	18.87

1.1.4 = $Th(SO_4)_2.(NH_4)_2SO_4.4H_2O$; 1.2.2 = $Th(SO_4)_2.2(NH_4)_2SO_4.2H_2O$; 1.3.3 = $Th(SO_4)_2.3(NH_4)_2SO_4.3H_2O$.

More recent determinations upon the system Thorium Sulfate, Ammonium Sulfate and Water at 25° by Rosenheim and Zickermann, 1932, will be found under Ammonium Sulfate.

Solubility of Thorium Sulfate in Aqueous Solutions of:

Sodium Sulfate at 16°. (Barre, 1910, 1911.)

Sulfuric Acid at 25°. (Barre, 1912.)

Gms. per 100 Gms. H_2O. Na_2SO_4.	$Th(SO_4)_2$.	Solid Phase.	Gms. per 100 Gms. H_2O. H_2SO_4.	$Th(SO_4)_2$.
1.094	1.743	$Th(SO_4)_2.Na_2SO_4.6H_2O$	0	1.722
1.960	2.387	"	1.072	1.919
2.98	3.962	"	1.941	2.017
4.11	3.375	"	2.821	2.060
5.79	2.136	"	3.843	2.061
9.35	1.379	"	5.212	2.035
12.24	1.169	"	8.055	1.863
15.36	1.048	"	10.105	1.702

Solubility of Thorium Sulfate in Aqueous Solutions of Sulfuric Acid

Results at 25°. (Wirth, 1912.)

Normality of Aq. H_2SO_4.	Gms. $Th(SO_4)_2$ per 100 Gms. Sat. Sol.	Solid Phase.
0	1.593	$Th(SO_4)_2.9H_2O$
1.1	1.831	"
2.16	1.488	"
4.32	0.8751	"
6.68	0.4312	"
9.68	0.1045	$Th(SO_4)_2.8H_2O$
10.89	0.0636	"
15.15	0.0308	$Th(SO_4)_2.4H_2O$

Results at 20° and at the b.-pt. (Koppel and Holtkamp 1910.)

t°.	Wt. % H_2SO_4 in Solvent.	Gms. $Th(SO_4)_2$ per 100 Gms. Sat. Sol.	Solid Phase.
20	5	1.722	$Th(SO_4)_2.8H_2O$
20	15	0.9752	"
20	25	0.3838	"
20	40	0.0103	$Th(SO_4)_2.4H_2O$
b. pt.	5	0.7407	$Th(SO_4)_2.8H_2O$
"	10	0.4808	"
"	15	0.3882	"

SO

Results at 30°. (Koppel and Holtkamp, 1910.)

Wt. % H_2SO_4 in Solvent.	Gms. $Th(SO_4)_2$ per 100 Gms. Sat. Sol.	Solid Phase.	Wt. % H_2SO_4 in Solvent.	Gms. $Th(SO_4)_2$ per 100 Gms. Sat. Sol.	Solid Phase.
0	2.152	$Th(SO_4)_2.8H_2O$	15.03	1.484	$Th(SO_4)_2.8H_2O$
0.466	2.055	"	23.64	0.7196	"
0.72	2.085	"	32.68	0.3364	"
1.468	2.267	"	37.80	0.077	$Th(SO_4)_2.4H_2O$
2.983	2.311	"	43.28	0.0213	"
4.38	2.367	"	45.69	0.0047	"
4.97	2.323	"	74	0.1208	"
9.95	1.961	"	80.5	0	"

Solubility of Anhydrous Thorium Sulfate in Pure Methyl Alcohol.

(Gibson, Driscoll and Jones, 1929.)

t°	Gms. $Th(SO_4)_2$ per 100 gms. CH_3OH
15	0.029
25	0.024
35	0.019
45	0.014
55	0.010

THORIUM Thallium SULFATE $2Th(SO_4)_2.7Tl_2SO_4.3H_2O$.

Solubility of Thorium Thallium Sulfate in Water. (Fernandez, 1925.)

t°.	Gm. ThO_2 per 100 cc. H_2O.	t°.	Gm. ThO_2 per 100 cc. H_2O.	t°.	Gm. ThO_2 per 100 cc. H_2O.
0	0.280	40	0.584	80	0.712
10	0.340	50	0.658	90	0.690
20	0.415	60	0.696	100	0.630
30	0.500	70	0.714		

THORIUM SELENATE $Th(SeO_4)_2.9H_2O$.

100 gms. H_2O dissolve 0.498 gm. $Th(SeO_4)_2$ at 0° and 1.972 gms. at 100°. (Cleve, 1885.)

TITANIUM Ti.

The percentage of Titanium in Mercury at 20°, determined by filtering an amalgam of the metal through a sintered glass filter, was found by Irvin and Russell, 1932, to be less than 1×10^{-6}.

TITANIUM Tetra BROMIDE

Br

Determinations of the Reciprocal Solubility of Titanium Tetra Bromide and Sulfur Dioxide, determined by the synthetic method, are given by Bond and Crone, 1934.

TITANIUM Tetra CHLORIDE $TiCl_4$.

100 gms. sat. solution of titanium tetrachloride in selenium oxychloride ($SeOCl_2$) contains 0.75 gm. $TiCl_4$ at 25°. (Wise, 1922.)

Cl

Freezing-point data are given for

$TiCl_4$ + CCl_4 (Carbon tetra chloride) (Nasu, 1933.)
" + C_2H_5CN (proprionitrile) (Hertel and Demmer, 1932.)
" + C_6H_5CN (benzo nitrile) " " "
" + m $C_6H_4(NO_2)_2$ (m di nitro benzene) (Hertel and Demmer, 1932.)
" + SO_2 (Sulfur dioxide) (Bond and Stephens, 1929.)

TITANIUM Potassium Hexa **FLUORIDE** TiK_2F_6.

F

1000 cc. sat. solution of titanium potassium hexa fluoride in aq. 0.125 *n* hydrofluoric acid contain 0.0483 gm. mols. TiK_2F_6 at 20°. (V. Hevesy, Christiansen and Berglund, 1925.)

TITANIUM OXIDE TiO_2.

Solubility of Titanium Oxide in Aqueous Solution of Alkalis. (Auger, 1923.)

Solvent.	Gm. TiO_2 per liter.	Solvent.	Gm. TiO_2 per liter.
Aq. 10 per cent NaOH...	0.02–0.025	Aq. 12 per cent $KHCO_3$......	0.50
» 36 » » ...	0.06–0.10	» 25 » »	2.75
» 10 » KOH....	0.30–0.45	» saturated »	7.00
» 40 » »	0.70–0.90	» 30 per cent K_2CO_3......	0.02
» 10 » $NaHCO_3$.	0.25	» saturated »	0.30

The temperature is not stated and the manner in which the determinations were made is not clearly described.

THALLIUM BORATES, $TlBO_2$, Tl_3BO_3 and $Tl_4B_2O_5$.

Freezing-point data, for the system $Tl_2O + B_2O_3$, which show the formation of the above three compounds are given by Cannori and Morelli, 1922.

THALLI-THALLO BROMIDES, TlBr, $TlBr_3$, $[TlBr_6]Tl_3$, $[TlBr_4]Tl$.

Solubility of Thalli-Thallo Bromides in Water. (Bonrath, 1924.)

Gms. per 100 gms. H_2O		
$TlBr_3$.	TlBr.	Solid Phase.
	Results at 30°.	
0.0	0.073	TlBr (white)
0.233	0.91	»
1.147	0.204	»
1.556	0.272	»
1.990	0.356	$[TlBr_6]Tl_3$ (red)
2.293	0.315	»
2.851	0.380	»
3.490	0.379	»
3.865	0.448	»
4.163	0.435	$[TlBr_4]Tl$ (yellow)
5.062	0.425	»
6.980	0.415	»
9.241	0.403	»
11.917	0.349	»
14.596	0.364	»
15.721	0.389	»
	Results at 50°.	
0.0	0.159	TlBr (white)
0.478	0.210	»
0.651	0.251	»
0.934	0.285	»
1.352	0.398	»
1.695	0.500	»
	Results at 50°.	
1.701	0.542	TlBr (white)
1.992	0.670	»
2.351	0.669	$[TlBr_6]Tl_3$ (red)
3.082	0.680	»
3.591	0.738	»
4.110	0.879	»
4.251	0.926	$[TlBr_4]Tl$ (yellow)
4.763	0.901	»
5.286	0.891	»
6.632	0.880	»
8.511	0.874	»
10.256	0.883	»
13.056	0.851	»
15.554	0.941	»
	Results at 80°.	
6.020	2.801	TlBr (white)
6.211	2.972	$[TlBr_6]Tl_3$ (red)
7.515	3.250	»
8.014	3.193	$[TlBr_4]Tl$ (yellow)
	Results at 90°.	
8.234	3.741	TlBr (white)
8.980	4.520	$[TlBr_6]Tl_3$ (red)
9.54	4.995	$[TlBr_4]Tl$ (yellow)

THALLIUM BROMIDE TlBr.

SOLUBILITY OF THALLIUM BROMIDE IN WATER.

The results of Kohlrausch, 1908; Noyes, 1890; and Osborg, 1926, were plotted and the following results taken from the curve. The results above 100° are by Benrath, Gjedebo, Schiffers and Wunderlich, 1937.

t°	Gms. TlBr per liter sat. sol.	Solid Phase
0	0.22	TlBr
10	0.32	"
20	0.48	"
25	0.57	"
30	0.68	"
40	0.97	"
50	1.32	"
70	2.50	"
162	1.73	TlBr
215	3.09	"
258	4.45	"
269	6.2	"
294	7.27	"
414	85.5	"
421	92.0	"
457	m.pt.100.0	"

SOLUBILITY OF THALLIUM BROMIDE IN AQUEOUS SOLUTIONS OF THALLIUM NITRATE AT 68.5°.

(Noyes, 1890.)

Gms. Mols. per Liter.		Gms. per Liter.	
$TlNO_3$.	TlBr.	$TlNO_3$.	TlBr.
0	0.00869	0	2.469
0.0163	0.00410	4.336	1.164
0.0294	0.00289	7.820	0.821
0.0955	0.00148	25.400	0.420

Br

100 gms. liquid Sulfur Dioxide (SO_2) dissolve 0.017 gm. TlBr at 0°. (Jander and Ruppolt, 1937.)

Freezing-point data for mixtures of TlBr + TlCl, TlBr + TlI and TlCl are given by Monkemeyer (1906). Results for TiCl + $SnCl_2$ and TlCl + $ZnCl_2$ are given by Korreng (1914). Results for TlBr + $TlNO_3$ are given by Rostkowski, 1929.)

THALLIUM BROMATE $TlBrO_3$.

One liter saturated aqueous solution contains 3.463 gms. $TlBrO_3$ at 19.9° (Böttger, 1903) and 7.355 gms. at 39.75°. (Noyes and Abbot, 1895.)

THALLIUM METHIONATE $Tl_2[CH_2(SO_3)_2]$.

100 gms. H_2O dissolve 6.42 gms. $Tl_2[CH_2(SO_3)_2]$ at 25°. (Backer and Terpstra, 1929.)

THALLIUM Chlor METHIONATE $Tl_2CH_3Cl(SO_3)_2$.

100 gms. H_2O dissolve 0.1438 gm. mols. $Tl_2CH_3Cl(SO_3)_2$ at 25°. (Backer, 1930.)

CH

THALLOUS METHOXIDE and ETHOXIDE.

SOLUBILITY OF EACH SEPARATELY IN ALCOHOL AND BENZENE AT 25°.

(Sidgwick and Sutton, 1930.)

Compound	Formula	Solvent	Gms. Compound per 100 gms. solvent
Thallous methoxide	$TlOCH_3$	CH_3OH	1.703
" "	"	C_6H_6	3.160
" ethoxide	$TlOC_2H_5$	C_2H_5OH	9.108

Results for the Solubility of Several Thallium derivatives of β Di Ketones and β Ketonic Esters in n Hexane at 27° are given by Menzies and Walker, 1936.

THALLIUM ACETATE $TlCH_3COO$.

100 gms. Liquid Sulfur Dioxide (SO_2) dissolve 7.5 gms. $TlCH_3COO$ at 0°. (Jander and Ruppolt, 1937.)

THALLIUM Racemic MANDELATE $TlC_8H_7O_3$.

EQUILIBRIUM IN THE SYSTEM RACEMIC THALLIUM MANDELATE, RACEMIC MANDELIC ACID AND WATER AT 25°.

(Ross and Morrison, 1936.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$C_8H_8O_3$	$TlC_8H_7O_3$		$C_8H_8O_3$	$TlC_8H_7O_3$	
0.0	7.8	$TlC_8H_7O_3$	20.9	5.8	1.1
1.0	8.1	"	24.0	6.0	"
1.9	8.5	"	22.6	6.0	" + $C_8H_8O_3$
2.8	9.5	" + 1.1	20.4	4.7	$C_8H_8O_3$
3.7	8.2	1.1	18.8	3.1	"
4.8	7.1	"	17.7	1.6	"
9.1	5.7	"	17.2	0.6	"
12.2	5.3	"	17.0	0.4	"
16.0	5.4	"	16.95	0.0	"

1.1 = $TlC_8H_7O_3 \cdot C_8H_8O_3$.

THALLIUM Laevo MANDELATE $TlC_8H_7O_3$.

EQUILIBRIUM IN THE SYSTEM LAEVO THALLIUM MANDELATE, LAEVO MANDELIC ACID AND WATER AT 25°.

(Ross, Morrison and Johnstone, 1937.)

CH

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$C_8H_8O_3$	$TlC_8H_7O_3$		$C_8H_8O_3$	$TlC_8H_7O_3$	
5.2	60.1	1.1	29.2	28.8*	$C_8H_8O_3$
3.8	52.2	"	23.0	22.0*	"
3.1	36.4	"	21.2	20.8*	"
4.5	18.1	"	17.8	16.7*	"
5.9	16.2	"	15.3	13.7	"
10.0	13.7	"	11.4	6.5	"
18.3	14.6*	"	10.4	2.4	"
19.4	17.0	" + $C_8H_8O_3$	10.1	0.0	"

* = Metastable; 1.1 = $TlC_8H_7O_3 \cdot C_8H_8O_3$.

THALLIUM PICRATE $TlOC_6H_2(NO_2)_3$.

SOLUBILITY IN WATER.

(Rabe, 1901.)

t°.	Gms. $TlOC_6H_2(NO_2)_3$ per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. $TlOC_6H_2(NO_2)_3$ per 100 Gms. H_2O.	Solid Phase.
0	0.135	Monoclinic Red	45	1.04	Triclinic Yellow
18	0.36	"	47	1.10	"
30	0.575	"	50	1.205	"
40	0.825	"	60	1.73	"
47	1.14	"	70	2.43	"

100 gms. H_2O simultaneously sat. with both salts dissolve:

0.132 gm. $C_6H_2(NO_2)_3OTl$ + 0.36 gm. $C_6H_2(NO_2)_3OK$ at 0°.
0.352 " " + 0.44 " " " 15°.
0.38 " " + 0.23 " " " 20°. (Rabe, 1901.)

SOLUBILITY OF THALLIUM PICRATE IN METHYL ALCOHOL.

(Rabe, 1901.)

t°.	Gms. $TlOC_6H_2(NO_2)_3$ per 100 Gms. CH_3OH.	Solid Phase.	t°.	Gms. $TlOC_6H_2(NO_2)_3$ per 100 Gms. CH_3OH.	Solid Phase.
0	0.39	Red Form (monoclinic)	45	1.195	Yellow Form (triclinic)
18	0.59	"	48	1.265	"
25	0.70	"	50	1.325	"
30	0.795	"	53	1.41	"
35	0.90	"	57	1.54	"
40	1.02	"	60	1.65	"
45	1.17	"	65	1.84	"
47	1.265	"			

THALLIUM OLEATE $C_8H_{17}CH:CH(CH_2)_7COOTl$ (m. pt. 83°, cor.).

THALLIUM PALMITATE $CH_3(CH_2)_{14}COOTl$ (m. pt. 115°-117°).

THALLIUM STEARATE $CH_3(CH_2)_{16}COOTl$ (m. pt. 119°, cor.).

SOLUBILITY OF EACH SEPARATELY IN WATER AND IN 96 % ETHYL ALCOHOL.

(Holde and Selim, 1925.)

The numerical results are not given but only small scale diagrams, from which the following approximate values were read.

	Solubility in Water. Gms. per 100 gms. sat. solution			Solubility in 96 % Alcohol. Gms. per 100 gms. sat. solution		
t°.	Tl Oleate.	Tl Palmitate.	Tl Stearate.	Tl Oleate.	Tl Palmitate.	Tl Stearate.
15.....	0.04	0.015	0.005	2.2	0.35	0.1
20.....	0.05	0.025	0.006	2.5	0.4	0.1
25.....	0.06	0.030	0.008	2.75	0.5	0.1
30.....	0.07	0.035	0.010	3.05	0.6	0.1
35.....	–			3.75	0.75	0.1
40.....	0.09	0.045	0.020	7.5	1.0	0.1
45.....	–		–	15.0	1.35	0.15
50.....	0.11	0.055	0.030			0.25
60.....	0.15	0.07	0.050			0.75
70.....	0.20	–	0.075			
80.....	0.30	–	0.110			

100 gms. sat. solution of thallium oleate in aq. 50 % alcohol contain 0.92 gms of the salt at 15°. (Holde and Selim, 1925.

THALLIUM LAURATE $C_{12}H_{23}O_2Tl$ (m. pt. 125°-6°).

100 gms. sat. sol. of thallium laurate in aq. 50 % ethyl alcohol contain 1.51 gms. $C_{12}H_{23}O_2Tl$ at 15°. (Halde and Takehara, 1925.)

THALLIUM MYRISTATE $C_{14}H_{27}O_2Tl$ (m. pt. 120°-123°.)

100 gms. sat. sol. of thallium myristate in aq. 50 % ethyl alcohol contain 0.53 gm. $C_{14}H_{27}O_2Tl$ at 15°. (Halde and Takehara, 1925.)

SOLUBILITY OF THALLIUM SALTS OF FATTY ACIDS, EACH DETERMINED SEPARATELY, IN ACETONE, ETHER AND IN 96 PERCENT ETHYL ALCOHOL.

(Canneri and Rigalli, 1936.)

CH

Solvent	t°	Gms. per 100 cc of solvent Tl Laurate	Tl Myristate	Tl Palmitate	Tl Stearate	Tl Oleate	Tl Arachinate
Acetone (anhy.)	5	0.026	0.028	0.022	0.036	0.023	0.024
" "	11	0.029	0.031	0.024	0.054	0.026	0.028
" "	19	0.038	0.035	0.028	0.078	0.029	0.032
" "	28	0.065	0.048	0.036	0.143	0.078	0.039
Ethyl Ether (anhy.)	5	0.011	0.028	0.010	0.019	0.128	0.007
" " "	12.2	0.024	0.041	0.027	0.059	0.353	0.022
" " "	15.4	0.042	0.048	0.036	0.119	0.684	0.038
" " "	21	0.057	0.954	0.045	0.138	1.983	0.047
" " "	24.5	0.079	0.071	0.057	0.203	3.460	0.079
" " "	30	0.088	0.078	0.068	0.235	8.150	0.101
Ethyl Alcohol (96%)	15	—	0.559	—	—	—	0.203
" " "	21	—	0.910	—	—	—	0.186
" " "	26	—	1.272	—	—	—	0.244
" " "	32	—	2.001	—	—	—	0.361
" " "	40	—	3.456	—	—	—	0.546
" " "	45	—	4.921	—	—	—	0.796

THALLIUM CYANIDE TlCN and Double Cyanides.

CN

SOLUBILITY IN WATER.

(Fronmüller, 1878.)

Cyanide.	Formula.	Gms. Salt per 100 Gms. H_2O.
Tl Cyanide	$TlCN$	16.8 at 28.5°.
Tl Cobalti Cyanide	$Tl_3Co(CN)_6$	3.6 at 0°; 5.86 at 9.5°; 10.04 at 19.5°.
Tl Zinc Cyanide	$2TlCN.Zn(CN)_2$	8.7 at 0°; 15.2 at 14°; 29.6 at 31°.
Tl Ferro Cyanide	$Tl_4Fe(CN)_6.2H_2O$	0.37 at 18°; 3.93 at 101°. (Lamy.)

100 gms. Liquid Sulfur Dioxide dissolve 0.012 gm. TlCN at 0°. (Jander and Ruppolt, 1937.

THALLIUM THIOCYANATE TlSCN.

SOLUBILITY IN WATER AND IN AQUEOUS SALT SOLUTIONS.

(Böttger, 1903; Noyes, 1890; Noyes and Abbott, 1895.)

CNS One liter sat. aq. solution contains 3.154 gms. TlSCN at 20°, 3.905 gms. at 25°, and 7.269 gms. at 39.75°.

Aq. Salt Solution.	t°.	Gms. Mols. per Liter. Salt.	TlSCN.	Gms. per Liter. Salt.	TlSCN.
Thallium Bromate $TlBrO_3$ (excess)	39.75	0.01496	0.0221	4.966	5.793 (N. & A.)
Thallium Nitrate $TlNO_3$	25	0.0227	0.00852	6.04	2.233 (N.)
"	25	0.0822	0.00406	21.88	1.064
Potassium Thiocyanate, KSCN	25	0.0227	0.0083	2.208	2.176 (N.)

100 gms. Liquid Sulfur Dioxide dissolve 0.024 gm. TlSCN at 0°. (Jander and Ruppolt, 1937.)

THALLIUM CARBONATE Tl_2CO_3.

SOLUBILITY IN WATER.

(Crookes, 1864; Lamy, 1863.)

t°.	15.5°.	18°.	62°.	100°.	100.8°.
Gms. Tl_2CO_3 per 100 gms. H_2O	4.2 (C.)	5.23	12.85	27.2 (C.)	22.4

100 gms. Liquid Sulfur Dioxide dissolve 0.01 gm. Tl_2CO_3 at 0°. (Jander and Ruppolt, 1937.)

Fusion-point data for Tl_2CO_3 + $TlNO_3$ are given by Broun, 1933.

THALLIUM OXALATE $Tl_2C_2O_4$

One liter of saturated aqueous solution contains 15.77 gms. $Tl_2C_2O_4$ at 20°, and 18.69 gms. at 25°. (Böttger, 1903; Abegg and Spencer, 1905.)

COO

SOLUBILITY OF THALLIUM OXALATE AT 25° IN AQ. SOLUTIONS OF:

Thallium Nitrate. (Abegg and Spencer.) — Potassium Oxalate. (Abegg and Spencer.)

Thallium Nitrate. Mol. Concentration.		Grams per Liter.		Potassium Oxalate. Mol. Concentration.		Grams per Liter.	
$TlNO_3$.	$Tl_2C_2O_4$.	$TlNO_3$.	$Tl_2C_2O_4$.	$K_2C_2O_4$.	$Tl_2C_2O_4$.	$K_2C_2O_4$.	$Tl_2C_2O_4$.
0.0	0.03768	0.00	18.69	0.0498	0.0351	8.281	17.42
0.04114	0.0264	10.95	13.10	0.0996	0.03565	16.57	17.69
0.0799	0.0195	21.26	9.68	0.2467	0.0390	41.02	19.36
0.1597	0.01235	42.51	6.128	0.4886	0.04506	81.25	22.37
				0.9785	0.05536	162.6	27.48

THALLIUM CHLORIDE TlCl.

SOLUBILITY IN WATER.

(Average curve from results of Noyes, 1892; Böttger, 1903; Kohlrausch, 1904; Hebberling; Crookes; Lamy. The results of Berkeley, 1904 are also given.)

t°.	Gms. TlCl per Liter.		t°.	Gms. TlCl per Liter.		t°.	Gms. TlCl per Liter.	
0	2.1 (av.)	1.7 (B.)	25	3.86	4	60	8	10.2
10	2.5	2.4	30	4.2	4.6	80	12	16
20	3.3	3.4	40	5.2	6	100	18	24.1 (99.3°)
			50	6.3	8			

The results of Berkeley are in terms of gms. of TlCl per 1000 gms. H_2O but since the densities of the solutions are approximately 1 in all cases, except for temperatures above 60°, the differences are negligible. The Sp. Gr. of the sat. sol. at 99.3° is 0.9787 and the figure 24.1, therefore, becomes 23.58 gms. per liter.

Cl

One liter sat. solution in water contains 2.27 gms. TlCl at 9.54°, 3.05 gms. at 17.7°, and 3.97 gms. at 25.76°. (Kohlrausch, 1908.)

The more recent determinations of Osborg, 1926; Butler and Hiscocks, 1926; Randall and Chang, 1928; Benrath and Ammer, 1929; Failey, 1932, 1932a, 1933; were plotted and the following results taken from the average curve. The results of Jones and Schumb, 1921, by the electrolytic conductivity method are not in good agreement with the others. The results for temperatures above 100° are by Benrath, Gjedebo, Schiffers and Wunderlich, 1937.

t°	Gms. TlCl per liter sat. sol.	t°	Gms. TlCl per liter sat. sol.	t°	Gms. TlCl per liter sat. sol.
0	1.61	144	4.2	338	26.4
10	2.40	177	6.67	364	30 - 86
20	3.25	205	9.0	367	91.5
25	3.80	234	12.3	381	96.2
50	7.83	303	21.1	430m.pt.	100.0

SOLUBILITY OF THALLI-THALLO CHLORIDES IN WATER AT 35°.

(Benrath, 1924.)

Gms. per 100 gms. H_2O $TlCl_3$.	Gms. per 100 gms. H_2O TlCl.	Solid Phase.
0.0	0.051	TlCl (white)
0.169	0.373	$[TlCl_6]Tl_3$(yellow)
0.823	0.265	»
2.173	0.237	»
2.872	0.232	»
3.566	0.216	»
4.444	0.236	»
8.723	0.237	»
15.097	0.272	»
28.109	0.244	»
39.940	0.314	»
74.401	0.770	$[TlCl_6]Tl_3$(yellow
88.510	1.021	»
118.875	1.536	»
144.782	2.272	»
157.161,	2.695	»
160.502	2.917	»
163.291	2.887	$[TlCl_4]Tl$(white)
166.434	2.826	»
172.971	2.779	»
197.997	2.653	»

SOLUBILITY OF THALLI-THALLO CHLORIDES IN WATER AT SEVERAL TEMPERATURE

(Benrath, 1924.)

Cl

Gms. per 100 gms. H_2O $TlCl_3$.	Gms. per 100 gms. H_2O TlCl.	Solid Phase.
Results at 45°		
0.0	0.070	TlCl (white)
0.214	0.496	$[TlCl_6]Tl_3$ (yellow)
1.875	0.405	»
4.954	0.356	»
20.184	0.426	»
39.561	0.495	»
65.597	0.803	»
90.693	1.187	»
117.654	1.976	»
144.840	3.115	»
156.167	3.771	»
166.853	4.424	»
171.000	4.400	$[TlCl_4]Tl$ (white)
195.820	4.361	»
209.542	4.302	»
Results at 55°		
0.0	0.092	TlCl (white)
0.291	0.678	$[TlCl_6]Tl_3$(yellow)
1.327	0.593	»
4.458	0.586	»
26.501	0.532	»
40.512	0.698	$[TlCl_6]Tl_3$(yellow
88.845	1.995	»
120.601	3.006	»
155.838	5.412	»
157.413	5.587	»
163.985	6.215	»
167.913	6.669	»
177.163	6.687	$[TlCl_4]Tl$(white)
183.968	6.612	»
201.022	6.578	»
214.579	6.493	»
Results at 70°		
178.31	10.356	$[TlCl_6]Tl_3$ (yellow
187.16	10.580	$[TlCl_4]Tl$ (white)
Result at 80°		
179.82	15.291	$[TlCl_6]Tl_3$ (yellow
225.37	16.013	»
245.20	15.920	$[TlCl_4]Tl$ (white)
Results at 90°		
287.41	20.085	$[TlCl_6]Tl_3$ (yellow
290.83	19.876	$[TlCl_4]Tl$ (white)

SOLUBILITY OF THALLIUM CHLORIDE AT 25° IN AQUEOUS SOLUTIONS OF:

Acetic Acid.

(Hill, 1917.)

Normality of Aq. CH_3COOH.	TlCl per Liter	
	Gms.	Gm. Equiv.
0	3.8515	0.016085
0.0501	3.8375	0.016027
0.0958	3.8326	0.016006
0.263	3.7503	0.015662
0.524	3.6539	0.015258

Nitric Acid.

(Hill and Simmons, 1909.)

Normality of Aq. HNO_3.	d_{25} of Sat. Sol.	TlCl per Liter.	
		Gms.	Gm. Equiv.
0	0.996	3.951	0.0165
0.4977	1.0184	5.937	2.475
1.0046	1.0359	6.882	2.875
2.0452	1.0705	8.143	3.401
4.0170	1.1362	9.925	4.145

SOLUBILITY OF THALLIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SALTS WITH A COMMON ION AT 25°.

(Noyes, 1892.)

Cl

Aqueous Solution of:	Gms. Equiv. Added Salt per Liter.	Gms. Equiv. Dissolved TlCl per Liter.	Aqueous Solution of:	Gms. Equiv. Added Salt per Liter.	Gms. Equiv. Dissolved TlCl per Liter.
Water alone	0	0.01612	$MgCl_2$	0.025	0.00904
NH_4Cl	0.025	0.00877	"	0.050	0.00618
"	0.05	0.00593	"	0.10	0.00413
"	0.20	0.00271	"	0.20	0.00275
$BaCl_2$	0.05	0.00620	$MnCl_2$	0.025	0.00898
"	0.10	0.00425	"	0.05	0.00617
$CdCl_2$	0.025	0.01040	"	0.10	0.00412
"	0.05	0.00780	"	0.20	0.00286
"	0.10	0.00578	KCl	0.025	0.00872
"	0.20	0.00427	"	0.05	0.00593
$CaCl_2$	0.025	0.00899	"	0.10	0.00399
"	0.05	0.00624	"	0.20	0.00265
"	0.10	0.00417	"	0.80	0.00170
"	0.20	0.00284	NaCl	0.025	0.00869
$CuCl_2$	0.025	0.00905	"	0.05	0.00592
"	0.05	0.00614	"	0.10	0.00395
"	0.10	0.00422	"	0.20	0.00271
"	0.20	0.00291	$TlClO_3$	0.025	0.00897
HCl	0.025	0.00869	"	0.025	0.00894
"	0.05	0.00585	$TlNO_3$	0.025	0.00883
"	0.10	0.00384	"	0.05	0.00626
"	0.20	0.00254	"	0.10	0.00423

SOLUBILITY OF THALLIUM CHLORIDE IN AQUEOUS SALT SOLUTIONS AT 25°.

(Noyes, 1890; Noyes and Abbott, 1895; Geffcken, 1904.)

Aq. Salt Solution.	G. Mols. per Liter.		Gms. per Liter.	
	Salt.	TlCl.	Salt.	TlCl.
Ammonium Nitrate NH_4NO_3	0	0.01612	0	3.861 (G.)
"	0.5	0.02587	40.02	6.209
"	1	0.03121	80.05	7.473
"	2	0.03966	160.10	9.497
Barium Chloride $BaCl_2$	0.0283	0.00857	5.895	2.052 (N.)
"	0.1468	0.00323	30.59	0.773
Cadmium Sulfate $CdSO_4$	0.030	0.0206	6.255	4.933 (N.)
"	0.0787	0.0254	16.41	6.081
"	0.1574	0.0309	32.82	7.399
Hydrochloric Acid HCl	0.0283	0.00836	1.032	2.002 (N.)
"	0.0560	0.00565	2.043	1.353
"	0.1468	0.00316	5.357	0.757
Lithium Nitrate $LiNO_3$	0.5	0.02542	34.53	6.085 (G.)
"	1	0.03035	69.07	7.266
"	2	0.03785	138.14	9.063
"	3	0.04438	207.21	10.630
Potassium Chlorate $KClO_3$	0.5	0.0237	61.28	5.674 (G.)
Potassium Nitrate KNO_3	0.015	0.0170	1.517	4.070 (N.)
"	0.030	0.0179	3.033	4.286
"	0.0787	0.0192	7.775	4.597
"	0.1574	0.0212	15.920	5.076
"	0.5	0.0257	50.55	6.153 (G.)
"	1	0.0308	101.11	7.375
"	2	0.0390	202.22	9.340
Sodium Acetate CH_3COONa	0.015	0.0168	1.231	4.023 (N.)
"	0.030	0.0172	2.462	4.118
"	0.0787	0.0185	6.46	4.430
"	0.1574	0.0196	12.92	4.693
Sodium Nitrate $NaNO_3$	0.5	0.02564	42.50	6.139 (G.)
"	1	0.03054	85.01	7.313
"	2	0.03851	170.02	9.221
"	3	0.04544	255.03	10.88
"	4	0.05128	340.12	12.28
Sodium Chlorate $NaClO_3$	0.5	0.02320	53.25	5.555 (G.)
"	1	0.02687	106.5	6.433
"	2	0.03060	213	7.326
"	3	0.03303	319.5	7.909
"	4	0.03850	426	9.215
Thallium Bromate $TlBrO_3$ (at 39.75°)	0.01567	0.01959	5.201	4.690 (N. & A.)
Thallium Nitrate $TlNO_3$	0.0283	0.0083	7.518	1.987 (N.)
"	0.0560	0.00571	14.89	1.368
"	0.1468	0.00332	39.05	0.795
Thallium Sulfate Tl_2SO_4	0.0283	0.00886	14.27	2.121 (N.)
"	0.0560	0.00624	28.23	1.494
Thallium Thiocyanate TlSCN	0.0107	0.0119	2.802	2.849 (N.)
" (at 39.75°)	0.02149	0.01807	5.632	4.326 (N. & A.)

NOTE. — In the case of the results for thallium bromate and thallium thiocyanate at 39.75°, the solutions were saturated with respect to these salts as well as with respect to thallium chloride.

SOLUBILITY OF THALLOUS CHLORIDE IN AQUEOUS SOLUTIONS OF SALTS.

(Butler and Hiscocks, 1926.)

Constant agitation was employed and equilibrium was approached from above and from below. The thallium was determined by titration with standard permanganate except in cases where thallous salts were used in the solvent.

Salt.	Mols. salt. per liter.	$d\frac{t^\circ}{4}$ of sat. sol.	Mols. TlCl. per liter.
	Results at 0°.		
None (= Water)		1.0014	0.00670
KNO_3	0.05	1.0039	0.00787
»	0.20	1.0155	0.00955
»	0.50	1.0349	0.01184
»	1.00	1.0661	0.01472
$ZnSO_4$	0.05	1.0105	0.00875
»	0.10	1.0188	0.00979
»	0.30	1.0674	0.01214
»	0.5994	1.1015	0.01423
$La_2(SO_4)_3$	0.01	1.0063	0.00746
»	0.015	1.0088	0.00805
»	0.02	1.0110	0.00828
»	0.025	1.0135	0.00845
	Results at 25°.		
None (= Water)		1.0004	0.01607
KCl	0.05	1.0003	0.00586
»	0.10	1.0033	0.00387
»	0.20	1.0063	0.00258
»	0.50	1.0203	0.00176
$TlNO_3$	0.65	1.0078	0.00615
»	0.10	1.0202	0.00413
»	0.20	1.0399	0.00300
KNO_3	0.05	1.0038	0.01826
»	0.20	1.0138	0.02151
»	0.50	1.0327	0.02556
»	1.00	1.0619	0.03030
Tl_2SO_4	0.025	1.0098	0.00680
»	0.05	1.0186	0.00463
$ZnSO_4$	0.05	1.0097	0.01801
»	0.10	1.0184	0.01836
»	0.30	1.0515	0.01913
»	0.5994	1.0993	0.01937
$La_2(SO_4)_3$	0.01	1.0055	0.01801
»	0.015	1.0079	0.01836
»	0.02	1.0098	0.01913
»	0.025	1.0122	0.01937
	Results at 50°		
None (= Water)		0.9950	0.03265
KCl	0.05	0.9943	0.01835
»	0.10	0.9957	0.01281
»	0.20	0.9996	0.00893
»	0.50	1.0121	0.00606
$TlNO_3$	0.10	1.0131	0.01381
»	0.20	1.0321	0.01010
Tl_2SO_4	0.025	1.0012	0.02061
»	0.05	1.0140	0.01567
KNO_3	0.05	0.9989	0.03598
»	0.20	1.0088	0.04136
»	0.50	1.0273	0.04794
»	1.00	1.0571	0.05524
$ZnSO_4$	0.05	1.0046	0.04027
»	0.10	1.0249	0.04457
»	0.30	1.0459	0.05349
»	0.5994	1.0952	0.06163

Cl

THALLIUM CHLORIDE

SOLUBILITY OF THALLIUM CHLORIDE AT 25° IN AQUEOUS SOLUTIONS OF:

(Randall and Chang, 1928.)

Magnesium Sulfate				Lanthanum Nitrate			
Gm. Mols. per 1000 gms. H_2O		Gm. Mols. per 1000 gms. H_2O.		Gm. Mols. per 1000 gms. H_2O		Gm. Mols. per 1000 gms. H_2O	
$MgSO_4$	TlCl	$MgSO_4$	TlCl	$La(NO_3)_3$	TlCl	$La(NO_3)_3$	TlCl
0.000	0.01611	0.06259	0.02214	0.005215	0.01740	0.04180	0.02129
0.01708	0.01920	0.1291	0.02504	0.008808	0.01778	0.08166	0.02433
0.03364	0.02042	0.1994	0.02641	0.02024	0.01946	0.1970	0.02697
0.04384	0.02106	0.3529	0.02878				

SOLUBILITY OF THALLIUM CHLORIDE IN AQUEOUS SOLUTIONS OF CADMIUM CHLORIDE AT 25°.

(Benrath and Ammer, 1929.)

Gms. per 100 gms. H_2O		Solid Phase	Gms. per 100 gms. H_2O		Solid Phase
$TlCl$	$CdCl_2$		$TlCl$	$CdCl_2$	
0.376	0.0	$TlCl$	0.033	52.96	$TlCl.CdCl_2$
0.024	9.27	$TlCl.CdCl_2$	0.034	76.16	"
0.016	19.27	"	0.041	93.70	"
0.019	23.60	"	0.043	99.25	"
0.023	37.59	"	0.052	125.02	"
			0.0	131.5	$CdCl_2$

SOLUBILITY OF THALLIUM CHLORIDE AT 25° IN AQUEOUS SOLUTIONS OF:

(Benrath and Ammer, 1929.)

Barium Chloride		Calcium Chloride		Strontium Chloride	
Gms. per 100 gms. H_2O		Gms. per 100 gms. H_2O		Gms. per 100 gms. H_2O	
$BaCl_2$	$TlCl$	$CaCl_2$	$TlCl$	$SrCl_2$	$TlCl$
2.0	0.070	5.0	0.040	5.0	0.042
5.0	0.043	18.5	0.060	10.0	0.040
10.0	0.041	28.3	0.109	20.0	0.045
18.0	0.044	41.28	0.154	30.0	0.062
25.0	0.044	45.30	0.203	40.0	0.074
30.0	0.063	67.77	0.488	50.0	0.098
36.32	0.086	88.67	0.875	53.4	0.134

Cl

The solid phase is $TlCl$ in all cases.

SOLUBILITY OF THALLIUM CHLORIDE IN AQUEOUS SOLUTIONS OF MERCURIC CHLORIDE AT 25°.

(Benrath and Ammer, 1929.)

Gms. per 100 gms. H_2O		Solid Phase	Gms. per 100 gms. H_2O		Solid Phase
$HgCl_2$	$TlCl$		$HgCl_2$	$TlCl$	
0.037	0.289	$TlCl$	2.146	0.065	$TlCl.HgCl_2$
0.072	0.270	"	3.748	0.059	"
0.291	0.144	"	4.691	0.057	"
1.303	0.091	$TlCl.HgCl_2$	6.346	0.034	"
1.561	0.078	"	7.218	0.0	$HgCl_2$

SOLUBILITY OF THALLIUM CHLORIDE IN AQUEOUS SOLUTIONS OF MAGNESIUM CHLORIDE AT 25°.

(Benrath and Ammer, 1929.)

Gms. per 100 gms. H_2O		Solid Phase	Gms. per 100 gms. H_2O		Solid Phase
$MgCl_2$	$TlCl$		$MgCl_2$	$TlCl$	
0.58	0.091	$TlCl$	30.0	0.076	$TlCl$
2.78	0.053	"	38.75	0.146	"
5.50	0.045	"	40.28	0.137	$3TlCl.MgCl_2$
11.69	0.033	"	44.47	0.085	"
17.19	0.040	"	51.41	0.020	"
20.00	0.055	"	54.15	0.007	"

THALLIUM CHLORIDE

SOLUBILITY OF THALLIUM CHLORIDE IN AQUEOUS SOLUTIONS OF ZINC CHLORIDE AT 25°.

(Benrath and Ammer, 1929.)

Gms. per 100 gms. H_2O		Solid Phase	Gms. per 100 gms. H_2O		Solid Phase
$ZnCl_2$	TlCl		$ZnCl_2$	TlCl	
0.0	0.376	TlCl	160.9	4.67	$3TlCl.ZnCl_2$
1.11	0.04	"	163.7	5.49	$2TlCl.ZnCl_2$
2.52	0.007	"	229.9	12.11	"
11.15	0.059	"	246.0	18.52	"
37.55	0.186	"	303.1	33.59	"
76.40	0.780	$3TlCl.ZnCl_2$	323.7	42.31	"
92.47	0.950	"	332.7	49.31	"
126.00	1.97	"	354.4	30.00	"
138.1	2.49	"	367.3	22.97	"
145.8	3.75	"	390.4	0.0	$ZnCl_2$

SOLUBILITY OF THALLIUM CHLORIDE IN AQUEOUS SOLUTIONS OF ZINC SULFATE AT 25°.

(LaMer and Goldman, 1929.)

Gm. Mols. per liter		Gm. Mols. per liter	
$ZnSO_4$	TlCl	$ZnSO_4$	TlCl
0.05	0.02059	0.30	0.02770
0.10	0.02279	0.5994	0.03203

SOLUBILITY OF THALLIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SALTS AT 25°

(Bray and Winninghoff, 1911.)

Solvent.			Saturated Solution.		
Salt Present.	Gms. Equiv. Salt. per Liter.	d_{25} of Aq. Solvent.	Gms. Equiv. Salt per Liter.	d_{25} of Sat. Sol.	Gms. Equiv. TlCl per Liter.
None	...	...	...	0.9994	0.01607
KNO_3	0.02001	0.9973	0.020	1.0009	0.01716
"	0.05000	0.9992	0.04997	1.0028	0.01826
"	0.10005	1.0023	0.09998	1.0063	0.01961
"	0.3002	1.0145	0.3000	1.0194	0.02313
"	1.0005	1.0568	0.9996	1.0632	0.03072
K_2SO_4	0.01997	0.9975	0.01996	1.0012	0.01779
"	0.05000	0.9995	0.04996	1.0037	0.01942
"	0.1000	1.0030	0.09989	1.0074	0.02137
"	0.3000	1.0167	0.29966	1.0221	0.02600
"	1	1.0628	0.9986	1.0698	0.03416
Tl_2SO_4	0.0200	1.0007	0.01999	1.0028	0.01034
"	0.0500	1.0076	0.04999	1.0090	0.006772
"	0.1000	1.0191	0.09997	1.0200	0.004679

One liter of water dissolves 2.7 gms. *thallo thallic chloride* $3TlCl.TlCl_3$ at 15°-17°, and 35 gms. at 100°. (Crookes, 1864; Lamy; Hebberling.)

THALLIUM CHLORIDE

SOLUBILITY OF THALLIUM CHLORIDE IN AQUEOUS SOLUTIONS OF AMINO ACIDS AT 25°.

(Failey, 1933.)

Aq. Solvent		Gm. Mol. TlCl	Aq. solvent		Gm. Mol. TlCl
Amino Acid	Gm. Mols. per liter	per liter	Amino Acid	Gm. Mols. per liter	per liter
Glycylglycine	0.2	0.01835	α Amino n Butyric Ac.	0.1	0.01648
Glycine	0.2	0.01725	" " " " "	0.2	0.01688
α Alanine	0.2	0.01703	" " iso " "	0.2	0.01679
Urea	0.2	0.01642	" " n Valeric "	0.1	0.01627
Diketo piperazine	0.1	0.01602	" " " "	0.2	0.01633

SOLUBILITY OF THALLIUM CHLORIDE IN AQUEOUS SOLUTIONS OF GLYCINE ALONE AND IN PRESENCE OF ACID AND BASE AT 25°.

(Failey, 1932.)

Gm. Mols. per 1000 gms. H_2O		Gm. Mols. TlCl	Gm. Mols. per 1000 gms. H_2O		Gm. Mols. TlCl
Glycine	HNO_3 or NaOH	per 1000 gms. H_2O	Glycine	HNO_3 or NaOH	per 1000 gms. H_2O
0.00	—	0.01617	0.10	0.025 NaOH	0.01810
0.010	—	0.01623	0.10	0.050 "	0.01902
0.030	—	0.01634	0.10	0.075 "	0.01978
0.050	—	0.01648	0.10	0.100 "	0.02051
0.100	—	0.01678	—	0.025 HNO_3	0.01734
0.200	—	0.01745	—	0.050 "	0.01821
0.10	0.025 HNO_3	0.01794	—	0.075 "	0.01887
0.10	0.050 "	0.01868	—	0.100 "	0.01945
0.10	0.075 "	0.01925	—	0.025 NaOH	0.01777
0.10	0.100 "	0.01979	—	0.050 "	0.01896
			—	0.075 "	0.01995
			—	0.100 "	0.02086

SOLUBILITY OF THALLIUM CHLORIDE IN AQUEOUS SOLUTIONS OF EDESTIN NITRATE AT 25°.

(Failey, 1932a.)

Per 1000 gms. H_2O of sat. sol.			Per 1000 gms. H_2O of sat. sol.		
Gms. Edestin	Gm. Mol. HNO_3	Gm. Mol. TlCl	Gms. Edestin	Gm. Mol. HNO_3	Gm. Mol. TlCl
0.0	0.025	0.01734	0.0	0.050	0.01821
4.5	0.025	0.01763	5.2	0.050	0.01842
13.4	0.025	0.01802	10.1	0.050	0.01861
13.8	0.025	0.01827	24.2	0.050	0.01953
30.1	0.025	0.01924	28.1	0.050	0.01971
34.7	0.025	0.01948	45.9	0.050	0.02131
48.8	0.025	0.02043			

100 gms. Methyl Alcohol (CH_3OH) dissolve 0.000029 gm. equiv. TlCl at 25°. (Buckley and Hartley, 1929.)

100 gms. Liquid Sulfur Dioxide (SO_2) dissolve 0.007 gm. TlCl at 0°. (Jander and Ruppolt, 1937.)

THALLIUM CHLORATE $TlClO_3$.

SOLUBILITY IN WATER.

(Muir, 1876.)

t°.	0°.	20°.	50°.	80°.	100°.
Gms. $TlClO_3$ per 100 gms. H_2O	2	3.92	12.67	36.65	57.31

One liter sat. aq. solution contains 38.51 gms. $TlClO_3$ at 20°. (Noyes and Farrel, 1911.)

One liter of aqueous solution, saturated with both salts, contains 30.4 gms. $TlClO_3$ + 34.43 gms. Tl_2SO_4 at 20°. (Noyes and Farrel, 1911.)

SOLUBILITY OF MIXED CRYSTALS OF THALLIUM CHLORATE AND POTASSIUM CHLORATE IN WATER AT 10°.

(Roozeboom, 1891.)

NOTE. — Solutions of the two salts were mixed in different proportions and allowed to crystallize, such amounts being taken that not more than one or two grams would separate from one liter.

Gms. per 1000 cc. Solution.		Mg. Mols. per 1000 cc. Solution.		Sp. Gr. of Solutions.	Mols. per cent $KClO_3$ in Mixed Crystals.
$TlClO_3$.	$KClO_3$.	$TlClO_3$.	$KClO_3$.		
25.637	...	89.14	...	1.0210	0
19.637	6.884	68.27	56.15	1.0222	2
12.001	26.100	41.73	212.89	1.0278	12.61
9.036	40.064	31.42	326.79	1.0338	25.01
7.885	46.497	27.42	379.26	1.0359	36.30–97.93
7.935	46.535	27.60	379.57	1.0360	
6.706	46.410	23.32	378.55	1.0357	99.28
6.723	47.109	23.37	384.25	1.0363	99.60
4.858	47.312	16.89	385.91	1.0345	99.62
2.769	47.134	9.63	384.46	1.0330	99.67
...	49.925	...	407.22	1.0330	100

C10

SOLUBILITY OF MIXED CRYSTALS OF THALLIUM CHLORATE AND POTASSIUM CHLORATE IN WATER AT DIFFERENT TEMPERATURES.

(Quoted by Rabe, 1902.)

100 gms. H_2O dissolve 2.8 gms. $TlClO_3$ + 3.3 gms. $KClO_3$ at 0°.
" H_2O dissolve 10 gms. $TlClO_3$ + 1.5 gms. $KClO_3$ at 15°.
" H_2O dissolve 12.67 gms. $TlClO_3$ + 16.2 gms. $KClO_3$ at 50°.
" H_2O dissolve 57.3 gms. $TlClO_3$ + 48.2 gms. $KClO_3$ at 100°.

THALLIUM PerCHLORATE $TlClO_4$.

SOLUBILITY IN WATER.

(Carlson, 1910.)

t°.	Sp. Gr. Sat. Sol.	Gms. $TlClO_4$ per 100 Gms. H_2O.	t°.	Sp. Gr. Sat. Sol.	Gms. $TlClO_4$ per 100 Gms. H_2O.
0	1.060	6	50	1.251	39.62
10	1.075	8.04	70	1.430	65.32
30	1.146	19.72	80	1.520	81.49

100 gms. H_2O dissolve 10 gms. $TlClO_4$ at 15° and 166.6 gms. at 100°. (Roscoe, 1866.)

100 gms. Liquid Sulfur Dioxide (SO_2) dissolve 0.013 gm. $TlClO_4$ at 0°. (Jander and Ruppolt, 1937.)

THALLIUM CHROMATE Tl_2CrO_4.

100 gms. H_2O dissolve 0.03 gm. Tl_2CrO_4 at 60°, and 0.2 gm. at 100°. (Browning and Hutchins, 1900.)

One liter of aq. 31 per cent KOH solution dissolves 18 gms. Tl_2CrO_4. (Lepierre and Lachand, 1891.)

One liter of H_2O dissolves 0.35 gm. thallium trichromate, $Tl_2Cr_3O_{10}$, at 15°, and 2.27 gms. at 100°. (Crookes, 1864.)

CrO

SOLUBILITY OF THALLIUM CHROMATE IN WATER AND IN AQUEOUS SOLUTIONS AT 20°.

(Moser and Brukl, 1926.)

Constant agitation was employed for securing saturation.

Solvent.	Gms. Tl_2CrO_4 per liter sat. sol.	Solvent.	Gms. Tl_2CrO_4 per liter sat. sol.
Water	0.0427	Aq. 2 % NH_3 + 1 % K_2CrO_4	0.0100
Aq. 60 % Ethyl Alcohol	0.0092	» » » + 2 % »	0.0095
» 70 % » »	0.0080	» 5 % » + » »	0.0142
» 80 % » »	0.0072	» 10 % » + » »	0.0205
» 96 % » »	0.0060	» 2 % » + 4 % » + 10 % Alcohol	0.0060

THALLIUM FLUORIDE TlF.

100 gms. H_2O dissolve 80 gms. TlF at 15°. (Büchner, 1865.)

THALLIUM IODIDE TlI

One liter sat. solution in water contains 0.0362 gm. at 9.9°, 0.056 gm. at 18.1° and 0.0847 gm. at 26°. (Kohlrausch, 1908.)

I

SOLUBILITY OF THALLIUM IODIDE IN WATER.

(Average results from Bottger, 1903; Kohlrausch, 1904–05; Werther; Crookes, 1864; Lamy; Hebberling.)

t°.	0°.	20°.	40°.	60°.	80°.	100°.
Gms. TlI per liter	0.02	0.06	0.15	0.35	0.70	1.20

One liter of 2½ per cent aq. ammonia dissolves 0.761 gm. TlCl.
One liter of 6½ per cent aq. ammonia dissolves 0.758 gm. TlCl.
One liter of 90 per cent alcohol dissolves 0.0038 gm. TlCl.
One liter of 50 per cent alcohol dissolves 0.027 gm. TlCl. (Long, 1888.)

Data for the temperatures of solidification of mixtures of TlI and $TlNO_3$ are given by Van Eyk (1901).

1000 cc. sat. solution of thallous iodide in water contain 0.0000587 gm. mol. Tl I at 0° and 0.000235 gm. mol. at 25°. The determinations were made by the electrolytic conductivity method. (Jones and Schumb, 1921.)

Similar determinations by Davies and Robinson, 1937, gave 6.47×10^{-8} as the solubility product and 0.000254 gm. mols. (= 0.084 gms. LiI) per liter at 25° as the solubility of LiI in water.

100 gms. Liquid Sulfur Dioxide (SO_2) dissolve 0.06 gm. TlI at 0°.

IO (Jander and Ruppolt, 1937.)

THALLIUM IODATE $TlIO_3$.

One liter aq. solution contains 0.578 gm. $TlIO_3$ at 20°. (Böttger, 1903.)

One liter aqueous solution contains $1.76.10^{-4}$ mols. $TlIO_3$ at 25° = 0.667 gm., determined by means of electrodes of the third kind. (Spencer, 1912.)

SOLUBILITY OF THALLIUM IODATE IN AQUEOUS SALT SOLUTIONS AT 25°.

(LaMer and Goldman, 1929.)

Concentration of Aq. salt sol. in Gm. Mols. per liter	Gm. Mols. $TlIO_3$ per liter sat. sol.	Concentration of Aq. salt sol. in Gm. Mols. per liter	Gm. Mols. $TlIO_3$ per liter sat. sol.
H_2O alone	0.001819 (1)	0.01 $NaNO_3$	0.002486
0.001 K_2SO_4	0.001912	0.0333 Na_2SO_4	0.002543
0.002 "	0.001958	0.05 "	0.002740
0.005 "	0.002075	0.005 MgSO	0.002068
0.010 "	0.002193	0.01 "	0.002172
0.013 "	0.002252	0.025 "	0.002387
0.030 "	0.002513	0.05 "	0.002640
0.0333 "	0.002544	0.05 "	0.002625 (1)
0.05 "	0.002747	0.01 KCl	0.002005
0.064 "	0.002877	0.02 "	0.002107
0.15 "	0.003520	0.05 "	0.002335
0.25 "	0.004028	0.10 "	0.002625
0.50 "	0.005128	0.0333 $MgCl_2$	0.002544
0.01 KNO_3	0.001987	0.05 "	0.002744
0.02 "	0.002079	0.05 "	0.002755 (1)
0.05 "	0.002270	0.10 NaCl	0.002620
0.10 "	0.002492	0.0333 $Mg(NO_3)_2$	0.002459
0.30 "	0.003126	0.05 "	0.002621
0.50 "	0.003673	0.05 $ZnSO_4$	0.002789
1.00 "	0.004821	0.05 $CdSO_4$	0.002798 (1)
		0.05 $CdCl_2$	0.002708 (1)

(1) Results in a later paper by Friedman and LaMer, 1931.

IO

SOLUBILITY OF THALLIUM IODATE IN AQUEOUS SOLUTIONS OF AMINO ACIDS AT 25°.

(Failey, 1933.)

Conc. of Aq. Amino Acid Sol. in Gm. Mols. per liter	Gm. Mols. $TlIO_3$ per liter sat. sol.	Conc. of Aq. Amino Acid Sol. in Gm. Mols. per liter	Gm. Mols. $TlIO_3$ per liter sat. sol.
H_2O alone	0.001843	0.20 Sarcosine	0.001993
0.20 Glycylglycine	0.002282	0.10 α Amino n Butyric Ac.	0.001966
0.025 Glycine	0.001875	0.2 " "	0.001971
0.05 "	0.001907	0.025 Di methyl Glycine	0.001859
0.10 "	0.001917	0.05 " " "	0.001873
0.15 "	0.002033	0.10 " " "	0.001901
0.20 "	0.002098	0.20 " " "	0.001957
0.025 α Alanine	0.001872	0.05 α Amino iso Butyric Ac	0.001874
0.05 "	0.001907	0.10 " " " "	0.001901
0.10 "	0.001963	0.15 " " " "	0.001934
0.20 "	0.002084	0.20 " " " "	0.001956
0.025 β Alanine	0.001863	0.10 α Amino n Valeric Ac	0.001895
0.05 "	0.001884	0.20 " " "	0.001939
0.10 "	0.001919	0.025 Urea	0.001845
0.15 "	0.001964	0.05 "	0.001851
0.20 "	0.002001	0.10 "	0.001861
0.05 Sarcosine	0.001880	0.15 "	0.001876
0.10 "	0.001917	0.20 "	0.001891
0.15 "	0.001954	0.10 Diketopiperzine	0.001844

SOLUBILITY OF THALLIUM IODATE IN AQUEOUS SOLUTIONS OF SODIUM SALTS AT 25°.

(Falley, 1933a.)

Conc. of aq. salt sol. in Gm. Mols. per liter	Gm. Mols. $TlIO_3$ per liter sat. sol.	Conc. of aq. salt sol. in Gm. Mols. per liter	Gm. Mols. $TlIO_3$ per liter sat. sol.
H_2O alone	0.001843	0.005 $Na_6C_{12}O_{12}$	0.004980
0.0001 $Na_6C_{12}O_{12}$ (1)	0.001967	0.01 "	0.006184
0.0002 "	0.002092	0.02 NaCl	0.002118
0.0005 "	0.002426	0.04 "	0.002277
0.001 "	0.002901	0.10 "	0.002629
0.002 "	0.003636	0.01 NaOH	0.002003

IO (1) Sodium Mellitate.

The author also gives results at 25° for the solubility of Thallium Iodate in aq. 0.001 and 0.02 normal solutions of Sodium Mellitate to which various amounts of a third salt have been added.

SOLUBILITY OF THALLIUM IODATE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 25°.

(La Mer and Goldman, 1931.)

d. of sat. sol.	Wt. % C_2H_5OH in aq. solvent	Gm. Mol. $TlIO_3$ per liter sat. sol.	d. of sat. sol.	Wt. % C_2H_5OH in aq. solvent	Gm. Mol. $TlIO_3$ per liter sat. sol.
0.99718	0.0	0.001841	0.9478	31.61	0.000297
0.9894	4.25	0.001416	0.9304	40.51	0.000135
0.9780	11.56	0.000915	0.9167	46.91	0.00083
0.9644	21.37	0.000504	—	94.71	trace

THALLIUM NITRIDE TlN_3.

SOLUBILITY OF THALLIUM NITRIDE IN WATER.

(Curtius and Rissom, 1898.)

t°	Gm. TlN_3 per 100 gms. sat. sol.	Solid Phase
0	0.171	TlN_3
5	0.196	"
16	0.30	"

NO

THALLIUM NITRITE $TlNO_2$.

SOLUBILITY OF THALLIUM NITRITE IN WATER.

(Ferrari and Colla, 1937.)

t°	d. of sat. sol.	Gms. $TlNO_2$ per 100 gms. sat. sol.	t°	d. of sat. sol.	Gms. $TlNO_2$ per 100 gms. sat. sol.
0	1.1471	15.15	50	1.8041	55.10
5	1.1811	18.43	55	1.9611	61.60
10	1.2383	22.44	60	2.2600	68.40
15	1.2627	25.30	65	2.7080	77.50
20	1.2942	28.75	71	—	86.19
25	1.3601	32.10	78	—	91.49
30	1.4193	34.73	89	—	94.45
35	1.5061	39.95	98	—	95.78
40	1.5771	45.53	110	—	97.42
45	1.6751	49.85	182 m.pt.	—	100.00

THALLIUM NITRATE $TlNO_3$.

SOLUBILITY IN WATER.

(Berkeley, 1904; see also Etard, 1894; Crookes; Lamy.)

t°.	Gms. $TlNO_3$ per 100 Gms. Solution.	Gms. $TlNO_3$ per 100 Gms. Water.	t°.	Gms. $TlNO_3$ per 100 Gms. Solution.	Gms. $TlNO_3$ per 100 Gms. Water.
0	3.76	3.91	60	31.55	46.2
10	5.86	6.22	70	41.01	69.5
20	8.72	9.55	80	52.6	111.0
30	12.51	14.3	90	66.66	200.0
40	17.33	20.9	100	80.54	414.0
50	23.33	30.4	105	85.59	594.0

NO

Solid phase. $TlNO_3$ rhombic.
100 gms. H_2O dissolve 43.5 gms. $TlNO_3$ + 104.2 gms. KNO_3 at 58°. (Rabe, 1902.)

The freezing-point curve for the system thallium nitrate + thallium nitrite shows that a continuous series of mixed crystals is formed. (Cuttica, 1920.)

THALLIUM HYDROXIDE TlOH.

SOLUBILITY IN WATER.

(Bahr, 1911.)

t°.	$d_{\frac{t}{4}}$ of Sat. Sol.	Mols. TlOH per Liter.	Gms. TlOH per Liter.	t°.	Mols. TlOH per Liter.	Gms. TlOH per Liter.
0	1.231	1.151	254.4	44.5	2.442	539.8
18.5	1.317	1.554	343.4	54.1	2.940	649.7
29	1.342	1.803	398.5	64.6	3.601	795.8
32.1	1.377	1.861	411.2	78.5	4.673	1033
36	1.417	2.075	458.6	90	5.705	1261
40	1.446	2.240	495	99.2	6.708	1483

OH

The solutions were stirred by means of a current of hydrogen. The solid phase is the same at all temperatures.

THALLIUM HYDROXIDE (ic) $Tl(OH)_3$.

SOLUBILITY OF THALLIC HYDROXIDE IN AQUEOUS SOLUTIONS OF PERCHLORIC ACID AND OF SULFURIC ACID AT 25°.

(Sherrill and Haas, 1936.)

Results for Aq. Perchloric Acid

Wt. formality per liter $HClO_4$	Wt. formality per liter $Tl(OH)_3$
0.5246	0.00221
0.9912	0.01485
1.4943	0.04424
1.9297	0.08881

Results for Aq. Sulfuric Acid

Wt. formality per liter H_2SO_4	Wt. formality per liter $Tl(OH)_3$
0.1590	0.001255
0.2084	0.002753
0.2871	0.006880
0.4676	0.02402
0.5267	0.03294
0.6215	0.05038

Fusion-point data for Tl_2O + V_2O_5 are given by Canneri, 1928.)

THALLIUM Hypo PHOSPHITE TlH_2PO_2.

SOLUBILITY OF THALLIUM HYPO PHOSPHITE IN WATER.

(Ferrari and Colla, 1937.)

PO

t°	Gms. TlH_2PO_2 per 100 gms. sat. sol.	Solid Phase	t°	d. of sat. sol.	Gms. TlH_2PO_2 per 100 gms. sat. sol.	Solid Phase
- 7	43.68	Ice	0	2.538	77.69	TlH_2PO_4
-12	56.91	"	10	2.688	79.90	"
-17	63.63	"	20	2.827	81.53	"
-25 Eutec.	—	"+TlH_2PO_2	25	2.900	83.80	"
-23	70.93	TlH_2PO_2	35	3.049	86.32	"
-17	72.37	"	50	3.260	90.64	"
- 9.5	74.42	"	65	—	93.28	"
- 6.0	75.51	"	77	—	95.74	"
			100	—	98.62	"
			110m.pt.	—	100.00	"

THALLIUM PHOSPHATE (ortho) Tl_3PO_4.

One liter of sat. aqueous solution contains 4.97 gms. Tl_3PO_4 at 15° and 6.71 gms. at 100°. (Crookes, 1864.)

THALLIUM Per RHENATE $TlReO_4$.

SOLUBILITY OF THALLIUM PER RHENATE IN WATER.

(Noddack and Noddack, 1931.)

t°	Gms. $TlReO_4$ per liter sat. sol.	Solid Phase	t°	Gms. $TlReO_4$ per liter sat. sol.	Solid Phase
20.3	1.6	$TlReO_4$	42	5.8	$TlReO_4$
21.5	1.7	"	93	15.4	"
24.8	2.1	"			

THALLIUM SULFIDE Tl_2S.

S One liter of sat. aqueous solution contains 0.215 gm. Tl_2S at 20°. (Böttger, 1903.)

The results of Moser and Behr, 1924, and of Bruner and Zawadski, 1909, 1910, upon the solubility of Thallous Sulfide in Water are critically reviewed and recalculated by Kolthoff, 1931, and by Ravitz, 1936, in connection with similar results upon other methal sulfides.

A diagram and discussion of the fusion points of $Tl_2S + S$, $Tl_2S + Se$ and $Tl_2S + Te$ are given by Pelabon, 1907.

1000 cc. aq. 0.01 normal H_2SO_4, saturated with H_2S at 1 atmosphere pressure, dissolve 1.451 gms. Tl_2S at 20°. (Moser and Behr, 1924.)

THALLIUM SULFITE Tl_2SO_3.

SO 100 gms. H_2O dissolve 3.34 gms. Tl_2SO_3 at 15.5°. (Seubert and Elten, 1892.)

100 gms. Liquid Sulfur Dioxide (SO_2) dissolve 0.242 gm. Tl_2SO_3 at 0°. (Jander and Ruppolt, 1937.)

THALLIUM SULFATE Tl_2SO_4.

SOLUBILITY IN WATER.

(Berkeley, 1904; see also Crookes; Lamy.)

t°.	Gms. Tl_2SO_4 per 100 Gms. Solution.	Gms. Tl_2SO_4 per 100 Gms. Water.	t°.	Gms. Tl_2SO_4 per 100 Gms. Solution.	Gms. Tl_2SO_4 per 100 Gms. Water.
0	2.63	2.70	60	9.89	10.92
10	3.57	3.70	70	11.31	12.74
20	4.64	4.87	80	12.77	14.61
30	5.80	6.16	90	14.19	16.53
50	8.44	9.21	99.7	15.57	18.45

100 gms. H_2O dissolve 3.36 gms. Tl_2SO_4 at 6.5°, 4.3 gms. at 12° and 19.14 gms. at 100°. (Tutton, 1907.)

One liter sat. solution in water contains 48.59 gms. Tl_2SO_4 at 20° (Noyes and Farrel, 1911) and 54.59 gms. at 25° (Noyes and Stewart, 1911).

100 gms. H_2O simultaneously sat. with both salts dissolve:

4.74 gms. Tl_2SO_4 + 10.3 gms. K_2SO_4 at 15°.
11.5 " " + 16.4 " " 62°.
18.52 " " + 26.2 " " 100°. (Rabe, 1902.)

The following results for the solubility of Thallium Sulfate in Water at temperatures above 100° are by Benrath, Gjedebo, Schiffers and Wunderlich, 1937.

t°	Gms. Tl_2SO_4 per 100 gms. sat. sol.	t°	Gms. Tl_2SO_4 per 100 gms. sat. sol.	t°	Gms. Tl_2SO_4 per 100 gms. sat. sol.
116	17.7	173	25.5	271	34.4
130	18.8	188	27.0	359	37-76
146	21.5	208	29.0	365	78.8
153	22.4	225	31.2	380	85.7
167	28.8	241	32.4	632 m.pt.	100.0

SOLUBILITY OF THALLIUM SULFATE IN WATER. (Cohen, de Meester and Moesveld, 1924).

The authors used a specially designed apparatus and observed all precautions necessary for determinations of the highest accuracy.

t°.	30.0.	49.9.	60.0.
Gms. Tl_2SO_4 per 100 gms. sat. sol.	5.83	8.43	9.79

SOLUBILITY OF THALLIUM SULFATE IN WATER AT 30° AND UNDER HIGH PRESSURES.

(Cohen, Voller and Moesveld, 1923.)

Pressure in atmospheres	1	500	1000	1500
Gms. Tl_2SO_4 per 100 gms. sat. sol.	5.83	7.48	9.03	10.50

SOLUBILITY OF THALLIUM OXIDE (Tl_2O_3) IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°. (Meyer, 1923; Meyer and Wilk, 1924.)

Constant agitation in a thermostat was employed.

Per cent H_2SO_4.	Gms. per 100 cc. Aq. Sulfuric Acid Tl_2O_3.	$Tl(OH)SO_4.2H_2O$.	$HTl(SO_4)_2.4H_2O$.
20	16.2	25.2	–
40	9.8	15.2	–
50	2.52	–	2.9
70	0.30	–	0.61

The diagram given by the authors contains three branches, corresponding respectively to the solubility of Tl_2O_3 in dilute sulfuric acid and of the two sulfates, $Tl(OH)SO_4.2H_2O$ and $HTl(SO_4)_2 4H_2O$, in stronger acid. The existence of the basic salt $Tl(OH)SO_4.2H_2O$ requires a concentration of at least 10 % H_2SO_4. The space diagram but not the numerical data is given for determinations at temperatures between 20° and 95°.

SOLUBILITY OF THALLIUM SULFATE IN AQUEOUS SOLUTIONS AT 25°.

(Noyes and Stewart, 1911.)

Solvent.		Saturated Solution.				
Salt Present.	Formula Wts. Salt per Liter.	Formula Wts. Salt per Liter.	Formula Wts. Tl_2SO_4 per Liter.	d_{25} of Sat. Sol.	Gms. Salt per Liter.	Gms. Tl_2SO_4 per Liter.
$TlNO_3$	0.099±	0.0996	0.08365	...	26.51	42.17
Na_2SO_4	0.04995	0.0497	0.1080	1.0531	7.062	54.44
"	0.20	0.1988	0.1173	1.0754	28.25	59.13
$NaHSO_4$	0.1015	0.1010	0.1161	1.0596	12.12	58.53
H_2SO_4	0.04967	0.0494	0.1172	1.0540	4.878	59.09
"	0.09933	0.0987	0.1249	1.0604	9.747	62.95

SOLUBILITY OF THALLIUM SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°.

(D'Ans and Fritsche, 1909.)

Mols. per 1000 Gms. Sat. Sol.		Solid Phase.	Mols. per 1000 Gms. Sat. Sol.		Solid Phase.
H_2SO_4.	Tl_2SO_4.		H_2SO_4.	Tl_2SO_4.	
0	0.103	Tl_2SO_4	4.89	0.59	$TlHSO_4$
2.99	0.46	" $+Tl_3H(SO_4)_2$	4.92	0.66	"
4.25	0.61	$Tl_3H(SO_4)_2+TlHSO_4$	4.78	0.75	"
4.55	0.56	$TlHSO_4$	4.26	1.01	"
4.79	0.55	"	4.03	1.08	"

SO

EQUILIBRIUM IN THE SYSTEM THALLIUM SULFATE, ZINC SULFATE AND WATER.

(Benrath, 1931.)

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms. sat. sol.		Solid Phase
	Tl_2SO_4	$ZnSO_4$			Tl_2SO_4	$ZnSO_4$	
0	0.81	26.81	$ZnSO_4.7H_2O$ + 1.1.6	64.5	2.93	41.07	$ZnSO_4.H_2O$
"	2.74	0.97	Tl_2SO_4 + "	"	5.66	40.04	" + 1.1.6
17.6	1.37	34.69	$ZnSO_4.7H_2O$ + "	"	6.35	38.30	1.1.6
"	1.73	26.36	1.1.6	"	8.57	34.45	"
"	4.68	2.04	" + Tl_2SO_4	"	10.85	21.39	"
40.5	2.32	39.58	$ZnSO_4.6H_2O$ + 1.1.6	"	14.71	10.43	" + Tl_2SO_4
"	2.64	37.16	1.1.6	"	13.95	8.77	Tl_2SO_4
"	3.2	33,6	"	100	3.55	37.10	$ZnSO_4.H_2O$
"	3.91	28.2	"	"	11.97	34.58	" + 1.1.6
"	4.39	22.66	"	"	24.5	31.3	Tl_2SO_4 + "
"	6.12	9.97	"	"	23.7	12.11	Tl_2SO_4
"	6.82	7.30	"				
"	8.34	4.48	" + Tl_2SO_4				

1.1.6 = $Tl_2SO_4.ZnSO_4.6H_2O$.

100 gms. Liquid Sulfur Dioxide (SO_2) dissolve 0.021 gm. Tl_2SO_4 at 0°. (Jander and Ruppolt, 1937.)

THALLIUM DOUBLE SULFATES

SOLUBILITY IN WATER AT 25°.

(Locke, 1901.)

Double Sulfate.	Formula.	Salt per 100 cc. H_2O. Gms. Anhydrous.	Salt per 100 cc. H_2O. Gms. Mols.
Tl Copper Sulfate	$Tl_2Cu(SO_4)_2.6H_2O$	8.1	0.0122
Tl Nickel Sulfate	$Tl_2Ni(SO_4)_2.6H_2O$	4.61	0.007
Tl Zinc Sulfate	$Tl_2Zn(SO_4)_2.6H_2O$	8.6	0.0129

THALLIUM ALUMS

SOLUBILITY IN WATER AT 25°.
(Locke, 1901.)

Alum.	Formula.	Salt per 100 Grams H_2O. Gms. Anhydrous.	Gms. Hydrated.	Gm. Mols.
Tl Aluminum Alum	$TlAl(SO_4)_2.12H_2O$	7.5	11.78	0.0177
Tl Vanadium Alum	$TlV(SO_4)_2.12H_2O$	25.6	43.31	0.0573
Tl Chromium Alum	$TlCr(SO_4)_2.12H_2O$	10.48	16.38	0.0212
Tl Iron Alum	$TlFe(SO_4)_2.12H_2O$	36.15	64.6	0.0799

THALLI-THALLO SULFATE $Tl_2SO_4.Tl_2(SO_4)_3$.

SOLUBILITY OF THALLI-THALLO SULFATE IN AQUEOUS 16.36 PER CENT SULFURIC ACID.
(Benrath and Espenschied, 1922.)

t°.	Gms. $Tl_2SO_4.Tl_2(SO_4)_3$ per 100 gms. sat. sol.	t°.	Gms. $Tl_2SO_4.Tl_2(SO_4)_3$ per 100 gms. sat. sol.
48.5	17.26	61.0	16.89
55.2	16.69	65.5	16.23
60.5	16.89	83.5	15.35

The density of the aqueous H_2SO_4 was 1.115. Below 48° the ratio of Tl (1) and Tl (3) in the solution is no longer 1:1 as required for the double salt.

THALLIUM SELENATE Tl_2SeO_4.

SOLUBILITY IN WATER.

t°.	Gms. Tl_2SeO_4 per 100 Gms. H_2O.	Authority.
9.3	2.13	(Tutton, 1907.)
12	2.4	"
20	2.8	(Glauser, 1910.)
80	8.5	"
100	10.86	(Tutton, 1907.)

SeO

THALLIUM SELENATES $TlH(SeO_4)_2.2H_2O$ and $Tl(OH)SeO_4.H_2O$.

The system $Tl_2O_3 + SeO_3 + H_2O$ at 25° is described by Meyer and Wilk, 1924, but numerical data are not given. It is stated that the curve is almost identical with that of selenium sulfate but the transition point is at 45 % H_2SeO_4 instead of at 40 %.

THALLIUM VANADATES.

SOLUBILITY IN WATER. (Carnelly, 1873; Liebig, 1860.)

Vanadate.	Formula.	Gms. Vanadate per 100 Gms. H_2O. At 15°.	At 100°.
Tl. meta vanadate	$TlVO_3$	0.087 (11°)	0.21
" ortho vanadate	Tl_3VO_3	1	1.74
" pyro vanadate	$Tl_4V_2O_7$	0.20 (14°)	0.26
" vanadate	$Tl_{12}V_8O_{28}$	0.107	0.29

THULIUM OXALATE $Tm_2(C_2O_4)_3.9H_2O(?.10H_2O)$.

100 cc. aq. 20% methylamine oxalate dissolve approx. 4.082 gms. thulium oxalate.
100 cc. aq. 20% ethylamine oxalate dissolve approx. 5.728 gms. thulium oxalate.
100 cc. aq. 20% triethylamine oxalate dissolve approx. 1.340 gms. thulium oxalate.
(Grant and James, 1917.)

THULIUM Bromonitrobenzene SULFONATE $Tm(C_6H_3Br.NO_2.SO_3,1.4.2)_3.12H_2O$.

100 gms. sat. solution in water contain 6.379 gms. of the anhydrous salt at 25°.
(Katz and James, 1913.)

URANIUM U.

The percentage solubility of Uranium in Mercury at 20°, determined by filtering an amalgam of the metal through a sintered glass filter, was found by Irvin and Russell, 1932, to be less than 1×10^{-8}.

URANYL FORMATE $UO_2(HCOO)_2.H_2O$.

SOLUBILITY OF URANYL FORMATE IN AQUEOUS SOLUTIONS OF FORMIC ACID AT 25°.

(Colani, 1929.)

The solutions were kept in darkness during the period of saturation. When uranyl formate is dissolved in water or dilute solutions of formic acid, a precipitate of basic formate separates after a short time. This increases in solubility with increase in concentration of formic acid until the neutral formate is formed. This latter then decreases in solubility with increase in the concentration of formic acid.

CH

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
UO_2	HCOOH		UO_2	HCOOH	
0.076	0.012	$UO_3.2H_2O.UO_2(HCOO)_2.H_2O$	4.12	20.16	$UO_2(HCOO)_2.H_2O$
0.368	0.285	"	2.52	31.57	"
0.759	0.806	"	1.15	44.85	"
1.07	1.33	"	0.765	50.67	"
3.06	4.88	"	0.325	61.23	"
4.87	8.23	"	0.116	72.29	"
6.05	10.87 (1)	" + $UO_2(HCOO)_2.H_2O$	0.058	85.86	"
5.71	12.33	$UO_2(HCOO)_2.H_2O$	0.057	93.93	

(1) This result corresponds to 7.99 gms. $UO_2(HCOO)_2.H_2O$ per 100 gms. sat. solution at 25°.

URANYL ACETATE $UO_2(CH_3COO)_2.2H_2O$.

SOLUBILITY OF URANYL ACETATE IN AQUEOUS SOLUTIONS OF ACETIC ACID AT 25°.

(Colani, 1927a.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
UO_2	CH_3COOH		UO_2	CH_3COOH	
0.549	0.270	2.1	3.11	30.70	$UO_2(CH_3COO)_2.2H_2O$
0.883	0.499	"	2.88	36.9	"
1.11	0.618	"	2.65	41.1	"
1.28	0.747	"	2.36	46.4	"
2.07	1.20	"	1.87	56.7	"
4.12	2.32	" + 1.1.3	1.38	65.9	"
4.47	2.49	1.1.3	0.831	77.4	"
4.89	2.64 (1)	" + $UO_2(CH_3COO)_2.2H_2O$	0.858	79.9	" + 1.2.1
4.54	2.87	$UO_2(CH_3COO)_2.2H_2O$	0.645	81.6	1.2.1
4.07	4.55	"	0.405	88.2	"
3.79	11.3	"	0.306	97.8	
3.30	24.8	"			

2.1 = $2(UO_2)(OH)_2.UO_2(CH_3COO)$; 1.2.1 = $UO_2(CH_3COO)_2.2CH_3COOH.H_2O$;
1.1.3 = $UO_2(OH)_2.UO_2(CH_3COO)_2.3H_2O$.

(1) This result corresponds to 7.24 gm. $UO_2(CH_3COO)_2.2H_2O$ and 0.39 gm. free acetic acid per 100 gms. sat. solution.

URANYL FORMATE, ACETATE etc.

SOLUBILITY OF EACH SEPARATELY IN WATER.
(Courtois, 1914.)

Compound	Formula	t°	Gms. Anhydrous Cmpd. per liter sat. sol.
Uranyl Formate	$UO_2[HCOO]_2.H_2O$	15	72.0
" Acetate	$UO_2[CH_3COO]_2.2H_2O$	17	77.3
" Propionate	$UO_2[C_2H_5COO]_2.2H_2O$	19	84.8
" n Butyrate	$UO_2[C_3H_7COO]_2.2H_2O$	17	105.3
" Iso "	"	20	42.5
" n Valerate	$UO_2[C_4H_9.COO]_2.2H_2O$	14	37.2

100 gms. Methyl Alcohol dissolve 0.74 gm. anhydrous uranyl acetate at 15° and 0.83 gm. at 66° (b.pt.).

100 gms. Acetone dissolve 2.37 gms. anhydrous uranyl acetate at 15°. (Henstock, 1934.)

URANYL Ammonium PROPIONATE $2UO_2(C_3H_5O_2)_2.NH_4C_3H_5O_2.2H_2O$.

URANYL Potassium PROPIONATE $UO_2(C_3H_5O_2)_2.KC_3H_5O_2$. CH

100 gms. aq. solution contain 16.48 gms. $2UO_2(C_3H_5O_2)_2.NH_4C_3H_5O_2$ at 29.8°.

100 gms. aq. solution contain 2.362 gms. $UO_2(C_3H_5O_2)_2$ + 0.82 gm. $KC_3H_5O_2$ at 29.4°, atomic relation, 1: 1.29. (Rimbach, 1904.)

URANYL Potassium BUTYRATE $UO_2(C_4H_7O_2)_2.KC_4H_7O_2$.

The double salt is decomposed by water at ordinary temperatures and the solution gets richer in uranyl butyrate. The solubility at 29.4° in water containing $KC_4H_7O_2$ is 2.10 gms. $UO_2(C_4H_7O_2)$ + 0.38 gm. $KC_4H_7O_2$ per 100 gms. solution. The atomic relation being 1: 0.64. (Rimbach, 1904.)

URANIUM HELIANTHATE $(C_{14}H_{14}N_3SO_3)_2U.4H_2O$.

1000 cc. H_2O dissolve 0.30 gm. hydrated uranium helianthate at 20-25°. (Stark and Dehn, 1918.)

URANYL Ammonium CARBONATE $UO_2CO_3.2(NH_4)_2CO_3$.

SOLUBILITY IN WATER.
(Giolitti and Vecchiarelli, 1905.)

A large excess of the double carbonate was agitated with water at constant temperature and the clear saturated solutions analyzed. CO

t°.	Gms. per 100 Gms. Sat. Sol.			Mol. Ratio.		
	U.	CO_2.	NH_3.	U	: CO_2	: NH_3.
18.6	2.71	1.54	0.795	1	3.08	4.10
36.5	3.09	2.29	1.188	1	4.01	5.35
48.3	3.03	2.71	1.35	1	4.95	6.35
62	...	3.17	1.62	...	...	...
87.3	3.95	3.96	2.027	1	5.42	7.15

Theoretical molecular ratio for $UO_2CO_3.2(NH_4)_2CO_3$ = 1: 3: 4.

Thus at the lower temperature, the composition of the dissolved salt is very near the ratio corresponding to the formula.

The author calculates that 6.04 gms. of $UO_2CO_3.2(NH_4)_2CO_3$ are contained in 100 gms. of the sat. solution at 18.6° (a recalculation from the U value, 2.71, indicates that this figure should be 5.26 gms.).

URANYL Campho CARBONATE $UO_2(C_{11}H_{15}O_3)_2$.

SOLUBILITY OF URANYL CAMPHO CARBONATE IN SEVERAL SOLVENTS.
(Picon, 1931.)

Solvent	t°	Gms. $UO_2(C_{11}H_{15}O_3)_2$ per liter sat. sol.	Solvent	t°	Gms. $UO_2(C_{11}H_{15}O_3)_2$ per liter sat. sol.
Ethyl Ether	7	22.4	Benzene	7	79.1
Acetone	7	13.5	Chloroform	7	61.0
Ethyl Acetate	7	52.6	Olive Oil	15	5.84

URANYL OXALATE $UO_2.C_2O_4.3H_2O$.

100 gms. H_2O dissolve 0.7401 gm. $UO_2C_2O_4.3H_2O$ at 25°. (Dittrich, 1899.)

SOLUBILITY OF URANYL OXALATE IN WATER. (Colani, 1925.)

t°	11.0	15.0	20.0	50.0	75.0	100.0
Gms. $UO_2C_2O_4$ per 100 gms. sat. sol.	0.45	0.47	0.50	1.00	1.65	3.06

The solid phase was $UO_2.C_2H_4.3H_2O$ in all cases.

SOLUBILITY OF URANYL OXALATE IN AQUEOUS SOLUTIONS OF ACIDS.
(Colani, 1925)

In Aq. HCl at 11°

Gms. per 100 gms. sat. sol.	
HCl.	$UO_2C_2O_4$
3.60	1.14
8.20	2.00
11.49	2.91
14.99	4.90
17.65	8.82

COO

In Aqueous Oxalic Acid at 15°

Gms. per 100 gms. sat. sol.		Solid Phase.	Gms. per 100 gms. sat. sol.		Solid Phase.
$H_2C_2O_4$.	$UO_2C_2O_4$		$H_2C_2O_4$.	$UO_2C_2O_4$.	
1.40	1.56	$UO_2.C_2O_4.3H_2O$	7.49	1.55	$H_2C_2O_4.2H_2$
2.66	1.86	"	7.55	1.20	"
4.12	2.02	"	7.56	0.78	"
5.18	2.09	"	7.48	0.39	"
7.33	2.19	"	7.46	0.00	"

In Aq. Nitric Acid at 20°.

Gms. per 100 gms. sat. sol.	
HNO_3.	$UO_2C_2O_4$.
1.84	0.79
5.34	1.19
12.14.	1.56
17.60	1.76
21.47	1.88
31.00	2.28

In Aq. Phosphoric Acid at 20°.

Gms. per 100 gms. sat. sol.	
H_3PO_4	$UO_2C_2O_4$
0.77	2.10
1.51	3.56
2.67	5.66
4.94	9.25
8.75	15.14
15.76	25.74

In Aq. Sulfuric Acid at 20°.

Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. so	
H_2SO_4.	$UO_2C_2O_4$.	H_2SO_4.	$UO_2C_2O_4$.
0.00	0.50	15.07	3.85
0.82	0.85	19.88	4.93
2.59	1.34	25.58	5.98
3.05	1.61	27.31	6.46
5.53	2.04	29.67	7.49

EQUILIBRIUM IN THE SYSTEM URANYL OXALATE, AMMONIUM OXALATE AND WATER.
(Colani, 1917.)

Results at 15°.

Gms. per 100 Gms. Sat. Solution.		Solid Phase.
$UO_2C_2O_4$.	$(NH_4)_2C_2O_4$.	
0.47	0	$UO_2C_2O_4.3H_2O$
7.19	2.14	" $+(NH_4)_2(UO_2)_2(C_2O_4)_3.3H_2O$
8.78	2.99	$(NH_4)_2(UO_2)(C_2O_4)_2.2H_2O+$ "
9.66	6.43	" $+(NH_4)_2C_2O_4.H_2O$
0	3.69	$(NH_4)_2C_2O_4.H_2O$

Results at 50°.

Gms. per 100 Gms. Sat. Solution.		Solid Phase.
$UO_2C_2O_4$.	$(NH_4)_2C_2O_4$.	
1	0	$UO_2.C_2O_4.3H_2O$
5.11	1.36	" $+(NH_4)_2(UO_2)_2(C_2O_4)_3$
19.89	8.52	$(NH_4)_2(UO_2)(C_2O_4)_2+$ "
23.82	15.90	" $+(NH_4)_2C_2O_4.H_2O$
0	9.36	$(NH_4)_2C_2O_4.H_2O$

Two determinations at 75° are also given.

EQUILIBRIUM IN THE SYSTEM URANYL OXALATE, POTASSIUM OXALATE AND WATER.

(Colani, 1916a.)

Results at 15°.

Gms. per 100 Gms. Sat. Solution.		Solid Phase.
$UO_2C_2O_4$.	$K_2C_2O_4$.	
0.47	0	$UO_2C_2O_4.3H_2O$
1.34	0.42	" $+K_2(UO_2)_2(C_2O_4)_3.4H_2O$
3.89	1.83	$K_2(UO_2)(C_2O_4)_2.3\frac{1}{2}H_2O+$ "
3.76	1.85	" $+K_6(UO_2)_2(C_2O_4)_5.10H_2O$
0.10	24.30	$K_2C_2O_4.H_2O+$ "
0	24.09	$K_2C_2O_4.H_2O$

Results at 50°.

Gms. per 100 Gms. Sat. Solution.		Solid Phase.
$UO_2P_2O_4$.	$K_2C_2O_4$.	
1	0	$UO_2C_2O_4.3H_2O$
3.45	1.11	" $+K_2(UO_2)_2(C_2O_4)_3.4H_2O$
9.82	4.83	$K_2(UO_2)(C_2O_4)_2+$ "
9.59	5.61	" $+K_6(UO_2)_2(C_2O_4)_5.10H_2O$
1.22	32.65	$K_2C_2O_4.H_2O+$ "
0	32.75	$K_2C_2O_4.H_2O$

SOLUBILITY OF URANYL OXALATE IN AQUEOUS SODIUM OXALATE AT 25°.

(Dittrich, 1899.)

Gms. $Na_2C_2O_4$ per 100 cc. Solution.	Gms. $UO_2.C_2O_4.3H_2O$ per 100 cc. Sat. Solution.
0.6706	2.0125
0.3353	0.9867
0.2235	0.6059

URANYL CHLORIDE $UO_2Cl_2.3H_2O$.

100 gms. H_2O dissolve 320 gms. UO_2Cl_2 at 18°. (Mylius and Dietz, 1901.)

SOLUBILITY OF URANYL AMMONIUM CHLORIDE, U. TETRA METHYL AMMONIUM CHLORIDE, U. TETRA ETHYL AMMONIUM CHLORIDE, U. CAESIUM CHLORIDE, U. RUBIDIUM CHLORIDE, AND U. POTASSIUM CHLORIDE IN WATER.

(Rimbach, 1904.)

Formula of Double Salt.	t°.	Gms. per 100 Gms. Sat. Sol.	Atomic Relation in Sol.	Solid Phase.
$UO_2Cl_2.2NH_4Cl.2H_2O$	15	$40.67UO_2+3.51NH_4+19.15Cl$	$1UO_2: 1.59NH_4: 3.59Cl$	1 Mol. double salt $+0.4$ Mol. NH_4Cl
$UO_2Cl_2.2N(CH_3)_4Cl$	29.8	19.85 " $+10.44Cl_2$ $=41.24$[*]	$1UO_2: 4.02Cl$	Double salt
	80.7	20.23 " $+10.52Cl_2$ $=41.91$[*]	$1UO_2: 3.98Cl$	"
$UO_2Cl_2.2N(C_2H_5)_4Cl$	27.1	15.02 " $+7.81Cl_2$ $=37.15$[†]	$1UO_2: 3.97Cl$	"
"	80.7	15.12 " $+7.78Cl_2$ $=37.23$[†]	$1UO_2: 3.94Cl$	"
$UO_2Cl_2.2CsCl$	29.75	22.11 " $+22.5$ Cs $=56.04$[‡]	$1UO_2: 2.07Cs$	"
$UO_2Cl_2.2RbCl.2H_2O$	24.8	27.18 " $+16.6$ Rb $+13.8Cl$[§]	$1UO_2: 1.96Rb: 3.90Cl$	"
"	80.3	30.66 " $+19.1Rb$ $+15.8Cl$[‖]	$1UO_2: 1.98Rb: 3.95Cl$	"
$UO_2Cl_2.2KCl.2H_2O$	0.8	38.57 " $+13.59Cl$ $+3.86K$	$1UO_2: 2.69Cl : 0.69K$	The double salt is decomposed by water at temperatures below 60°.
"	14.9	33.71 " $+13.51Cl$ $+$ ... K	$1UO_2: 3.06Cl : 1.06K$	
"	17.5	37.36 " $+14.50Cl$ $+5.27K$	$1UO_2: 2.96Cl : 0.96K$	
"	25	35.01 " $+15.26Cl$ $+$ ... K	$1UO_2: 3.33Cl : 1.33K$	
"	41.5	35.27 " $+15.92Cl$ $+7.39K$	$1UO_2: 3.44Cl : 1.44K$	
"	50	34.18 " $+16.56Cl$ $+$ ... K	$1UO_2: 3.71Cl : 1.71K$	
"	60	34.19 " $+17.25Cl$ $+9.14K$	$1UO_2: 3.85Cl : 1.85K$	
"	71.5	33.55 " $+17.44Cl$ $+9.28K$	$1UO_2: 3.96Cl : 1.96K$	Double salt
"	78.5	35.26 " $+18.24Cl$ $+9.95K$	$1UO_2: 3.95Cl : 1.95K$	"

$UO_2Cl_2.2N(CH_3)_4Cl$. [†] $UO_2Cl_2.N(C_2H_5)_4Cl$. [‡] $UO_2Cl_2.2CsCl$.

[§] $=57.9$ gms. $UO_2Cl_2.2RbCl_2$. [‖] $=65.8$ gms. $UO_2Cl_2.2RbCl_2$.

URANYL Penta Antipyrine Per **CHLORATE** $[UO_2(COC_{10}H_2N_2)_5](ClO_4)_2$.

100 cc sat. solution of Uranyl Penta Antipyrine Perchlorate in Water contain 0.46 gm. $[UO_2(COC_{10}H_{12}N_2)_5](ClO_4)_2$ at 20°. (Wilke-Dörfurt and Schliephake, 1929.)

URANYL Sodium **CHROMATE** $2(UO_2)CrO_4.Na_2CrO_4.10H_2O$.

100 gms. sat. aqueous solution contain 52.52 gms. $2(UO_2)CrO_4Na_2CrO_4$ at 20°. (Rimbach, 1904.)

URANYL Double FLUORIDES with Organic Bases

SOLUBILITY OF EACH SEPARATELY IN WATER AT 20°.
(Olsson, 1930.)

F

Organic Base	Formula of Double Fluoride	Gms. Compound per 100 cc sat. sol.
Pyridine	$C_5H_5NHUO_2F_3.H_2O$	1.289
"	$C_5H_5NH(UO_2)_2F_5.3H_2O$	1.952
Quinoline	$C_9H_7NHUO_2F_3.H_2O$	0.126
"	$C_9H_7NH(UO_3)_2F_5.2H_2O$	0.979
Tetra Methyl Ammonium	$(CH_3)_4N(UO_2)_2F_5.2H_2O$	0.143
" Ethyl "	$(C_2H_5)_4NUO_2F_3$	0.716
" " "	$(C_2H_5)_4N(UO_2)_2F_5.2H_2O$	0.771
Tri methyl -p- Tolyl Ammonium	$C_6H_4CH_3(CH_3)_3.NUO_2.2H_2O$	1.645
" " " " "	$C_6H_4CH_3(CH_3)_3N(UO_2)_2F_5.H_2O$	3.091
Tri methyl pyridine	$C_5H_2(CH_3)_3NH(UO_2)_3F_7.6H_2O$	0.708
Di ethyl aniline	$C_6H_5N(C_2H_5)_2H(UO_2)_2F_3.2H_2O$	1.759
" " "	$C_6H_5N(C_2H_5)_2H(UO_2)_2F_5.H_2O$	3.896
Tri ethyl sulfine	$(C_2H_5)_3S(UO_2)_2F_5.2H_2O$	0.897

URANYL IODATE $UO_2(IO_3)_2$.

SOLUBILITY OF THE DIFFERENT CRYSTALLINE FORMS IN WATER AT 18°.
(Artmann, 1912–13.)

IO

	Appearance of Crystals.	Gms. $UO_2(IO_3)_2$ per 100 Gms. H_2O.
$UO_2(IO_3)_2.H_2O$	Type I warty, later prismatic needles	0.1049
"	Type II pyramids, sphenoids	0.1214
$UO_2(IO_3)_2.2H_2O$		0.2044

URANYL NITRATE $UO_2(NO_3)_2.6H_2O$.

SOLUBILITY IN WATER.
(Wasilieff, 1916.)

NO

t°.	Gms. $UO_2(NO_3)_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $UO_2(NO_3)_2$ per 100 Gms. Sat. Sol.	Solid Phase.
− 1.6	10.83	Ice	− 2.2	48.77	$UO_2(NO_3)_2.6H_2O$
− 2.1	12.24	"	0	49.46	"
− 2.9	17.19	"	5.5	50.55	"
− 4.4	23.52	"	12.3	52.88	"
− 6	26.20	"	21.1	55.98	"
− 7.9	32.53	"	25.6	57.17	"
−11.2	37.09	"	36.7	61.27	"
−18.1	43.12	" $+UO_2(NO_3)_2.6H_2O$	45.2	65.12	"
−12.1	45.53	$UO_2(NO_3)_2.6H_2O$	51.8	67.76	"

Data for the densities of uranyl nitrate solutions in water and other solvents are given by de Coninck (1900).

More recent determinations of the solubility of Uranyl Nitrate in Water by Guempel, 1929, gave the following results.

t°		Gms. $UO_2(NO_3)_2$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $UO_2(NO_3)_2$ per 100 gms. sat. sol.	Solid Phase
- 0.3		7.87	Ice	25.0	55.90	$UO_2(NO_3)_2.6H_2O$
- 2.9		17.33	"	25.0	56.08(1)	"
- 5.4		24.85	"	36.1	60.28	"
- 7.3		29.60	"	43.6	64.20	"
-18.0		43.04	"	54.5	70.25	"
-18.1	Eutec.	43.10	"$+UO_2(NO_3)_2.6H_2O$	57.4	72.76	"
-11.5		46.25	$UO_2(NO_3)_2.6H_2O$	58.6	75.65	"$+UO_2(NO_3)_2.xH_2O$
- 5.55		48.47	"	62.9	76.83	$UO_2(NO_3)_2.xH_2O$
+ 7.6		51.57	"	72.4	78.50	"
15.0		52.80	"	80.6	80.20	"
20.0		54.40	"	88.5	81.13	"

(1) Colani, 1928.

EQUILIBRIUM IN THE SYSTEM URANYL NITRATE, NITRIC ACID AND WATER AT 25°.

(Colani, 1926.)

NO

Gms. per 100 gms. sat. sol.			Gms. per 100 gms. sat. sol.		
Free HNO_3.	$UO_2(NO_3)_2$.	Solid Phase.	Free HNO_3.	$UO_2(NO_3)_2$.	Solid Phase.
0.0	56.08	$UO_2(NO_3)_2.6H_2O$	46.12	27.18	$UO_2(NO_3)_2.3H_2O$
12.35	40.36	»	50.43	25.79	»
25.14	30.29	»	53.20	26.77	»
28.67	29.65	»	53.71	27.49	»
29.84	31.27	»	55.24	27.24	$UO_2(NO_3)_2.2H_2O$
30.43	36.72	»	60.38	23.65	»
30.15	37.99	»	66.71	22.29	»
32.31	36.28	$UO_2(NO_3)_2.3H_2O$	68.83	22.49	»

SOLUBILITY OF URANYL NITRATE HEXAHYDRATE IN AQUEOUS NITRIC ACID AT 20°.

(Nichols, Howes, et. al. 1919.)

Per cent concentration of aq. HNO_3..........	10.0	20.0	30.0	40.0	70.0
Gms. $UO_2(NO_3)_2.6H_2O$ per 100 gms. solvent..	160.0	115.0	80.0	65.0	65.0

100 gms. abs. acetone dissolve 1.5 gms. $UO_2(NO_3)_2.6H_2O$ at 12°. (de Coninck, 1900.)
100 gms. 85% alcohol dissolve 3.3 gms. $UO_2(NO_3)_2.6H_2O$ at 12°. "

100 gms. sat. solution of anhydrous Uranyl Nitrate in Ethyl Ether contain 0.95 gm. $UO_2(NO_3)_2$ at 20°. (Guempel, 1929.)

SOLUBILITY OF URANYL NITRATE IN ETHER.

(Lebeau, 1911.)

When a large excess of uranyl nitrate is shaken with ether at 7°, two liquid layers are formed. The ethereal layer contains 59 gms. $UO_2(NO_3)_2$ per 100 gms. of solution and the aqueous layer contains 62.5 gms. per 100 gms. of solution. An elevation of temperature was noted when ether and $UO_2(NO_3)_2.6H_2O$ were mixed at room temperature, therefore, indicating that solution is accompanied by combination and elimination of the water of the salt.

EQUILIBRIUM IN THE SYSTEM URANYL NITRATE, ETHYL ETHER AND WATER AT 0°.

(Misciattelli, 1930.)

Gms. per 100 gms. lower layer			Gms. per 100 gms. upper layer			Solid Phase
$(C_2H_5)_2O$	H_2O	$UO_2(NO_3)_2$	$(C_2H_5)_2O$	H_2O	$UO_2(NO_3)_2$	
0	52.0	48.0	—	—	—	$UO_2(NO_3)_2.6H_2O$
4.15	47.47	48.38	45.15	10.29	44.56	"
5.00	46.30	48.70	41.17	13.56	45.27	"
5.50	65.50	38.00	67.50	6.50	26.00	None
6.48	65.00	28.52	87.85	3.02	9.13	"
9.48	66.56	25.09	86.46	6.95	6.58	"
7.05	73.50	19.38	97.49	0.96	1.55	"
9.79	77.74	12.47	98.53	1.60	0.31	"
11.6	88.40	—	99.0	1.0	—	"
—	—	—	68.0	7.0	24.5	"
—	—	—	78.0	—	22.0	"

EQUILIBRIUM IN THE SYSTEM URANYL NITRATE, ETHYL ETHER AND WATER AT 20°.

(Quempel, 1929; Misciatelli, 1930.)

NO

Gms. per 100 gms. lower layer			Gms. per 100 gms. upper layer			Solid Phase
$(C_2H_5)_2O$	H_2O	$UO_2(NO_3)_2$	$(C_2H_5)_2O$	H_2O	$UO_2(NO_3)_2$	
—	45.6	54.4	—	—	—(G)(M)	$UO_2(NO_3)_2.6H_2O$
3.30	42.47	54.23	38.12	12.80	49.08(G)	"
3.87	43.52	52.61	42.88	8.10	49.02(M)	"
4.00	60.0	36.0	67.10	7.0	25.90(M)	None
3.30	42.47	54.23	49.08	12.80	38.12(G)	"
4.5	72.0	23.5	96.0	1.50	2.5 (M)	"
5.3	56.44	38.26	62.50	8.25	29.25(G)	"
6.1	75.33	18.57	96.0	3.11	0.89(G)	"
6.50	93.5	—	99.0	1.0	— (M)	"
—	—	—	86.4	1.10	12.50(M)	$UO_2(NO_3)_2$
—	—	—	91.22	—	8.78(M)	"

URANYL Potassium **NITRATES** $UO_2(NO_3)_2.KNO_3$, $UO_2(NO_3)_2.2KNO_3$.

SOLUBILITY OF URANYL POTASSIUM NITRATES IN AQUEOUS NITRIC ACID AT 20°.

(Nichols, Howes et. al., 1919.)

Results for $UO_2.(NO_3)_2.KNO_3$

Per cent HNO_3 in solvent.	Gms. $UO_2.(NO_3)_2.KNO_3$ per 100 gms solvent	Solid Phase.
0.0	85.5	KNO_3
10.0	82.0	»
20.0	99.8	»
30.0	89 0	$UO_2(NO_3)_2.6H_2O$
30.0	89.5	$UO_2(NO_3)_2.KNO_3$
40.0	81.0	»
50.0	54.0	»
60.0	33.9	»

Results for $UO_2(NO_3)_2.2KNO_3$

Per cent HNO_3 in solvent.	Gms. $UO_2(NO_3)_2.2KNO_3$ per 100 gms. solvent.	Solid Phase.
0.0	62.9	KNO_3
10.0	52.2	»
20.0	45.7	»
30.0	51.8	»
40.0	67.2	»
50.0	52.3	$UO_2(NO_3)_2.2KNO_3$
50.0	57.2	$UO_2(NO_3)_2.KNO_3$

URANYL DOUBLE NITRATES.

SOLUBILITY OF URANYL AMMONIUM NITRATE + URANYL NITRATE; U. CAESIUM NITRATE + CAESIUM NITRATE; U. POTASSIUM NITRATE + POTASSIUM NITRATE AND U. RUBIDIUM NITRATE + RUBIDIUM NITRATE IN WATER.

(Rimbach, 1904.)

Formula of Salt.	t°.	Gms. per 100 Gms. Sat. Solution. UO_2.		Atomic Relation in Solution.
			Total Salt.	
$UO_2(NO_3)_2.NH_4NO_3$	0.5	29.71 + 2.92 NH_4	= ...	1 UO_2: 1.47 NH_4: 3.47 NO_3
"	24.9	36.46 + 3.54 "	= 68.95	" : 1.46 " : 3.46 "
"	59	44.37 + 2.90 "	= ...	" : 0.98 " : 2.98 "
"	80.7	44.95 + 2.98 "	= 78.95	" : 1 " : 3 "
$UO_2(NO_3)_2.CsNO_3$	16	31.39 + 6.59 Cs	= 55.4	" : 0.44 Cs
$UO_2(NO_3)_2.KNO_3$	0.5	31.98 + 1.72 K	= ...	" : 2.37 NO_3: 0.37 K
"	13	33.40 + 2.72 "	= ...	" : 2.57 " : 0.57 "
"	25	37.07 + 4.01 " *	= 64.82	" : 1.60 " : 0.76 "
"	45	42.18 + 5.16 "	= ...	" : 2.84 " : 0.84 "
"	59	41.65 + 6.03 "	= ...	" : 3 " : 1 "
"	80.6	43.71 + 6.38 "	= 80.1	" : 3.01 " : 1.01 "
$UO_2.(NO_3)_2.RbNO_3$	25	35.41 + 4.65 Rb†	= 59.60	" : 1.40 " : 0.45 Rb
"	80	34.66 + 11.01 "	= 69.49	" : 3 " : 1.01 "

* + 23.5NO_3. † + 19.74NO_3.

URANYL SULFATE $UO_2SO_4.3H_2O$.

SOLUBILITY IN SEVERAL SOLVENTS.

(de Coninck, 1901, 1903.)

Solvent	t°.	Gms. UO_2SO_4.-$3H_2O$ per 100 Gms. Solvent.	Solvent.	t°.	Gms. UO_2SO_4.-$3H_2O$ per 100 Gms. Solvent.
Water	13.2	18.9	Conc. HBr ($d = 1.21$)	12	16.8
Water	15.5	20.5	Conc. HNO_3	12	9.1
16.2% Alcohol	10	12.3	Conc. H_2SO_4 ($d = 1.138$)	13	24.3
85% Alcohol	16	2.6	1 Vol. HCl + 1 Vol. HNO_3	16	18
Conc. HCl	13	30	Selenic Acid ($d = 1.4$)	15	27

SOLUBILITY OF URANYL SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°.

(Colani, 1928.)

Gms. per 100 gms. sat. sol. UO_2SO_4	H_2SO_4 (free)	Solid Phase	Gms. per 100 gms. sat. sol. UO_2SO_4	H_2SO_4 (free)	Solid Phase
61.18	0.0	$UO_2SO_4.3H_2O$	6.62	59.83	1.1.5
58.96	1.64	"	4.69	63.82	"
47.96	10.56	"	3.81	67.40	"
30.03	25.42	"	4.70	70.70	"
28.65	26.99	" + $UO_2SO_4.2H_2O$	7.09	72.49	" + 1.1.2
27.25	28.00	$UO_2SO_4.2H_2O$	6.74	75.33	1.1.2
21.79	30.53	"	10.72	74.81	"
17.03	40.19	"	16.90	71.14	"
15.77	43.45	"	19.10	69.18	"
15.88	45.22	"	19.65	68.93	" + 1.1.1
17.74	47.75	" + 1.1.5	17.76	71.52	1.1.1
16.00	49.86	1.1.5	11.37	78.78	"
12.13	53.32	"	7.81	82.86	"
			3.77	89.62	"

1.1.5 = $UO_2SO_4.H_2SO_4.5H_2O$; 1.1.2 = $UO_2SO_4.H_2SO_4.2H_2O$; 1.1.1 = $UO_2SO_4.H_2SO_4.1H_2O$.

URANYL Potassium **SULFATE** $UO_2SO_4.K_2SO_4.2H_2O$.

100 gms. sat. aq. solution contain 10.41 gms. $UO_2SO_4.K_2SO_4$ at 25° and 23.13 gms. at 70.5°. (Rimbach, 1904.)

SOLUBILITY OF $UO_2SO_4.2K_2SO_4.2H_2O + UO_2SO_4.K_2SO.2H_2O$ IN WATER.

t°.	Gms. per 100 Gms. Solution.			Atomic Relation in Sol.			Mol. % in Solid Phase.	
	UO_2.	K.	SO_4.	UO_2.	K.	SO_4.	Mono Salt.	Di Salt.
14	0.85	4.19	5.71	1	35.75	18.88	29	71
50	6.70	8.15	12.37	1	5.20	8.40	76	24
80	14.29	8.54	15.53	1	4.13	3.06	12	88

URANIUM SULFATE (ous) $U(SO_4)_2$.

SOLUBILITY IN WATER.

(Giolitti and Bucci, 1905.)

t°.	Gms. $U(SO_4)_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $U(SO_4)_2$ per 100 Gms. Sat. Sol.	Solid Phase.
18	10.17	$U(SO_4)_2.8H_2O$	93	63.2	$U(SO_4)_2.8H_2O$
25.6	13.32	"	24	9.8	$U(SO_4)_2.4H_2O$
37	19.98	"	37	8.3	"
48.2	28.72	"	48.2	8.1 (7.8)	"
62	36.8	"	63	7.3	"

The determinations were made with difficulty on account of the considerable tendency towards formation of basic sulfate and simultaneous clouding of the solution.

APPROXIMATE SOLUBILITY OF URANIUM SULFATE, IN AQUEOUS SOLUTIONS.

(de Coninck, 1903.)

80

Solvent.	t°.	Gms. $U(SO_4)_2.4H_2O$ per 100 Gms. Solvent.	Solvent.	t°.	Gms. $U(SO_4)_2.4H_2O$ per 100 Gms. Solvent.
Water	11	23.2	Dilute Selenic Acid (1:4)	11.4	21.7
Dilute HCl (1:4)	9	17.2	Dilute H_2SO_4 (1:4)	10	15.6
Dilute HNO_3 (1:4)	10.5	18.2	Dilute Alcohol (1:4)	11.3	12.3

URANIUM SULFATE (ous) $U(SO_4)_2$.

SOLUBILITY OF URANIUM SULFATE IN 0.1 NORMAL SULFURIC ACID SOLUTIONS.

(Meyer and Nachod, 1924.)

Tenth normal sulfuric acid was used as solvent instead of water to prevent hydrolysis to $UO SO_4.2 H_2O$. The saturated solutions were prepared by constant agitation for 12 hours of 3-5 gms. of each hydrate with 10-12 cc. of 0.1 *n* acid.

t°.	Gms. $U(SO_4)_2$ per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. $U(SO_4)_2$ per 100 gms. sat. sol.	Solid Phase.
15.5....	6.61	$U(SO_4)_2.8H_2O$	92.0...	6.61	Polymeric 4 Hydrate
20.0....	8.78	"	22.7...	13.68	$U(SO_4)_2.4H_2O$
22.4....	9.68	"	25.0 ..	12.62	"
25.0....	11.22	"	30.4...	10.92	"
30.4.. .	13.88	"	40.0...	8.98	"
40.0....	18.50	"	50.0...	8.32	"
60.0....	29.93	"	80.0...	6.93	"

VANADIUM V.

The percentage solubility of Vanadium in Mercury at 20°, determined by filtering an amalgam of the metal through a sintered glass filter, was found by Irvin and Russell, 1932, to be less than 5×10^{-5}.

VANADIUM Pent OXIDE V_2O_5.

100 gms. sat. solution of Vanadium Pentoxide in Water at 25° contain 0.07 gm. V_2O_5 at 25° and 0.07 gm. at 100°. (Meyer and Aulich, 1930.)

XENON Xe.

SOLUBILITY IN WATER.

(von Antropoff, 1909–10.)

The results are in terms of the coef. of absorption β, as defined by Bunsen (see p. 553) and modified by Kuenen in respect to the substitution of mass for volume of water.

t°.	0°.	10°.	20°.	30°.	40°.	50°.
Abs. Coef. β	0.2180	0.1500	0.1109	0.0900	0.0812	0.0878

SOLUBILITY OF XENON IN WATER AND IN ANILINE. (Antropoff, 1919.)

The determinations were made with the highest accuracy possible. An apparatus was used in which the solvent and its vapor touched no cock. The results are expressed in terms of the Bunsen absorption coefficient β, as modified by Kuenen. They show the volume of xenon in cubic centimeters (reduced to 0° and 760 mm.) dissolved by *one gram* of solvent.

t	Coef. of absorption β in Water.	Coef. of absorption β in Aniline.
0	0.242	-
10	0.174	0.669
20	0.123	0.501
30	0.098	0.455
40	0.082	0.431
50	0.073	0.411

SOLUBILITY OF XENON IN LIQUID OXYGEN.

(v. Stackelberg, 1934.)

The determination of the saturation point was made by means of vapor pressure measurements.

t°	Mol. Xe per 1.0 mol. Xe + O
70	0.141
80	0.217
90	0.304

YTTRIUM BROMIDE YBr_3.

SOLUBILITY OF YTTRIUM BROMIDE IN WATER. (Crew, Stewart and Hopkins, 1925.)

The solutions were saturated by frequent agitation during 5 hours and equilibrium was approached from above and from below.

t°.	Gms. YBr_3 per 100 gms. H_2O.
0	64.0
30	83.3
50	96.1
75	111.3
95	129.6

YTTRIUM ACETATE $Y(CH_3COO)_3.4H_2O$.

100 gms. sat. solution of yttrium acetate in water prepared by constant rotation for 24 hours contained 8.28 gms. $Y(CH_3COOH)_3$ at 25°. (Meyer and Müller, 1920).

YTTRIUM GLYCOLATE $Y(C_2H_3O_3)_3.2H_2O$.

One liter of water dissolves 2.447 gms. of the salt at 20°.
(Jantsch and Grünkraut, 1912–1913.)

YTTRIUM LACTATE $Y(C_3H_5O_3)_3.2H_2O$.

1000 cc. sat. solution of yttrium lactate in water prepared by constant rotation in a thermostat contain 1.096 gm. $Y(C_3H_5O_3)_3.2H_2O$ at 20°. (Jantsch, 1926.)

YTTRIUM MALONATE $Y_2(C_3H_2O_4)_3.8H_2O$.

SOLUBILITY IN AQUEOUS MALONIC ACID AND AMMONIUM MALONATE SOLUTIONS.
(Holmberg, 1907.)

Solvent.	t°.	Gms. $Y_2(C_3H_2O_4)_3$ per 100 Gms. Solvent.
1 Gm. Am. Malonate per 10 cc. Solution	20	0.3
2 Gms. Malonic Acid per 10 cc. Solution	20	2.3

CH

YTTRIUM TARTRATE $Y_2(C_4H_4O_6)_3.5H_2O$.

SOLUBILITY IN AQUEOUS TARTARIC ACID AND AMMONIUM TARTRATE SOLUTIONS AT 20°. (Holmberg, 1907.)

Aq. Solvent.	Gms. $Y_2(C_4H_4O_6)_3$ per 100 Gms. Sat. Sol.	Aq. Solvent.	Gms. $Y_2(C_4H_4O_6)_3$ per 100 Gms. Sat. Sol.
1 gm. Am. Tartrate per 10 cc. solution	0.6	2 gms. Tartaric Acid per 10 cc. solution	0.02
2 gms. Am. Tartrate per 10 cc. solution	1.1	4 gms. Tartaric Acid per 10 cc. solution	0.02

YTTRIUM SULFONATES

SOLUBILITY OF YTTRIUM SULFONATES IN WATER.

Sulfonate.	Formula.	t°.	Gms. Anhy. Sulfonate per 100 Gms. H_2O.	Authority.
Yttrium Benzene Sulfonate	$Y(C_6H_5SO_3)_3.9H_2O$	15	60.4	(Holmberg, 1907.)
" " *m* Nitrobenzene Sulfonate	$Y(C_6H_4.NO_2.SO_3)_3.7H_2O$	15	48.3	
Yttrium Bromonitrobenzene Sulfonate	$Y(C_6H_3Br.NO_2.SO_3.1.4.2)_3.10H_2O$	25	3.88	(Katz & James, '13.)

YTTRIUM CobaltiCYANIDE $Y_2(CoC_6N_6)_2.9H_2O$.

1000 gms. aq. 10% HCl (d_{15} = 1.05) dissolve 2.78 gms. of the salt at 25°.
(James and Willand, 1916.)

YTTRIUM OXALATE $Y_2(C_2O_4)_3.9H_2O$.

One liter H_2O dissolves 0.001 gm. $Y_2(C_2O_4)_3$ at 25°, determined by the electrolytic method. (Rimbach and Schubert, 1909.)

100 gms. aqueous ammonium oxalate solution (3.26% $(NH_4)_2C_2O_4.H_2O$) dissolve 0.01714 gm. $Y_2(C_2O_4)_3.9H_2O$ at room temp. (Cleve, 1902.)

100 gms. aq. 2.16 *n* H_2SO_4 dissolve 0.6884 gm. $Y_2(C_2O_4)_3$ at 25°. (Wirth, 1912.)

100 gms. aq. 4.32 *n* H_2SO_4 dissolve 1.4 gms. $Y_2(C_2O_4)_3$ at 25°. "

100 cc. aq. 20% methylamine oxalate dissolve 0.877 gm. yttrium oxalate at ord. temp.

100 cc. aq. 20% ethylamine oxalate dissolve 1.653 gms. yttrium oxalate at ord. temp.

100 cc. aq. 20% triethylamine oxalate dissolve 1.006 gms. yttrium oxalate at ord. temp. (Grant and James, 1917.)

YTTRIUM Potassium **OXALATE** $Y_2(C_2O_4)_3.4K_2C_2O_4.12H_2O$.

SOLUBILITY IN WATER AT 25°. (Pratt and James, 1911.)

The determinations were made with great care. The mixtures were constantly rotated for 8 weeks.

d_{25} of Sat. Sol.	Gms. per 100 Gms. H_2O.		Solid Phase.
	$Y_2(C_2O_4)_3$.	$K_2C_2O_4$.	
1.008	Trace	1.31	Solid Solution
1.035	0.02	5.30	"
1.059	0.06	8.88	"
1.096	0.27	14.50	"
1.132	0 72	20.27	"
1.166	1.37	26.02	$Y_2(C_2O_4)_3.4K_2C_2O_4.12H_2O$
1.174	1.50	27.44	$Y_2(C_2O_4)_3.4K_2C_2O_4.12H_2O$
1.199	1.49	32.83	"
1.222	1.48	37.68	"
1.231	1.42	39.12	$K_2C_2O_4$
1.228	1.09	38.77	"
1.218	0	37.87	"

COO

SOLUBILITY OF YTTRIUM OXALATE IN AQUEOUS SOLUTIONS OF NITRIC ACID ALONE AND CONTAINING OXALIC ACID AT 90°.

(Neckers and Kremers, 1928.)

Conc. of Aq. HNO_3 in normality	Gms. Y_2O_3 per 100 cc sat. sol.	Solid Phase
2.5	1.3180	$Y_2(C_2O_4)_3.9H_2O$
5.0	3.0135	"
2.5 + 5% $(COOH)_2$	0.4315	"
5.0 + "	1.4515	"

YTTRIUM CHLORIDE $YCl_3.6H_2O$.

SOLUBILITY OF YTTRIUM CHLORIDE IN WATER.

(Crew, Steinert and Hopkins, 1925; Williams, Fogg and James, 1925.)

C1

t°.	Gms. YCl_3 per 100 gms. sat. sol.		Solid Phase.
	C. S. and H.	W. F. and J.	
0....	42.36	43.60	$YCl_3.6H_2O$
10...	42.65	43.85	"
20...	42.87	44.08	"
25...	42.95	44.20	"
30...	43.07	44.33	"
40...	43.30	44.70	$YCl_3.6H_2O$
50...	43.45	45.07	"
60...	43.60	–	"
70...	43.75	–	"
80...	43.86	–	"

SOLUBILITY OF YTTRIUM CHLORIDE IN AQUEOUS HYDROCHLORIC ACID OF DENSITY 1.1051. (Williams, Fogg and James, 1925.)

Constant agitation in a thermostat for 9 hours and approaching equilibrium from above and below was employed.

t°.	Gms. YCl_3 per 100 gms. sat. sol.	Solid Phase.
10.......	24.35	$YCl_3.6H_2O$
20.......	24.63	"
30.......	25.48	"
40.......	26.52	$YCl_3.6H_2O$
50.......	27.55	"

YTTRIUM CHLORIDE YCl_3.

100 gms. alcohol dissolve	61.1 gms. YCl_3 at 15°.	(Matignon, 1906.)
" "	60.5 gms. YCl_3 at 20°.	(Matignon, 1909.)
" pyridine dissolve	6.5 gms. YCl_3 at 15°.	(Matignon, 1906.)

YTTRIUM Hexa Antipyrine Per CHLORATE $Y(COC_{10}H_{12}N_2)_6(ClO_4)_3$.

100 cc sat. solution of the salt in water contain 0.55 gm. $Y(COC_{10}H_{12}N_2)_6(ClO_4)_3$ at 20°. (Wilke-Dorfurt and Schliephake, 1928.)

YTTRIUM Hexa Antipyrine IODIDE $Y(COC_{10}H_{12}N_2)_6I_3$.

100 cc sat. solution of the salt in water contain 4.44 gm.
I $Y(COC_{10}H_{12}N_2)_6I_3$ at 20°. (Wilke-Dorfurt and Schliephake, 1928.)

YTTRIUM IODATE $Y(IO_3)_3.3H_2O$.

100 gms. H_2O dissolve 0.53 gm. yttrium iodate. (Berlin.)

YTTRIUM NITRATE $Y(NO_3)_3$.

SOLUBILITY OF YTTRIUM NITRATE IN WATER. (Crew, Steinert and Hopkins, 1925.)

Saturation was obtained by frequent agitation during 5 hours and approaching equilibrium from above and from below.

t°.	Gms. $Y(NO_3)_3$ per 100 gms. H_2O.	t°.	Gms. $Y(NO_3)_3$ per 100 gms. H_2O.
0.0	93.1	60.2	200.0
22.5	134.5	66.5	211.0
35.0	155.0		

YTTRIUM Basic NITRATE $3Y_2O_3.4N_2O_5.2H_2O$.

EQUILIBRIUM IN THE SYSTEM YTTRIUM NITRATE, YTTRIUM HYDROXIDE AND WATER AT 25°. (James and Pratt, 1910.)

NO The determinations were made with very great care. The mixtures were rotated 4½ months.

d_{25} of Sat. Sol.	Gms. per 100 Gms. H_2O.		Solid Phase.
	$Y(NO_3)_3$.	Y_2O_3 as $Y(OH)_3$.	
1.0260	3.13	0.014	$Y(OH)_3$
1.1106	13.87	0.034	"
1.1907	24.94	0.063	"
1.2517	33.02	0.160	" $+3Y_2O_3.4N_2O_5.2H_2O$
1.3268	44.35	0.114	$3Y_2O_3.4N_2O_5.2H_2O$
1.4104	58.61	0.095	"
1.4867	73.03	0.078	$3Y_2O_3.4N_2O_5.2H_2O$
1.5587	89.06	0.074	"
1.6259	103.80	0.075	"
1.6931	122.40	0.080	"
1.7440	137.10	0.083	" $+y(NO_3)_3$
1.7446	141.6	0	$Y(NO_3)_3$

100 cc of a sat. solution of Yttrium Nitrate in Ethyl Ether prepared by frequent agitation and allowing to stand over night at about 20°, contain 0.792 gm. Y_2O_3. A saturated ethereal solution prepared as above but using yttrium nitrate dehydrated at 150°, contains 0.803 gm. Y_2O_3 per 100 cc. (Wells, 1930.)

YTTRIUM OXIDE Y_2O_3.

One liter sat. solution of Yttrium Oxide in Water contain 0.000008 gm. mol. Y_2O_3 at 29° as determined by electrometric titration.
(Busch, 1927.)

YTTRIUM DimethylPHOSPHATE $Y_2[(CH_3)_2PO_4]_6$.

100 gms. H_2O dissolve 2.8 gms. $Y_2[(CH_3)_2PO_4]_6$ at 25° and 0.55 gm. at 95°.
(Morgan and James, 1914.)

The following determinations differing from the above are given by Marsh, 1939.

t°	Gms. $Y_2[(CH_3)_2PO_4]_6$ per 100 gms. H_2O
0	6.44
25	3.53
50	1.90

SO

YTTRIUM SULFATE $Y_2(SO_4)_3$.

SOLUBILITY OF YTTRIUM SULFATE IN WATER. (Crew, Steinert and Hopkins, 1925.)

t°.	Gms. $Y_2(SO_4)_3$ per 100 gms. H_2O.	t°.	Gms. $Y_2(SO_4)_3$ per 100 gms. H_2O
3.6	7.94	50.0	5.37
15.8	7.49	75.0	3.22
25.0	7.20	95.0	2.03

100 gms. H_2O dissolve 9.764 gms. $Y_2(SO_4)_3.8H_2O$ at 20° and 4.9 gms. at 40°. (Jackson and Rienacker, 1930.)

YTTRIUM SULFATE $Y_2(SO_4)_3$.

SOLUBILITY OF YTTRIUM SULFATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE AT 25°. (James and Holden, 1913.)

Equilibrium was reached very slowly and it was necessary to rotate the mixtures for 14 months before final equilibrium was reached.

Gms. per 100 Gms. H_2O.		Solid Phase.	Gms. per 100 Gms. H_2O.		Solid Phase.
$Y_2(SO_4)_3$.	Na_2SO_4.		$Y_2(SO_4)_3$.	Na_2SO_4.	
5.61	1.29	$Y_2(SO_4)_3$	1.90	14.89	$Y_2(SO_4)_3.Na_2SO_4.2H_2O$
6.38	3.85	"	1.79	16.51	"
7.40	6.21	"	1.86	18.44	"
8.43	8.53	" $+Y_2(SO_4)_3.Na_2SO_4.2H_2O$	2.99	19.96	"
5.86	7.57	$Y_2(SO_4)_3.Na_2SO_4.2H_2O$	3.04	21.05	"
4.75	7.72	"	2.27	27.14	"
3.42	10.14	"	1.52	28.22	"
2.36	11.36	"	1.61	28.13	"
2.02	13.42	"	5.38	0	$Na_2SO_4.10H_2O$

YTTERBIUM Cobalti**CYANIDE** $Yb_2(CoC_6N_6)_2.9H_2O$.

1000 gms. aqueous 10% HCl (d_{15} = 1.05) dissolve 0.38 gm. of the salt at 25°. (James and Willand, 1916.)

YTTERBIUM OXALATE $Yb_2(C_2O_4)_3.10H_2O$.

SOLUBILITY IN WATER AND IN SEVERAL AQUEOUS SOLUTIONS.

Aqueous Solution of:	Per cent Conc. of Aq. Sol.	t°.	Gms. $Yb_2(C_2O_4)_3$ per 100 cc. Solvent.	Authority.
Water	...	25	0.000334	(Rimbach and Schubert, 1909.)
$(NH_4)_2C_2O_4.H_2O$	3.26	ord.	0.095*	(Cleve, 1902.)
Methylamine Oxalate	20	"	5.24*	(Grant and James, 1917.)
Ethylamine Oxalate	20	"	5.86*	"
Triethylamine Oxalate	20	"	2.05*	"
Sulfuric Acid (1 *n*)	4.9	"	0.372	(Cleve, 1902.)

* The authors do not state whether their figures are for anhydrous or hydrated salt.

YTTERBIUM CHLORIDE $YbCl_3.6H_2O$.

SOLUBILITY OF YTTERBIUM CHLORIDE IN AQUEOUS HYDROCHLORIC ACID OF DENSITY 1.1051. (Williams, Fogg and James, 1925.)

Constant rotation in a thermostat for 9 hours and approaching equilibrium from above and below was employed. Cl

t°.	Gms. $YbCl_3$ per 100 gms. sat. sol.	Solid Phase.	t°.	Gms. $YbCl_3$ per 100 gms. sat. sol.	Solid Phase.
10.....	32.00	$YbCl_3.6H_2O$	40......	33.84	$YbCl_3.6H_2O$
20.....	32.38	"	50......	34.88	"
30.....	33.03	"			

YTTERBIUM Dimethyl **PHOSPHATE** $Yb_2[(CH_3)_2PO_4]_6$.

100 gms. H_2O dissolve 1.2 gms. $Yb_2[(CH_3)_2PO_4]_6$ at 25° and 0.25 gm. at 95°. (Morgan and James, 1914.)

The following results differing from the above are by Marsh, 1939.

t°	Gms. $Yb_2[(CH_3)_2PO_4]_6$
0	2.68
25	1.35
50	0.72

YTTERBIUM SULFATE $Yb_2(SO_4)_3.8H_2O$.

SO

SOLUBILITY IN WATER.

(Cleve, 1902.)

t°.	Gms. $Yb_2(SO_4)_3$ per 100 gms. H_2O.	t°.	Gms. $Yb_2(SO_4)_3$ per 100 Gms. H_2O.	t°.	Gms. $Yb_2(SO_4)_3$ per 100 Gms. H_2O.
0	44.2	55	11.5	80	6.92
15.5	34.6	60	10.4	90	5.83
35	19.1	70	7.22	100	4.67

100 gms. H_2O dissolve 34.78 gms. $Yb_2(SO_4)_3.8H_2O$ at 20° and 22.9 gms. at 40°. (Jackson and Rienacker, 1930.)

YTTERBIUM Bromonitrobenzene **SULFONATE** $Yb(C_6H_3Br.NO_2.SO_3, 1.4.3)_3.12H_2O$.

100 gms. sat. solution in water contain 7.294 gms. of the anhydrous salt at 25°. (Katz and James, 1913.)

ZINC Zn.

SOLUBILITY OF ZINC IN AQUEOUS POTASSIUM CYANIDE SOLUTIONS. (White, 1919.)

The weight of zinc dissolved per 24 hours from rectangular (2.5 × 1.5 cm.) pieces of ordinary commercial rolled sheet zinc 0.03 mm. in thickness, when suspended in aqueous potassium cyanide solutions, was determined. Uniform conditions were maintained in each experiment but the temperature was not held constant. The influence of oxygen concentration, cyanide concentration, alkalinity, etc. was studied. The main reaction in presence of oxygen is

$$Zn + 4KCN + O + H_2O = K_2Zn(CN)_4 + 2KOH.$$

Therefore, 6.0 milligrams of oxygen per liter is equivalent to 0.0089 per cent KCN and to 24.5 milligrams of Zn per liter. However, in the absence of oxygen some zinc may dissolve. Numerous tables and curves are given.

SOLUBILITY OF ZINC IN MILK.

(Quam, 1929.)

Highly polished 4 x 7.5 cm. strips of zinc were each immersed in 50 cc portions of raw milk and rocked 46 times per minute for 30 minutes. The loss in weight of the Zn strips was determined and the result expressed in mgs. Zn dissolved per sq. decimeter of surface exposed.

t°	Mgs. Zn dissolved per sq. dm.	t°	Mgs. Zn dissolved per sq. dm.
30	0.432	75	1.78
40	0.744	85	1.546
50	1.03	95	1.03
60	1.546		

AsO

ZINC ARSENITE $Zn_3(AsO_3)_2$.

100 gms. 95% formic acid dissolve 0.36 gm. $Zn_3(AsO_3)_2$ at 21°. (Aschan, 1913.)

ZINC ARSENATE $Zn_3(AsO_4)_2.8H_2O$.

100 gms. 95% formic acid dissolve 0.26 gm. $Zn_3(AsO_4)_2$ at 21°. (Aschan, 1913.)

ZINC BROMIDE $ZnBr_2.2H_2O$.

SOLUBILITY IN WATER.

(Dietz, 1900; see also Etard, 1894.)

Br

t°.	Gms. $ZnBr_2$ per 100 Gms. Solution.	Mols. $ZnBr_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $ZnBr_2$ per 100 Gms. Solution.	Mols. $ZnBr_2$ per 100 Mols. H_2O.	Solid Phase.
−15	77.13	27.0	$ZnBr_2.3H_2O$	25	82.46	37.6	$ZnBr_2.2H_2O$
−10	78.45	29.1	"	30	84.08	42.3	"
− 5	80.64	33.3	"	37	86.20	50.0	"
− 8	79.06	30.2	$ZnBr_2.2H_2O$	35	85.45	46.9	$ZnBr_2$
0	79.55	31.1	"	40	85.53	47.4	"
+13	80.76	33.5	"	60	86.08	49.5	"
18	81.46	35.1	"	80	86.57	51.5	"
				100	87.05	53.8	"

The transition point of $ZnBr_2.2H_2O \rightarrow ZnBr_2$ is given as 35° by Ishikawa and Yoshida, 1930.

SOLUBILITY OF ANHYDROUS ZINC BROMIDE IN PURE ACETONE.

(Bell, Rowlands, Bamford, Thomas and Jones, 1930.)

t°	Gms. $ZnBr_2$ per 100 gms. $(CH_3)_2CO$	Solid Phase
20	364.0	$ZnBr_2.\frac{1}{2}(CH_3)_2CO$
30	363.0	"
31 tr.pt.	—	" + $ZnBr_2$
40	380.0	$ZnBr_2$
50	381.0	"

Br 100 cc Pyridine dissolve 4.4 gms. $ZnBr_2$ at 18°. (Müller, R., 1924.)

ZINC CACODYLATE $Zn[(CH_3)_2AsOO]_2.7H_2O$.

SOLUBILITY OF ZINC CACODYLATE IN WATER.

(Tiollais and Perdreau, 1930.)

t°	Gms. $Zn[(CH_3)_2AsOO]_2$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $Zn[(CH_3)_2AsOO]_2$ per 100 gms. sat. sol.	Solid Phase
1	25.9	$Zn[(CH_3)_2AsOO]_2.7H_2O$	34	35.5	$Zn[(CH_3)_2AsOO]_2.H_2O$
8	28.0	"	42	34.2	"
21	33.2	"	56	34.0	"
23	36.5	"	64	34.3	$Zn[(CH_3)_2AsOO]_2$
25	40.0	" + $Zn[(CH_3)_2AsOO]_2.H_2O$	72	36.0	"
27.5	38.1	$Zn[(CH_3)_2AsOO]_2.H_2O$	84	39.2	"
30	36.5	"	98	44.2	"

These authors also give similar results for the solubility of Cadmium Cacodylate in Water.

CH **ZINC FORMATE** $Zn(HCOO)_2.2H_2O$.

SOLUBILITY OF ZINC FORMATE IN WATER.

(Ashton, Houston and Saylor, 1933.)

t°	Gms. $Zn(HCOO)_2$ per 100 gms. H_2O	Solid Phase	t°	Gms. $Zn(HCOO)_2$ per 100 gms. H_2O	Solid Phase
0	3.7	$Zn(HCOO)_2.2H_2O$	60	11.8	$Zn(HCOO)_2.2H_2O$
10	4.3	"	70	15.5	"
20	5.2	"	80	21.2	"
30	6.1	"	90	28.8	"
40	7.4	"	100	38.0	"
50	9.2	"			

ZINC ACETATE $Zn(C_2H_3O_2)_2.2H_2O$.

SOLUBILITY IN AQUEOUS ETHYL ALCOHOL AT 25°. (Seidell, 1910.)

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $Zn(C_2H_3O_2)_2.2H_2O$ per 100 Gms. Sat. Sol.	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $Zn(C_2H_3O_2)_2.2H_2O$ per 100 Gms. Sat. Sol.
0	1.168	30.80	60	0.920	10.60
10	1.127	27.20	70	0.880	7.80
20	1.090	23.70	80	0.850	5.50
30	1.055	20.40	90	0.830	4.20
40	1.015	17	95	0.825	4
50	0.970	13.80	100	0.796	1.18*

* = gms. anhydrous salt. The solid phase was $Zn(C_2H_3O_2)_2.2H_2O$ in all cases except this solution.

100 gms. H_2O dissolve 41.6 gms. $Zn(C_2H_3O_2)_2.H_2O$ at 15°, *d* of sat. sol. = 1.165. (Greenish and Smith, 1902.)

100 cc. anhydrous hydrazine dissolve 4 gms. zinc acetate with separation of a white suspension at ordinary temperature. (Welsh and Broderson, 1915.)

100 gms. Methyl Alcohol dissolve 1.9 gm. anhydrous Zinc Acetate at 15° and 1.9 gms. at 66.6° (b.pt.). (Henstock, 1934.)

SOLUBILITY OF ZINC ACETATE IN PURE ACETIC ACID.
(Davidson and McAllister, 1930.)

t°	Mol. Percentage $Zn(CH_3COO)_2$ in sat. sol.	Solid Phase	t°	Mol. Percentage $Zn(CH_3COO)_2$ in sat. sol.	Solid Phase
40.5	0.0050	$Zn(CH_3COO)_2$	56	0.0150	$Zn(CH_3COO)_2$
43	0.0054	"	62	0.0231	"
48	0.0085	"	72	0.0382	"
52	0.0109	"			

CH

Results are also given for the ternary system $Zn(CH_3COO)_2 + NaCH_3COO + CH_3COOH$.

Results for the ternary system $Zn(CH_3COO)_2 + NH_4CH_3COO + CH_3COOH$ are given by Davidson and Griswold, 1935.

Results for the ternary system $Zn(CH_3COO)_2 + ZnCl_2 + CH_3COOH$ are given by Davidson and Chappell, 1939.

ZINC FUMARATE $ZnC_4H_2O_4.5\,H_2O$.

100 gms. H_2O dissolve 1.96 gms. of the compound at 30°. The sat. solution was analyzed by evaporating to dryness and drying the residue at 100°. The result, therefore, probably refers to the anhydrous compound. (Weiss and Downs, 1923.)

ZINC TARTRATE $C_4H_4O_6.Zn.2H_2O$.

SOLUBILITY IN WATER.
(Cantoni and Zachoder, 1905.)

t°.	Gms. $C_4H_4O_6.Zn.2H_2O$ per 100 cc. Solution.	t°.	Gms. $C_4H_4O_6.Zn.2H_2O$ per 100 cc. Solution.	t°.	Gms. $C_4H_4O_6.Zn.2H_2O$ per 100 cc. Solution.
15	0.019	40	0.060	65	0.100
20	0.022	45	0.073	70	0.088
25	0.036	50	0.087	75	0.078
30	0.041	55	0.116	80	0.059
35	0.055	60	0.104	85	0.041

ZINC VALERATE $Zn(C_4H_9COO)_2.2H_2O$.

SOLUBILITY OF ZINC VALERATE IN AQUEOUS ALCOHOL SOLUTIONS AT 25°.
(Seidell, 1910.)

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $Zn(C_4H_9COO)_2.2H_2O$ per 100 Gms. Sat. Sol.	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $Zn(C_4H_9COO)_2.2H_2O$ per 100 Gms. Sat. Sol.
0	1.004	1.44	85	0.836	2.15
20	0.972	0.75	90	0.827	3.20
40	0.936	0.76	92.3	0.828	5.50
60	0.894	1.15	95	0.832	8.80
80	0.848	1.70	100	0.844	15.60

ZINC GLUCONATE $Zn(C_6H_{11}O_7)_2.3H_2O$.

100 cc sat. solution of Zinc Gluconate in Water contain 12.7 gms. $Zn(C_6H_{11}O_7)_2$ at 25°. (May, Weisberg and Herrick, 1929.)

23
25
27.5

ZINC BENZOATE $Zn(C_7H_5O_2)_2$.

SOLUBILITY IN WATER.
(Pajetta, 1906.)

t°.	15.9°.	17°.	27.8°.	31.3°.	37.5°.	49.8°.	59.°
Gms. $Zn(C_7H_5O_2)_2$ per 100 gms. aq. solution	2.55	2.49	2.41	2.05	1.87	1.62	1.45

CH

SOLUBILITY OF ZINC BENZOATE IN SEVERAL SOLVENTS.
(Menstock, 1934.)

Solvent	t°	Gms. $Zn(C_6H_5COO)_2$ per 100 gms. solvent
Methyl Alcohol	15	9.90
" "	65.9 (b.pt.)	6.62
Acetone	15	1.00
Benzene	15	4.20

ZINC BENZOATE Chloro, Nitro, etc., **BENZOATES.**

SOLUBILITY OF EACH SEPARATELY IN WATER AT 20°. (Ephraim and Pfister, 1925.)

Compound.	Formula.	Gms. anhydrous compound per 100 cc. sat. sol.
Zinc Benzoate..........	$Zn(C_6H_5.COO)_2.H_2O$	2.048
» 4-Chloro Benzoate....	$Zn(C_6H_4.Cl.COO)_2.2H_2O$	0.649
» 4-Methoxy »	$Zn(C_6H_4.OCH_3.COO)_2.H_2O$ ..	1.174
» 4-Nitro... »	$Zn(C_6H_4.NO_2.COO)_2.2H_2O$ ..	0.556
» 4-Oxy.... »	$Zn(C_6H_4.OH.COO)_2.8H_2O$...	1.687

ZINC Nitroso β PHENYL HYDROXYLAMINE $Zn[C_6H_5.N(NO).O]_2$.

One liter sat. solution in Water contains 0.00049 gm. at. = 0.032 gm Zn at 18°. (Pinkus and Martin, 1927.)

ZINC CINNAMATE $ZnC_{18}H_{14}O_4.2H_2O$.

100 cc. sat. solution of zinc cinnamate in water contain 0.15 gm. Zn $C_{18}H_{14}O_4$ at 20°. (Ephraim, and Pfister, 1925.)

100 cc. sat. solution in water contain 0.144 gm. zinc cinnamate at 26.5°. (De Jong, 1909.)

ZINC SULFONATES

SOLUBILITY IN WATER.

Name.	Formula.	t°.	Gms. Anhy. Salt per 100 Gms. H_2O.	Authority.
Zinc β Naphthalene Sulfonate	$(C_{10}H_7.SO_3)_2Zn.6H_2O$	25	0.45	(Witt, 1915.)
Zinc 2-Phenanthrene "	$(C_{14}H_9.SO_3)_2Zn.6H_2O$	20	0.083	(Sandquist, '12.)
" 3- " "	$(C_{14}H_9.SO_3)_2Zn.4H_2O$	20	0.19	"
" 10- " "	$(C_{14}H_9.SO_3)_2Zn.6H_2O$	20	0.15	"

ZINC Benzene and Naphthalene SULFONATES.

SOLUBILITY OF EACH SEPARATELY IN WATER. (Ephraim and Seger, 1925.)

Results for Zinc Benzene sulfonate.

t°.	Gms. $Zn(C_6H_5SO_3)_2$ per 100 cc. sat. sol.	Solid Phase.
10.0	14.769	$Zn(C_6H_5SO_3)_2.6H_2O$
34.0	19.107	»
49.5	24.705	»
64.5	32.018	»
80.5	40.085	»
82.0	41.014	»

Results for Zinc Naphtalene-2-sulfonate.

t°.	Gms. $Zn(C_{10}H_7SO_3)_2$ per 100 cc. sat. sol.	Solid Phase.
20	0.487	$Zn(C_{10}H_7SO_3)_2.6H_2O$
32	0.579	»
45	0.853	»
54.5	1.218	»
65	1.690	»
76.5	2.512	»
82	3.130	»

CH

SOLUBILITY OF SEVERAL ZINC SULFONATES IN WATER.

Compound.	Formula.	t°.	Gms. anhydrous cmpd. per 100 cc. sat. sol.	
Zinc Anthracene-1-sulfonate...	$Zn(C_{14}H_9SO_3)_2.6H_2O$	20	0.05	(1)
» » -2- » ...	$Zn(C_{14}H_9SO_3)_2.6H_2O$	20	0.00741	(1)
» Naphthalene-1- » ...	$Zn(C_{10}H_7SO_3)_2.6H_2O$	17	0.659	(2)
» » -6- oxy -2- » ...	$Zn(C_{16}H_7SO_3)_2.8H_2O$	20	0.874	(1)
» » -5-chlor 1- » ...	$Zn(C_{10}H_6ClSO_3)_2 4H_2O$	20	1.205	(1)
» -2.6.8- Naphthylamine disulfonate......	$ZnC_{10}H_5NH_2(SO_3)_2$	15	34.5 *	(3)
» -2.5.7- Naphthylamine disulfonate......		15	39.4 *	(3)

(1) Ephraim and Pfister, 1925 *a*. (2) Ephraim and Seger, 1925. (3) Braunschweig, 1922, 1926.

* These results are in terms of grams per 100 grams of the saturated solution instead of gms. per 100 cc. sat. solution.

SOLUBILITY OF ZINC PHENOLSULFONATE, *p* $(C_6H_4.OH.SO_3)_2Zn.8H_2O$, IN AQUEOUS ALCOHOL SOLUTIONS AT 25°.

(Seidell, 1910.)

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $(C_6H_4.OH.SO_3)_2Zn.8H_2O$ per 100 Gms. Sat. Sol.	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $(C_6H_4.OH.SO_3)_2Zn.8H_2O$ per 100 Gms. Sat. Sol.
0	1.185	39.8	80	1.057	40.7
20	1.161	40.7	90	1.047	41.4
40	1.139	42.1	92.3	1.048	41.9
47	...	42.2	95	1.052	42.9
60	1.106	41.6	100	1.075	48.8

100 gms. H_2O dissolve 37 gms. $(C_6H_4.OH.SO_3)_2Zn.8H_2O$ at 15° and d_{15} of sat. sol. = 1.162. (Greenish and Smith, 1902.)

ZINC HELIANTHATE $Zn(C_{14}H_{14}N_3SO_3)_2.4H_2O$.

1000 cc. H_2O dissolve 0.098 gm. of the hydrated salt at 20-25°. (Stark and Dehn, 1918.)

ZINC CYANIDE $Zn(CN)_2$.

One liter sat. solution of zinc cyanide in water contains 0.000049 gm. mol. $Zn(CN)_2$ at 18°, as determined by E.M.F. measurements. (Masaki, 1931.)

100 cc. concentrated $Zn(C_2H_3O_2)_2$ + Aq. dissolve 0.4 gm. $Zn(CN)_2$.
100 cc. concentrated $ZnSO_4$ + Aq. dissolve 0.2 gm. (Joannis, 1882.)

100 gms. H_2O dissolve 0.24 gm. zinc mercuric thiocyanate, $ZnHg(CNS)_4$ at 15°. (Robertson, P. W., 1907.)

ZINC THIOCYANATE $Zn(SCN)_2$.

One liter sat. solution of zinc thiocyanate in water contains 0.144 gm. mol. $Zn(SCN)_2$ at 18°, as determined by E.M.F. measurements. (Masaki, 1931.)

100 gms. Liquid Sulfur Dioxide dissolve 0.73 gm. $Zn(SCN)_2$ at 0°. (Jander and Ruppolt, 1937.)

ZINC CARBONATE $Zn\ CO_3$

100 gms. of a sat. solution of $Zn\ CO_3$ in water at 18° and in contact with CO_2 at a pressure of 1 atmosphere contain 0.07 gm. $Zn\ CO_3$. At a pressure of 56 atmospheres of CO_2 0.084 gm. $Zn\ CO_3$ are dissolved. (Hachnel, 1924.)

Ageno and Valla (1911) report that the solubility of $ZnCO_3$ in water at 25° is $1.64 \cdot 10^{-4}$ mols. = 0.206 gm. per liter.

One liter of aq. 5.85% NaCl solution dissolves 0.0586 gm. $ZnCO_3$ at 14°.
One liter of aq. 7.45% NaCl solution dissolves 0.0477 gm. $ZnCO_3$ at 14°.
(Cantoni and Passamanik, 1905.)

CO

ZINC BICARBONATE $Zn(HCO_3)_2$.

SOLUBILITY OF ZINC BICARBONATE IN WATER CONTAINING CARBON DIOXIDE.
(Smith, 1918.)

For description of the experimental method see iron bicarbonate, p. 336.

Atmospheres Pressure of CO_2, Calc. by Henry's Law.	Results at 25°.		Results at 30°.	
	Gm. Mols. Free H_2CO_3 per Liter.	Gm. Mols. $Zn(HCO_3)_2$ per Liter.	Gm. Mols. Free H_2CO_3 per Liter.	Gm. Mols. $Zn(HCO_3)_2$ per Liter.
4.12	0.1390	0.00194	0.1838	0.00215
5.33	0.1797	0.00211	0.3838	0.00277
7.64	0.2579	0.00242	0.4038	0.00286
10.61	0.3580	0.00270	0.4601	0.00308
12.16	0.4103	0.00278	0.6064	0.00324
13.29	0.4480	0.00291	0.6257	0.00337
19.73	0.6657	0.00317	0.7470	0.00352
20.65	0.6969	0.00319	0.8351	0.00376
22.56	0.7610	0.00343	1.0840	0.00339
40.61	1.3701	0.00445	1.1275	0.00429

The calculated pressures are lower than the actual pressures since Henry's Law does not hold at very high pressures.

"If zinc carbonate were not hydrolytically dissociated, its solubility in pure water at 25°, would be 4.58×10^{-4} gms. mols. per liter." (Smith, 1918.)

ZINC Campho CARBONATE $Zn(C_{11}H_{15}O_3)_2$.

SOLUBILITY OF ZINC CAMPHO CARBONATE IN SEVERAL SOLVENTS AT 10°.

(Picon, 1931.)

Solvent	Gms. $Zn(C_{11}H_{15}O_3)_2$ per liter sat. sol.
Water	4.0
Petroleum	373.3
Acetone	281.0
Olive oil	125.0 (15°)

When the compound is dissolved in boiling benzene and is then separated from this solvent and thus completely dehydrated, it becomes soluble to the extent of 500 gms. per liter in methyl alcohol, ethyl alcohol, benzene, chloroform, carbon tetrachloride, carbon disulfide and petroleum ether.

ZINC OXALATE $ZnC_2O_4.2H_2O$.

One liter H_2O dissolves 0.0057 gm. ZnC_2O_4 at 9.76°, 0.0064 gm. at 17.92° and 0.00715 gm. at 26.15°. (Kohlrausch, 1908.)

One liter sat. solution of $ZnC_2O_4.2H_2O$ in Water contains 0.0209 gm. ZnC_2O_4 at 18°. (Scholder, Gadenne and Niemann, 1927.) COO

SOLUBILITY OF ZINC OXALATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 18°.

(Britton and Jarrett, 1932.)

Gm. Mols. per liter	
H_2SO_4	ZnC_2O_4
0.05	0.000445
0.125	0.000737
0.25	0.001395
0.50	0.002178
1.00	0.003901
1.50	0.005550
1.875	0.006695

SOLUBILITY OF ZINC OXALATE IN AQUEOUS AMMONIUM OXALATE SOLUTIONS AT 25°.

(Kunschert, 1904.)

Mol. Normal $(NH_4)_2C_2O_4$	0.05	0.10	0.15	0.20	0.25
Mol. Zn per Liter	0.0022	0.0055	0.01055	0.0174	0.0257

Complex ammonia zinc oxalates are formed. When more than 0.15 free oxalate is present the complex has the formula, $(NH_4)_4Zn(C_2O_4)_3$. In the more dilute solutions it has the composition, $(NH_4)_2Zn(C_2O_4)_2$.

SOLUBILITY OF ZINC OXALATE AT 25° IN AQUEOUS SOLUTIONS OF:

(Clayton and Vosburgh, 1937.)

Cadmium Sulfate

Mols. per 1000 gms. H_2O	
$CdSO_4$	ZnC_2O_2
0.0	0.000168
0.005	0.000145
0.010	0.000202
0.020	0.000226
0.040	0.000386
0.080	0.000645

Potassium Oxalate

Mols. per 1000 gms. H_2O	
Total Oxalate	ZnC_2O_4
0.0100	0.000460
0.02745	0.001030
0.04841	0.001803
0.1116	0.006480

ZINC CHLORIDE $ZnCl_2$.

SOLUBILITY IN WATER.

(Mylius and Dietz, 1905; see also Dietz, 1900; Etard, 1894.)

t°.	Gms. $ZnCl_2$ per 100 Gms. Water.	Gms. $ZnCl_2$ per 100 Gms. Solution.	Solid Phase.	t°.	Gms. $ZnCl_2$ per 100 Gms. Water.	Gms. $ZnCl_2$ per 100 Gms. Solution.	Solid Phase.
− 5	14	12.3	Ice	9	360	78.3	$.2\frac{1}{2}H_2O$ + $.H_2O$
−10	25	20.0	"	6	385	79.4	$ZnCl_2.2\frac{1}{2}H_2O$
−40	83	45.3	"	6	298	74.9	$ZnCl_2.1\frac{1}{2}H_2O$
−62	104	51.0	Ice + $ZnCl_2.4H_2O$	10	330	76.8	"
−50	113	53.0	$ZnCl_2.4H_2O$	20	368	78.6	"
−40	127	55.9	"	26	423	80.9	$.1\frac{1}{2}H_2O$ + $ZnCl_2.H_2O$
−30	160	61.5	$.4H_2O$ + $.3H_2O$	26.3	433	81.2	$.1\frac{1}{2}H_2O$ + $ZnCl_2$
−10	189	65.4	$ZnCl_2.3H_2O$	0	342	77.4	$ZnCl_2.H_2O$
0	208	67.5	"	10	364	78.4	"
+ 5	230	69.7	"	20	396	79.8	"
6.5	252.4	71.6	"	28	436	81.3	$ZnCl_2.H_2O$ + $ZnCl_2$
5	282	73.8	"	31	477	82.7	$ZnCl_2.H_2O$
0	309	75.5	$.3H_2O$ + $.1\frac{1}{2}H_2O$	25	432	81.2	$ZnCl_2$
0	235	70.1	$ZnCl_2.2\frac{1}{2}H_2O$	40	452	81.9	"
6.5	252	71.6	$.2\frac{1}{2}H_2O$ + $.3H_2O$	60	488	83.0	"
10	272	73.1	$ZnCl_2.2\frac{1}{2}H_2O$	80	543	84.4	"
12.5	303	75.2	"	100	615	86.0	"
11.5	335	77.0	$.2\frac{1}{2}H_2O$ + $.1\frac{1}{2}H_2O$	262	∞	100.0	"

Cl

SOLUBILITY OF OXYCHLORIDES OF ZINC IN AQUEOUS SOLUTIONS OF ZINC CHLORIDE AT ROOM TEMPERATURE.

(Driot, 1910.)

Gms. per 100 Gms. H_2O		Solid Phase.	Gms. per 100 Gms. H_2O.		Solid Phase.
$ZnCl_2$.	ZnO.		$ZnCl_2$.	ZnO.	
8.22	0.0137	$ZnCl_2.4ZnO.6H_2O$	62.85	0.884	$ZnCl_2.4ZnO.6H_2O$
23.24	0.138	"	96	1.792	"
45.95	0.497	"	124.7	3.213	"
51.5	0.604	"	144.8	2.64	"
56.9	0.723	"	203	1.59	$ZnCl_2.ZnO.1\frac{1}{2}H_2O$

Results are also given for mixture of the oxychloride and oxide in aqueous zinc chloride solutions at various temperatures.

Data for equilibrium in the system Zinc Chloride, Zinc Oxide and Water at 25° and at 50° are given by Holland, 1930. The results are presented according to Janecke's method and can only be converted to the weight basis by tedious calculations. The author failed to find the compound $ZnCl_2.ZnO.1\frac{1}{2}H_2O$ reported by Drist. He obtained evidence for the existance of two new oxychlorides of zinc, namely, $ZnCl_2.ZnO.2H_2O$ and $ZnCl_2.ZnO.H_2O$. Of those formerly described only $ZnCl_2.5ZnO.8H_2O$ exists in stable equilibrium in the range of concentration of the present experiments.

Additional data on this system are given by Feitknecht, 1930. The results which are given only in the form of a diagram are in satisfactory agreement with those of Driot. In addition to the solubility of ZnO in aqueous solutions of $ZnCl_2$ the author also gives curves showing the solubility of ZnO in aqueous solutions of $ZnBr_2$ and of ZnI_2.

EQUILIBRIUM IN THE SYSTEM ZINC CHLORIDE AND ACETIC ACID.
DETERMINED BY THE FREEZING-POINT METHOD.

(Davidson and Chappell, 1939.)

t°	Mol. percent $ZnCl_2$ in Mixture	Solid Phase
16.6	0.0	CH_3COOH
15.75	1.77	"
14.95	3.46	"
12.85	7.31	"
11.45	9.67	"
10.35	10.99	CH_3COOH
8.55	12.88	"
7.30	14.14	"
4.80	16.16	"
2.0	18.45	"
4.0	22.07	"

The authors also give results for the system Zinc Chloride + Zinc Acetate + Acetic Acid.

100 gms. abs. acetone dissolve 43.5 gms. $ZnCl_2$ at 18°, d_{18} of sat. sol. = 1.14. (Naumann, 1904.)

100 gms. glycerol dissolve 50 gms. $ZnCl_2$ at 15.5°. (Ossendowski, 1907.)

100 cc. anhydrous hydrazine dissolve 8 gms. $ZnCl_2$ at room temp. (Welsh and Broderson, 1915.)

When 1 gm. of zinc as chloride is dissolved in 100 cc. of aq. 10% HCl and shaken with 100 cc. of ether, 0.03 per cent of the metal enters the ethereal layer. (Mylius, 1911.)

Cl

ZINC CHLORIDE $ZnCl_2$.

SOLUBILITY OF ZINC CHLORIDE IN PYRIDINE. (Mason and Mathews, 1925.)

The determinations were made with a modified Meyerhoffer-Saunders apparatus (Walton and Judd, *J. Am. Chem. Soc.*, 33, 1039, 1911).

t°.	Gms. $ZnCl_2$ per 100 gms. sat. sol.	Solid Phase.
0....	1.60	$ZnCl_2 . 2C_5H_5N$
5....	1.80	»
10....	2.02	»
15....	2.28	»
20....	2.55	»
24.12.	2.80	»
35....	3.67	»
45....	4.66	$ZnCl_2 . 2C_5H_5N$
55....	5.85	»
65....	7.33	»
75....	9.06	»
85....	11.11	»
95....	13.60	»
105 ...	16.26	»

100 gms. sat. solution of zinc chloride in selenium oxychloride ($SeOCl_2$) contain 1.10 gms. $ZnCl_2$ at 25°. (Wise, 1923.)

100 gms. Liquid Sulfur Dioxide dissolve 0.16 gm. $ZnCl_2$ at 0°. (Jander and Ruppolt, 1937.)

ZINC CHLORIDE .2 Thiourea, $ZnCl_2 . 2(NH_2)_2CS$.

One liter of its saturated solution in Water contains 174.8 gms. of the compound at about 20°. (Walter and Reimer, 1934.)

ZINC CHLORATE $Zn(ClO_3)_2.6H_2O$.

SOLUBILITY IN WATER.

(Meusser, 1902; at 18°, Mylius and Funk, 1897.)

t°.	Gms. $Zn(ClO_3)_2$ per 100 Gms. Solution.	Mols. $Zn(ClO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Zn(ClO_3)_2$ per 100 Gms. Solution.	Mols. $Zn(ClO_3)_2$ per 100 Mols. H_2O.	Solid Phase.
−18	55.62	9.70	$Zn(ClO_3)_2.6H_2O$	30	67.66	16.20	$Zn(ClO_3)_2.4H_2O$
0	59.19	11.08	"	40	69.06	17.29	"
8	60.20	11.72	"	55	75.44	24	"
15	67.32	15.96	"	Ice curve			
18	66.52	15.39	$Zn(ClO_3)_2.4H_2O$	−13	30.27	3.36	Ice
				− 9	26.54	2.80	"

Sp. Gr. of solution saturated at 18° = 1.916.

ZINC Per CHLORATE $Zn(ClO_4)_2.6H_2O$.

ClO 100 gms. Furfural dissolve 85 gms. $Zn(ClO_4)_2.(?6H_2O)$ at about 20°.
" " Cellosolve(1) " 130 " " " " "

(1) Mono ethyl ether of ethylene glycol. (Chavey and Mann, 1931.)

ZINC Hexa Antipyrine Per CHLORATE $[Zn(COC_{10}H_{12}N_2)_6](ClO_4)_2$.

100 cc sat. solution of this salt in water contain 10.2 gms. $[Zn(COC_{10}H_{12}N_2)_6](ClO_4)_2$ at 20°. (Wilke-Dörfurt and Schliephake, 1929.)

ZINC CHROMATES.

EQUILIBRIUM IN THE SYSTEM ZINC OXIDE, CHROMIUM TRIOXIDE AND WATER AT 25°.

(Gröger, 1911.)

CrO An excess of ZnO was, in each case, shaken for 3 days at 25°, with gradually increasing concentrations of chromic acid.

Gms. per Liter Sat Sol.		Solid Phase.	Gms. per Liter Sat Sol.		Solid Phase.
ZnO.	CrO_3.		ZnO.	CrO_3.	
0.409	0.604	$4ZnO\ CrO_3.3H_2O$	66.1	151	$4ZnO.CrO_3.3H_2O$
2.24	4.19	"	83.7	192	" $+3ZnO.2CrO_3.H_2O$
5.86	11.5	" $+3ZnO.CrO_3.2H_2O$	123	285	$3ZnO.2CrO_3.H_2O$
10.7	22.2	$3ZnO\ CrO_3.2H_2O$	193	450	"
26.7	57.5	"	196	461	" $+ZnO.CrO_3.H_2O$
30.4	66.7	" $+4ZnO.CrO_3\ 3H_2O$	202	475	$ZnO.CrO_3.H_2O$
32.2	70.6	$4ZnO.CrO_3.3H_2O$	389	940	"

ZINC FLUORIDE $ZnF_2.4H_2O$.

SOLUBILITY OF ZINC FLUORIDE IN WATER.

t°	Gms. ZnF_2 per 100 cc sat. sol.	Solid Phase	Authority
18	1.6	$ZnF_2.4H_2O$	(Dietz, 1900.)
20	1.62	"	(Kurtenacker, Finger and Hey, 1933.)
25	1.516	"	(Carter, 1928.)

SOLUBILITY OF ZINC FLUORIDE IN AQUEOUS SOLUTIONS OF HYDROFLUORIC ACID AT 20°.

(Kurtenacker, Finger and Hey, 1933.)

Gms. per 100 gms. sat. sol. HF	Gms. per 100 gms. sat. sol. ZnF_2	Solid Phase
2.47	2.54	$ZnF_2.4H_2O$
3.69	4.98	"
17.38	9.53	"
25.43	11.40	"
29.16	11.84	"

SOLUBILITY OF ZINC FLUORIDE AT 20° IN AQUEOUS SOLUTIONS OF:

(Kurtenacker, Finger and Hey, 1933.)

Ammonium Fluoride

Gms. per 100 gms. sat. sol. NH_4F	Gms. per 100 gms. sat. sol. ZnF_2	Solid Phase
4.0	0.46	$ZnF_2.4H_2O$
8.6	0.31	"
13.0	0.16	$ZnF_2.2NH_4F.2H_2O$
20.4	0.05	"
28.0	0.03	"
39.8	0.027	"

Potassium Fluoride

Gms. per 100 gms. sat. sol. K F	Gms. per 100 gms. sat. sol. ZnF_2	Solid Phase
1.5	0.25	Mixed crystals
10.0	0.025	"
19.0	—	"
26.5	—	
34.0	—	"
41.8	—	"

F

The mixed crystals contained per 1 mol. ZnF_2 from 1.2 to 1.4 mol. KF.

ZINC Hexa Antipyrine Boro FLUORIDE $[Zn(COC_{10}H_{12}N_2)_6](BF_4)_2$.

100 cc sat. sol. of this salt in water contain 16.4 gms. $[Zn(COC_{10}H_{12}N_2)_6](BF_4)_2$ at 20°. (Wilke-Dörfurt and Mureck, 1929.)

ZINC Silico FLUORIDE $ZnSiF_6.6H_2O$.

SOLUBILITY OF ZINC SILICO FLUORIDE IN WATER.

(Jatlov and Pinaevskaja, 1938.)

t°	Gms. $ZnSiF_6$ per 100 gms. sat. sol.	Solid Phase	t°	Gms. $ZnSiF_6$ per 100 gms. sat. sol.	Solid Phase
- 0.8	5.0	Ice	0	33.73	$ZnSiF_6.6H_2O$
- 1.4	10.0	"	20	35.16	"
- 3.2	15.0	"	20 ($d=1.4336$)	32.86 (1)	"
- 4.8	20.0	"	40	37.04	"
- 7.4	25.0	"	60	38.49	"
-11.8	30.	"	80	40.95	"
-14.6	32.	" + $ZnSiF_6.6H_2O$	100	42.18	"

SOLUBILITY OF ZINC SILICO FLUORIDE IN SILICO FLUORIC ACID AT 20°.

(Jatlov and Pinsevskaya, 1930.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
H_2SiF_6	$ZnSiF_6$		H_2SiF_6	$ZnSiF_6$	
0.0	35.16	$ZnSiF_6 \cdot 6H_2O$	14.15	20.13	$ZnSiF_6 \cdot 6H_2O$
1.0	34.90	"	26.13	8.47	"
1.81	33.65	"	37.40	3.69	"
6.20	27.64	"	48.95	0.78	"

ZINC IODIDE ZnI_2.

SOLUBILITY IN WATER.

(Dietz, 1900; see also Etard, 1894.)

t°.	Gms. ZnI_2 per 100 Gms. Solution.	Mols. ZnI_2 per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. ZnI_2 per 100 Gms. Solution.	Mols. ZnI_2 per 100 Mols. H_2O.	Solid Phase.
−10	80.50	23.3	$ZnI_2.2H_2O$	0	81.11	24.2	ZnI_2
−5	80.77	23.7	"	18	81.20	24.4	"
0	81.16	24.3	"	40	81.66	25.1	"
+10	82.06	25.8	"	60	82.37	26.4	"
22	83.12	27.8	"	80	83.05	27.5	"
27	89.52	50.3	"	100	83.62	28.7	"

Sp. Gr. of sat. solution of the anhydrous salt at 18° = 2.725.

100 gms. glycerol dissolve 40 gms. ZnI_2 at 15.5°. (Ossendowski, 1907.)

EQUILIBRIUM IN THE SYSTEM ZINC IODIDE, ETHYL ETHER AND WATER.

(Quempel, 1929.)

I

Zinc iodide greatly increases the mutual solubility of ether and water. The system has an upper critical solution temperature. At concentrations of salt less than 70 percent a homogeneous liquid is not obtained by increase of temperature.

t° of saturation	Wt. Percent ZnI_2 in aq. solution	Gms. $(C_2H_5)_2O$ per 100 gms. $(C_2H_5)_2O + H_2O$	t° of saturation	Wt. Percent ZnI_2 in aq. solution	Gms. $(C_2H_5)_2O$ per 100 gms. $(C_2H_5)_2O + H_2O$
- 6.0	69.93	10.40	21.2	79.86	60.45
+22.4	"	15.68	18.2	"	65.05
39.8	"	22.32	13.5	"	69.21
47.9	"	28.03	3.8	"	75.77
54.5	"	32.81	0.0	84.64	44.10
60.6	"	37.50	+3.6	"	51.75
0.0	74.59	11.96	3.4	"	61.75
+24.0	"	28.11	-1.1	"	66.80
45.2	"	49.37	-6.0	"	68.42
51.1	"	54.67	-2.0	"	73.63
56.0	"	56.0	-3.0	"	74.10
62.6	"	64.4	-5.9	85.08	42.00
- 2.1	79.86	15.70	-3.4	"	45.53
+11.1	"	27.30	-0.5	"	54.21
12.6	"	30.79	-2.6	"	65.54
16.5	"	37.74	-12.2	"	70.36
22.0	"	52.98	-30.0	"	75.66
21.5	"	58.73			

100 cc Pyridine dissolve 12.6 gms. ZnI_2 at 18°. (Müller, R., 1924.)

100 gms. Liquid Ammonia dissolve 0.10 gm. ZnI_2 at 0°. (Hunt and Boncyk, 1933.)

100 gms. Liquid Sulfur Dioxide dissolve 0.11 gm. ZnI_2 at 0°. (Jaader and Ruppolt, 1937.)

ZINC IODATE $Zn(IO_3)_2$.

100 gms. H_2O dissolve 0.87 gm. $Zn(IO_3)_2$ cold and 1.31 gms. hot.
(Rammelsberg, 1838.)

ZINC NITRATE $Zn(NO_3)_2.6H_2O$.

SOLUBILITY OF ZINC NITRATE IN WATER.

(Sieverts and Petzold, 1933.)

The earlier determinations of Funk, 1900, and of Jones and Getman, 1904, for the ice curve, are in general agreement with the results of Sieverts and Petzold.

t°	Gms. $Zn(NO_3)_2$ per 100 gms. sat. sol.	Solid Phase
-5.8	16.4	Ice
-12.0	25.4	"
-19.6	31.7	"
-28.0	37.1	"
-32.0	38.9	" + $Zn(NO_3)_2.9H_2O$
-29.0	39.7	$Zn(NO_3)_2.9H_2O$
-23.0	40.8	"
-19.5	42.9	"
-17.6	—	" → $Zn(NO_3)_2.6H_2O$
-23.0	43.5*	$Zn(NO_3)_2.6H_2O$
-19.0	44.5*	"
+0.4	48.3	"
30.0	58.1	"
35.0	61.2	"
36.4 m.pt.	—	$Zn(NO_3)_2.6H_2O$
35.8	65.0	" + $Zn(NO_3)_2.4H_2O$
43.5	69.7	$Zn(NO_3)_2.4H_2O$
45.0	70.2	"
45.5 m.pt.	—	"
45.0	73.8	"
43.5	75.8	"
37.0	77.9	" + $Zn(NO_3)_2.2H_2O$
51	80.7	$Zn(NO_3)_2.2H_2O$
54 m.pt.	83.2	"
51.8	86.2	" + $Zn(NO_3)_2.H_2O$
59.0	87.2	$Zn(NO_3)_2.H_2O$
73.1	89.9	"
73.9	91.2	"
73.0	92.6	"

NO

* = Metastable.

The following very accurate determinations made by the freezing-point method are given by Ewing, McGovern and Mathews, Jr., 1933.)

t°	Gms. $Zn(NO_3)_2$ per 100 gms. sat. sol.	Solid Phase
25.1	56.1	$Zn(NO_3)_2.6H_2O$
27.3	56.9	"
30.4	58.3	"
32.4	59.5	"
34.1	60.8	"
36.1 m.pt.	63.4	"
35.4	65.2	"
34.6	66.2	" + $Zn(NO_3)_2.4H_2O$
33.1	67.4*	"
40.0	67.9	$Zn(NO_3)_2.4H_2O$
43.2	70.0	"
44.7 m.pt.	72.5	"
42.4	75.8	"
39.7	77.2	"
38.2	77.8	$Zn(NO_3)_2.4H_2O$
37.2	78.0	" + $Zn(NO_3)_2.2H_2O$
32.2	79.0*	"
43.6	79.7	$Zn(NO_3)_2.2H_2O$
44.9	79.8	"
51.9	81.9	"
55.4 m.pt.	84.0	"
55.2	85.2	"
52.1	86.3	" + $Zn(NO_3)_2.H\ O$
52.8	86.6	$Zn(NO_3)_2.H_2O$
59.2	87.6	"
65.2	88.6	"
68.6	89.4	"
70.7	90.0	"

* = Metastable.

EQUILIBRIUM IN THE SYSTEM ZINC NITRATE, NITRIC ACID AND WATER AT 20°.

(Malquori, 1928.)

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$Zn(NO_3)_2$	HNO_3		$Zn(NO_3)_2$	HNO_3	
54.03	0.0	$Zn(NO_3)_2.6H_2O$	36.02	36.11	$Zn(NO_3)_2.4H_2O$
48.13	10.40	"	32.75	38.10	"
42.09	18.11	"	29.28	49.22	"
36.15	25.35	"	29.03	50.82	"
32.71	30.15	"	29.00	57.19	"
36.11	34.45	"+$Zn(NO_3)_2.4H_2O$	29.57	59.21	"

The following more complete data for this system at 25° are given by Ewing, Richards, Taylor Jr., and Winkler, 1933.

Gms. per 100 gms. sat. sol.		Solid Phase	Gms. per 100 gms. sat. sol.		Solid Phase
$Zn(NO_3)_2$	HNO_3		$Zn(NO_3)_2$	HNO_3	
56.1	0.0	$Zn(NO_3)_2.6H_2O$	64.2	14.9*	$Zn(NO_3)_2.4H_2O$
53.1	3.5	"	62.2	17.9	"+$Zn(NO_3)_2.2H_2O$
49.4	9.5	"	65.9	12.8*	$Zn(NO_3)_2.2H_2O$
46.8	15.5	"	57.9	22.6	"
47.6	16.6	"	55.2	26.6	"
49.7	15.5	"+$Zn(NO_3)_2.4H_2O$	44.6	42.1	"
41.5	24.0	$Zn(NO_3)_2.4H_2O$	44.9	43.5	"
34.6	36.7	"	46.7	42.2	"
35.0	39.2	"	52.6	36.9	"
37.5	38.0	"	52.1	37.4	$Zn(NO_3)_2.H_2O$
41.4	35.1	"	43.5	47.4	"
45.9	31.6	"	28.1	65.5	"
54.0	24.5	"	15.3	78.9	"
60.5	18.5	"	11.6	85.9	"
62.2	16.8*	"	9.9	88.8	"

NO

EQUILIBRIUM IN THE SYSTEM ZINC OXIDE, NITROGEN PENTOXIDE AND WATER.

(Denham and Dick, 1931.)

Results at 25°				Results at 50°			
d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	N_2O_5	ZnO			N_2O_5	ZnO	
1.015	1.0	0.8	1.5.3	1.022	1.6	1.0	1.5.3
1.094	5.7	4.6	"	1.116	7.5	5.9	"
1.218	12.7	9.7	"	1.401	21.6	16.9	"
1.380	20.3	15.5	"	1.476	24.7	19.0	"
1.585	27.9	21.5	"+1.1.3	1.503	25.6	19.9	"
1.657	30.6	22.0	1.1.3	1.544	26.7	20.8	"+1.1.3
1.695	31.8	23.5	"+$Zn(NO_3)_2.6H_2O$	1.571	27.4	21.3	1.1.3
1.675	33.5	22.0	$Zn(NO_3)_2.6H_2O$	1.613	29.5	22.6	"
1.679	39.6	20.2	"	1.660	31.1	23.8	"
1.737	42.6	21.4	"+$Zn(NO_3)_2.4H_2O$	1.750	34.4	26.4	"
1.737	42.6	21.3	$Zn(NO_3)_2.4H_2O$	1.793	36.0	27.2	"
1.695	45.6	18.6	"	1.941	40.8	30.9	"

1.5.3 = $Zn(NO_3)_2.5ZnO.3H_2O$; 1.1.3 = $Zn(NO_3)_2.ZnO.3H_2O$.

SOLUBILITY OF ZINC NITRATE IN LIQUID AMMONIA.

(Donskaja and Portnov, 1939.)

t°	Gms. $Zn(NO_3)_2$ per 100 gms. NH_3	Solid Phase	t°	Gms. $Zn(NO_3)_2$ per 100 gms. NH_3	Solid Phase
-79	1.06	NH_3	-39	33.62	$Zn(NO_3)_2 \cdot 8NH_3$
-79	6.61	"	-31	31.88	"
-78.5	11.71	"	0	29.01	"+$Zn(NO_3)_2 \cdot 6NH_3$
-78	16.34	"	+43	31.88	$Zn(NO_3)_2 \cdot 6NH_3$
-77	20.11	"+$Zn(NO_3)_2 \cdot 10NH_3$	48	53.62	"
-75	22.17	$Zn(NO_3)_2 \cdot 10NH_3$	58	35.18	"+$Zn(NO_3)_2 \cdot 4NH_3$
-73	24.10	"	60	37.81	$Zn(NO_3)_2 \cdot 4NH_3$
-71	26.36	"	63	40.38	"
-67	29.01	"	68	44.67	"
-62	31.88	"	75	50.30	"
-60	33.62	"	79	55.09	"
-58	35.10	"+$Zn(NO_3)_2 \cdot 8NH_3$	101	71.38	"
			125	85.40	"

ZINC HYDROXIDE $Zn(OH)_2$.

SOLUBILITY OF ZINC OXIDE (HYDROXIDE) IN WATER AT 18°.

(Remy and Kuhlmann, 1924; Remy, 1925.)

The determinations were made by (1) the ordinary electrolytic conductivity method, taking into consideration the carbonate content of the water and assuming that the zinc is present as completely dissociated hydroxide, and (2) by a conductotitrametric method.

By method (1) there was found 0.00306 gms. or 0.038 millimols ZnO per liter.
" " (2) " " 0.00292 " 0.036 " " "

OH

The solubility of Zinc Hydroxide in Water, determined by electrometric titration, is given by Busch, 1927, as 1.92 x 10^{-5} gm. mol. ZnO per liter at 29°.

One liter of water dissolves 0.0042 gm. ZnO at 18 as determined by the conductivity method. (Dupre, .)

One liter of water dissolves 0.0042 gm. ZnO at 18°, conductivity method.
(Dupre and Bialas, 1903.)

One liter of water dissolves 0.01 gm. at 25°. (Bodlander, 1898.)

SOLUBILITY OF ZINC HYDROXIDE IN AQUEOUS SOLUTIONS OF:

Ammonia and Ammonia Bases at 17°-19°.
(Herz, 1902.)

Normality of the Base.	Normality of Dissolved Zn.	Gms. ZnO per 20 cc. Solution.
0.0942 NH_3	0.0011	0.00185
0.236 "	0.0110	0.0180
0.707 "	0.059	0.0958
0.0944 NH_2CH_3	0.0005	0.0008
0.472 "	0.0081	0.0132
0.944 "	0.03	0.0484
0.068 $NH_2C_2H_5$	0.0003	0.0005
0.51 "	0.0045	0.0074
0.68 "	0.0098	0.0161

Sodium Hydroxide at Ord. Temp.
(Rubenbauer, 1902.)

Gms. per 20 cc. Solution		Mol Dilution of the NaOH.
Na.	Zn.	
0.1012	0.0040	4.50
0.1978	0.0150	2.33
0.4278	0.0442	1.06
0.6670	0.1771	0.70
0.9660	0.9630	0.48
1.4951	0.2481	0.31
2.9901	0.3700	0.16

Moist $Zn(OH)_2$ used. Solutions shaken 5 hours.

SOLUBILITY OF ZINC HYDROXIDE IN AQUEOUS SOLUTIONS OF AMMONIUM HYDROXIDE.

Results of Euler (1903).			Results of Bonsdorff (1904) at 25°.			
t°.	Normality of Aq. Ammonia.	Mols. Zn per Liter.	Normality of Aq. Ammonia.	Gms. ZnO per Liter.	Normality of Aq. Ammonia.	Gms. ZnO per Liter.
15-17	0.485	0.013-0.010*	0.311	0.85	0.321	0.34
15-17	0.97	0.034	0.825	3.84	0.643	0.845
21	0.253	0.0029	1.287	7.28	1.215	2.70
21	0.259	0.0022*			1.928	5.07
21	0.500	0.0097			2.570	7.01
21	0.518	0.0070			3.213	10.16

Euler states that the higher results of Herz are due to incompletely purified zinc hydroxide and uses material precipitated from the nitrate for his experiments. Different preparations of $Zn(OH)_2$ containing from 55 to 77 per cent H_2O were used and in the two cases marked * ZnO was used.

Bonsdorff used for his second series of determinations, $Zn(OH)_2$ precipitated from the nitrate and brought in moist condition into the ammonia solutions.

OH

SOLUBILITY OF CRYSTALLINE ZINC HYDROXIDE IN AQUEOUS SOLUTIONS OF AMMONIUM HYDROXIDE AND OF SODIUM HYDROXIDE AT 25°.

(Dietrich and Johnston, 1927.)

Attention is called to the discordant character of previous results due to the uncertain nature of the solid phase present in each case. The authors used crystalline zinc hydroxide prepared by dissolving washed precipitated zinc hydroxide in ammonia and gradually removing the ammonia from the solution by absorption from the vapor phase by concentrated sulfuric acid. The crystals which gradually deposit contain 18.12% H_2O corresponding to pure $Zn(OH)_2$. Equilibrium was reached within 24 hours. The following are the interpolated values from the average experimental results.

Gm. Mol. NaOH or NH_4OH per 1000 gms. H_2O	Gm. Mols. $Zn(OH)_2$ dissolved per 1000 gms. H_2O in aq.:		Gm. Mol. NaOH or NH_4OH per 1000 gms. H_2O	Gm. Mols. $Zn(OH)_2$ dissolved per 1000 gms. H_2O in aq.:	
	NH_4OH	NaOH		NH_4OH	NaOH
0.0	0.00002	0.00002	1.5	0.0496	0.1042
0.2	0.00130	0.00206	2.0	0.0790	0.1832
0.3	0.00275	0.00444	2.5	0.1105	0.2845
0.4	0.00468	0.00760	3.0	0.1428	0.4065
0.5	0.00705	0.0115	3.5	0.1757	0.5470
0.75	0.0147	0.02625	4.0	0.2096	0.7032
1.0	0.0246	0.0468	5.0	0.2785	1.0740

Results are also given for 0° and 35°.

SOLUBILITY OF ZINC HYDROXIDE IN AQUEOUS POTASSIUM HYDROXIDE SOLUTIONS.

(Klein, 1912.)

The determinations were made by adding aq. $ZnSO_4$ solution (containing one gm. mol. per liter) to aq. KOH solutions until a permanent precipitate just appeared. The titrations are also recalculated to mols. per liter and correction made for the dilution of the KOH solution by the aq. $ZnSO_4$.

Normality of Aq. KOH.	cc. $ZnSO_4$ Sol. per 50 cc. Aq. KOH.	Calculated Mols. per Liter of Sat. Sol.		
		Oric Conc. KOH.	Corrected Conc. of KOH.	Conc. of Zn.
1	5.5	1	0.9	0.10
1.78	13.1	1.78	1.42	0.209
2	14.3	2	1.56	0.223
2.22	17.9	2.22	1.63	0.266
2.5	18.8	2.5	1.81	0.272
3	24.6	3	2.02	0.330
3.6	29.1	3.6	2.28	0.368
4	34	4	2.38	0.405
6	56 (?)	6	2.78	0.540

OH

SOLUBILITY OF ZINC HYDROXIDE IN AQUEOUS SODIUM HYDROXIDE AT 30°.

(Fricke, 1928.)

The mixtures were agitated for periods up to 15 days. The solubility increased with time owing to the formation of ZnO.

Gms. per 100 gms. sat. sol.		Gms. per 100 gms. sat. sol.	
NaOH	ZnO	NaOH	ZnO
7.10	1.44	22.0	8.76
13.3	5.15	24.6	12.81
13.7	6.81	28.3	13.8
17.8	9.81	31.75	21.57

Results for the solubility of calcined and hydrated zinc oxide in aqueous solutions of NaOH and of KOH, and for sodium zincate in aqueous solutions of NaOH are given by Müller, Müller and Fouvel, 1927.

SOLUBILITY OF ZINC HYDROXIDE IN ONE PER CENT AQUEOUS SALT SOLUTIONS AT 16°-20°.

(Snyder, 1878.)

The CO_2 free $Zn(OH)_2$ dissolved is calculated as milligrams Zn per liter of the given salt solution. Additional determinations are also given.

Aq. Salt Solution.	Mgs. Zn per Liter Solution.	Aq. Salt Solution.	Mgs. Zn per Liter Solution.	Aq. Salt Solution.	Mgs. Zn per Liter Solution.
NaCl	51	K_2SO_4	37.5	K_2CO_3	0
KCl	43	$MgSO_4$	27	NH_4Cl	95
$CaCl_2$	57.5	KNO_3	17.5	NH_4NO_3	77
$MgCl_2$	65	$Ba(NO_3)_2$	25	$(NH_4)_2SO_4$	88
$BaCl_2$	38				

ZINC PHOSPHATES $Zn_3(PO_4)_2.4H_2O$, $ZnHPO_4.3H_2O$, $Zn(H_2PO_4)_2.2H_2O$.

EQUILIBRIUM IN THE SYSTEM ZINC OXIDE, PHOSPHORUS PENTOXIDE AND WATER AT 25° AND AT 37°. (Eberly, Gross and Crowell, 1920.)

The flasks containing the mixtures were kept in thermostats and occasionally shaken during several weeks. The analyses of the saturated solutions and solid phases were repeated at intervals of two weeks untill constant results were obtained.

PO

Results at 25°.

Gms. per 100 gms. sat. sol.		
P_2O_5.	ZnO.	Solid Phase.
5.08	2.38	$Zn_3(PO_4)_2.4H_2O$
9.76	4.65	»
12.42	6.13	»
13.52	6.56	»
14.00	6.74	»
14.37	6.97	»
14.83	7.37	»
15.98	7.71	$ZnHPO_4.3H_2O$
17.15	8.26	»
18.33	8.73	»
22.75	10.74	»
26.48	12.47	»
28.70	13.48	»
30.09	14.16	»
32.55	15.40	»
33.79	15.82	»
37.15	17.30	»
39.61	18.04	»
42.05	16.14	$Zn(H_2PO_4)_2.2H_2O$
44.53	13.20	»
48.70	9.58	»
52.25	7.64	»
55.97	7.23	»

Results at 37°.

Gms. per 100 Gms. sat. sol.		
P_2O_5.	ZnO.	Solid Phase.
4.87	2.08	$Zn_3(PO_4)_2.4H_2O$
9.46	4.12	»
13.60	6.27	»
18.13	8.78	»
19.48	9.66	»
20.32	10.16	»
21.96	10.88	$ZnHPO_4.3H_2O$
26.75	13.26	»
29.65	14.77	»
33.39	17.06	»
34.58	17.92	»
36.13	16.00	$ZnHPO_4.H_2O$
37.80	15.78	»
39.93	16.12	»
42.42	15.81	»
42.65	16.82	»
44.89	17.83	»
46:11	18.05	$Zn(H_2PO_4)_2.2H_2O$
46.41	14.74	»
48.99	12.55	»
51.35	11.26	»
51.92	11.12	»
54.32	10.82	»

ZINC Ammonium PHOSPHATE $ZnNH_4PO_4$.

One liter sat. solution in water contains 0.0136 gm. $ZnNH_4PO_4$ at 10.5° and 0.0145 gm. at 17.5°. (Artmann, 1915.)

ZINC Tetrammine Per RHENATE $[Zn(NH_3)_4](ReO_4)_2$.

One liter sat. solution of this salt in aqueous ammonia of d = 0.930 (19 percent) contain 1.852 gm. at 20°. (Wilke-Dorfurt and Gunzert, 1933.)

ZINC SULFIDE ZnS.

S

Critical reviews of the published determinations of the solubilities of the metal sulfides in water are given by Kolthoff, 1931, and Ravitz, 1936. The preferred value for ZnS, calculated by Ravitz with the aid of recent viscosity data, is 1.47 x 10^{-9} gm. mols. per liter.

1000 cc. aq. 2.0 *n* H_2SO_4, sat. with H_2S at 1 atmosphere pressure, dissolve 0.6172 gm. ZnS (= $6.34.10^{-8}$ gm. mols. ZnS) at 20°. (Moser and Behr, 1924.)

ZINC SULFITE $ZnSO_3.2\frac{1}{2}H_2O$.

EQUILIBRIUM IN THE SYSTEM ZINC OXIDE, SULFUR DIOXIDE AND WATER.

(Terres and Ruhl, 1934.)

The determinations were made by the synthetic method. The results are given in the present paper only in the form of a small diagram from which the following approximate values were read.

Results at 15°

Mol. Percent in sat. sol. ZnO	Mol. Percent in sat. sol. SO_2	Solid Phase
1.0	2.1	$ZnSO_3.2\frac{1}{2}H_2O$
2.0	4.0	"
2.55	5.0	" + $Zn(HSO_3)_2$(?)
2.5	6.0	$Zn(HSO_3)_2$(?)
3.0	7.2	"
4.0	9.1	"
5.0	10.75	"
5.6	11.8*	"

Results at 25°

Mol. Percent in sat. sol. ZnO	Mol. Percent in sat. sol. SO_2	Solid Phase
1.0	2.4	$ZnSO_3.2\frac{1}{2}H_2O$
2.0	4.6	"
2.8	6.0	" + $Zn(HSO_3)_2$(?)
2.0	6.4	$Zn(HSO_3)_2$(?)
1.5	7.0	"
1.3	9.0	"
1.5	9.0	"
2.0	10.0	"
3.3	11.8*	"

* Between 11.8 and 84 Mol. percent SO_2 the mixtures separated into two liquid layers.

100 gms. H_2O dissolve 0.16 gm. $ZnSO_3.2H_2O$. (Houston and Trichborne, 1890.)

SO

ZINC SULFATE $ZnSO_4.6H_2O$.

SOLUBILITY OF ZINC SULFATE IN WATER.

(Bury, 1924; Cohen and Hetterschij, 1925; Cohen and Moesveld, 1925.)

The very exact determinations of these authors were plotted and the following table constructed from the curves.

t°.	Gms. $ZnSO_4$ per 100 gms. H_2O.	Solid Phase.
0	41.61	$ZnSO_4.7H_2O$ (Rhombic)
5	44.41	»
10	47.25	»
15	50.34	»
20	53.80	»
25	57.45	»
30	61.30	»
35	66.17	»
37.9 tr. pt.	69.4	» + $ZnSO_4.6H_2O$
10	54.4	$ZnSO_4.7H_2O$ (Monoclinic)
15	57.0	»
20	60.0	»
24.8 tr. pt.	63.4	» + $ZnSO_4.6H_2O$

t°.	Gms. $ZnSO_4$ per 100 gms. H_2O.	Solid Phase.
10	58.6	$ZnSO_4.6H_2O$
15	60.2	»
20	61.8	»
24.8 tr. pt.	63.4	» + $ZnSO_4.7H_2O$ (Monoclinic
25	63.5	»
30	65.5	»
35	68.0	»
37.9 tr. pt.	69.4	» + $ZnSO_4.7H_2O$ (Rhombic)
40	70.5	$ZnSO_4.6H_2O$
45	73.0	»
50	76.2	»
55	80.0	»
60	85.2	»

The following more recent determinations are given by Schröder, 1936.

t°	d. of sat. sol.	Gms. $ZnSO_4$ per 100 gms. sat. sol.	Solid Phase	t°	d. of sat. sol.	Gms. $ZnSO_4$ per 100 gms. sat. sol.	Solid Phase
0	1.3796	29.58	$ZnSO_4 \cdot 7H_2O$	50	1.6072	43.20	$ZnSO_4 \cdot 6H_2O$
25	1.4921	36.67	"	54.5	—	—	" + $ZnSO_4 \cdot H_2O$
33	1.5320	39.17	"	60	1.5921	42.98	$ZnSO_4 \cdot H_2O$
37	1.5502	40.50	"	75	1.5382	40.93	"
44	1.5836	41.98	$ZnSO_4 \cdot 6H_2O$	86	1.5041	39.26	"
				99	1.4623	37.70	"

Other determinations in satisfactory agreement with the above are given by Caven and Johnston, 1926, 1928 and Benrath, 1931.

Data for the solubility of $ZnSO_4$ in water at high pressures are given by Cohen and Sinnige, 1909, 1910.

SOLUBILITY OF ZINC SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID.

(Agde and Schimmel, 1928.)

80

t°	Gms. per 100 gms. sat. sol.		Solid Phase	t°	Gms. per 100 gms. sat. sol.		Solid Phase
	$ZnSO_4 \cdot 7H_2O$	H_2SO_4			$ZnSO_4 \cdot 7H_2O$	H_2SO_4	
-6.55	48.25	0.0	Ice+$ZnSO_4 \cdot 7H_2O$	+10	57.5	0.0	$ZnSO_4 \cdot 7H_2O$
-6.9	44.2	2.6	" "	"	48.2	5.4	"
-8.0	35.75	7.5	" "	"	41.5	11.0	"
-8.9	31.6	9.8	" "	"	36.0	15.4	"
-10.0	28.0	12.5	" "	"	32.0	20.3	"
"	19.5	19.3	$ZnSO_4 \cdot 7H_2O$	"	28.0	24.75	"
"	12.3	30.0	"	"	24.4	36.0	"
"	3.5	41.7	"	18.2	38.0	25.4	$ZnSO_4 \cdot 7H_2O \rightarrow$ $ZnSO_4 \cdot 6H_2O$
0	52.6	0.0	"				
"	48.6	2.5	"	28.5	52.5	14.2	"
"	36.5	10.0	"	39.1	73.5	0.0	"
"	27.7	16.9	"	20	63.1	0.0	$ZnSO_4 \cdot 6H_2O$
"	25.0	20.4	"	"	56.0	4.8	"
"	18.6	30.0	"	"	48.7	10.25	"
"	17.0	34.6	"	"	42.75	17.25	"
				30	68.4	0.0	"
				"	61.2	5.2	"

SOLUBILITY OF ZINC SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 12.5°.

(Montemartini and Losana, 1928.)

d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol.		Solid Phase
	$ZnSO_4$	H_2SO_4			$ZnSO_4$	H_2SO_4	
1.4214	33.28	0.0	Zn7	1.4116	5.92	44.36	Zn6+Zn2
1.3930	26.64	7.71	"	1.4620	1.19	58.76	Zn2
1.3786	20.76	16.14	"	1.5578	0.28	64.21	"+Zn
1.3888	17.02	23.64	Zn6	1.6552	0.22	72.26	Zn
1.4131	14.91	28.21	"	1.7664	0.18	81.56	"
1.4202	9.62	36.80	"	1.8402	0.16	98.96	"

Zn7 = $ZnSO_4 \cdot 7H_2O$; Zn6 = $ZnSO_4 \cdot 6H_2O$; Zn2 = $ZnSO_4 \cdot 2H_2O$; Zn = $ZnSO_4$.

EQUILIBRIUM IN THE SYSTEM ZINC SULFATE, AMMONIA AND WATER AT 0°.

(Applebey and Windridge, 1932.)

d. of sat. sol.	Gms. per 100 gms. sat. sol. NH_3	Gms. per 100 gms. sat. sol. $ZnSO_4$	Solid Phase	d. of sat. sol.	Gms. per 100 gms. sat. sol. NH_3	Gms. per 100 gms. sat. sol. $ZnSO_4$	Solid Phase
1.435	17.75	42.20	1.4.2	0.956	23.56	4.37	1.4.2
1.411	18.21	40.98	"	0.917	26.79	1.26	"
1.292	20.20	37.44	"	0.912	29.30	0.65	"
1.180	20.83	25.83	"	0.903	30.46	0.40	"
1.147	21.30	22.52	"	0.900	31.23	0.35	Solid Sol.
1.097	21.26	16.14	"	0.896	32.86	0.15	"
1.006	21.89	8.98	"	—	38.52	trace	"
				—	40.50	"	"

1.4.2 = $ZnSO_4.4NH_3.2H_2O$; Solid solution of $ZnSO_4.4NH_3$ + $ZnSO_4.5NH_3$.

At 18° the mixtures separate into two liquid layers of the following compositions.

Lower Layer			Upper Layer			
d. of solution	Gms. per 100 gms. solution NH_3	Gms. per 100 gms. solution $ZnSO_4$	d. of solution	Gms. per 100 gms. solution NH_3	Gms. per 100 gms. solution $ZnSO_4$	Solid Phase
1.488	19.24	46.22	—	—	—	1.4.2
1.457	20.37	46.02	—	—	—	"
1.395	21.70	42.13	—	—	—	"
1.304	23.32	36.97	0.928	28.74	4.44	"
1.233	23.07	32.20	0.967	26.34	7.82	—
1.201	22.85	29.38	0.995	25.30	10.71	—
—	—	—	0.929	28.68	4.01	1.4.2
—	—	—	0.911	29.07	2.20	"
—	—	—	0.895	30.03	1.23	"
—	—	—	0.887	32.43	0.43	solid sol.
—	—	—	0.880	33.30	0.49	"
—	—	—	—	38.75	0.01	"

Several results similar to the above are given for other temperatures.

SOLUBILITY OF ZINC SULFATE IN AQUEOUS ETHYL ALCOHOL.

(Schiff, 1861.)

Concentration of Alcohol	10 per cent	20 per cent	40 per cent
Gms. $ZnSO_4.7H_2O$ per 100 Gms. Solution	51.1	39	3.45

100 gms. abs. methyl alcohol dissolve 0.65 gm. $ZnSO_4$ at 18°, 5.90 gms. $ZnSO_4.7H_2O$ at 18°.

100 gms. 50 per cent methyl alcohol dissolve 15.7 gms. $ZnSO.7H_2O$ at 18°. (de Bruyn, 1892.)

100 gms. glycerol dissolve 35 gms. zinc sulfate at 15.5°. (Ossendowski, 1907.)

SOLUBILITY OF ANHYDROUS ZINC SULFATE IN:

(Gibson, Driscoll and Jones, 1929.)

Methyl Alcohol			Ethyl Alcohol		
t°	Gms. $ZnSO_4$ per 100 gms. CH_3OH	Solid Phase	t°	Gms. $ZnSO_4$ per 100 gms. C_2H_5OH	Solid Phase
15	0.485	$ZnSO_4.2\frac{1}{2}CH_3OH$	15	0.038	$ZnSO_4$
25	0.425	"	25	0.034	"
35	0.408	"	35	0.029	"
45	0.420	"	55	0.020	"
55	0.463	$ZnSO_4.CH_3OH$(?)			

EQUILIBRIUM IN THE SYSTEM ZINC SULFATE, ACETONE AND WATER AT 25°.

(Leaming, ----)

The binodal curve for this system was determined by the titration method; tie lines or the plait point were not determined. The author's results were plotted and the following values taken from the average curve.

80

Gms. per 100 gms. homogeneous liquid			Gms. per 100 gms. homogeneous liquid		
$ZnSO_4$	$(CH_3)_2CO$	H_2O	$ZnSO_4$	$(CH_3)_2CO$	H_2O
30.0	4.0	66.0	11.7	17.5	70.8
27.0	5.0	68.0	9.3	20.0	70.7
25.0	6.0	69.0	7.5	22.5	70.0
22.2	7.5	70.3	5.7	25.0	69.3
19.0	10.0	71.0	4.2	27.5	68.3
16.4	12.5	71.1	3.0	30.0	67.0
14.0	15.0	71.0	2.2	32.5	65.3

The composition of the homogeneous mixture mixture (plait point) of the system Zinc Sulfate + Tertiary Butyl Alcohol + Water at 25° was found by Ginnings, Hering and Webb, 1933, to be

$$6.0 \text{ gms. } ZnSO_4 + 25.5 \text{ gms. } (CH_3)_3COH + 68.5 \text{ gms. } H_2O.$$

The original results for the remaining points on the binodal curve are not given but only the values of a series of constants, calculated by means of emperical equations.

EQUILIBRIUM IN THE SYSTEM ZINC SULFATE URETHAN AND WATER AT 25°.

(Palitzsch, 1928, 1929.)

Gms. Mols. per 1000 gms. H_2O		Solid Phase
$ZnSO_4$	$NH_2COOC_2H_5$	
3.59	0.0	$ZnSO_4.7H_2O$
0.02	49.84	Upper liquid layer
3.51	0.239	Lower liquid layer
0.0	53.09	$NH_2COOC_2H_5$

ZIRCONIUM Oxy BROMIDE $ZrOBr_2.8H_2O$.

SOLUBILITY OF ZIRCONIUM OXY BROMIDE IN AQUEOUS SOLUTIONS OF HYDROBROMIC ACID AT 25°.

(v. Hevesy and Wagner, 1930.)

d. of sat. sol.	Normality of Aq. HBr	Gms. ZrO_2 per liter sat. sol.	d. of sat. sol.	Normality of Aq. HBr	Gms. ZrO_2 per liter sat. sol.
1.7488	1.046	355.7	1.4900	4.50	125.3
1.7343	1.301	344.5	1.4060	6.44	26.80
1.7139	1.485	329.6	1.4836	8.72	3.654
1.5606	3.488	190.5	1.4861	9.09	3.656
1.5525	3.663	180.2	—	13.17	2.11

ZIRCONIUM Tetra CHLORIDE $ZrCl_4$.

SOLUBILITY OF ZIRCONIUM TETRA CHLORIDE IN LIQUID SULFUR DIOXIDE.

(Bond and Stephens, 1929.)

A monel metal bomb having two chambers communicating by means of a needle valve, was used.

t°	Gm. Mol. $ZrCl_4$ per 1.0 mol. $ZrCl_2$ + SO_2
0	0.0138
10	0.0199
20	0.0258

ZIRCONIUM Oxy CHLORIDE $ZrOCl_2.8H_2O$.

SOLUBILITY OF ZIRCONIUM OXYCHLORIDE IN AQUEOUS HYDROCHLORIC ACID AT 20°.

(v. Hevesy, 1925.)

Constant agitation for many hours was employed. The zirconium oxychloride contained 0.4 % oxide of hafnium. The solid phase was $ZnOCl_2.8H_2O$ up to concentrations of 10 normal H Cl.

Normality of Aq. HCl.	Gms. ZrO_2 per liter sat. sol.	Mols. $ZrOClO_2$ per liter sat. sol.	Normality of Aq. HCl	Gms. ZrO_2 per liter sat. sol.	Mols. $ZrOCl_2$ per liter sat sol.
0.20....	358.1	2.91	6.35....	12.78	0.1037
1.47....	264 5	2.14	8.72....	6.74	0.0547
3.72....	102.2	0.832	10.14....	12.17	0.0988
4.97....	40.5	0.329	10.94....	25.3	0.205
5.81....	19.35	0.157	11.61.....	41.1	0.334

ZIRCONIUM Oxy FLUORIDE $ZrOF_2.2HF.2H_2O$.

SOLUBILITY OF ZIRCONIUM OXYFLUORIDE IN AQUEOUS SOLUTIONS OF HYDROFLUORIC ACID AT 25°.

(v. Hevesy and Wagner, 1930.)

d. of sat. sol.	Normality of aq. HF	Gms. ZrO_2 per liter sat. sol.	d. of sat. sol.	Normality of aq. HF	Gms. ZrO_2 per liter sat. sol.
1.489	0	408.5	1.685	10.05	548.5
1.559	1.06	502.2	1.600	15.05	444.3
1.712	6.03	571.8	1.430	20.09	288.3

The salt $ZrF_4.3H_2O$ crystallizes from aqueous hydrofluoric acids of concentrations between 5.0 and 20.0 normal.

ZIRCONIUM Potassium Hexa FLUORIDE ZrK_2F_6.

SOLUBILITY OF ZIRCONIUM POTASSIUM HEXA FLUORIDE IN AQUEOUS SOLUTIONS OF HYDROFLUORIC ACID AT 20°.

(v. Hevesy, 1925 v. Hevesy, Christiansen and Berglund, 1925.)

Normality of aq. HF...................	0.125	5.89
Mols. ZrK_2F_6 per liter.................	0.0655	0.1298

ZIRCONIUM Ammonium FLUORIDES $Zr(NH_4)_2F_6$ and $Zn(NH_4)_3F_7$.

SOLUBILITY OF EACH SEPARATELY IN WATER.

(v. Hevesy, 1925, v. Hevesy, Christiansen and Berglund, 1925.)

The solutions were saturated by constant shaking in a thermostat.

Compound.	t°	*d* of sat. sol.	Mol. per liter sat.sol.	
			Zr.	NH_3.
Zirconium Ammonium Hexa Fluoride $Zr(NH_4)_2F_6$...	0	–	0.611	1.226
» » » » » ...	20	1.154	1.050	2.115
» » » » » ...	45	–	1.842	3.680
» » » » » ...	90	–	2.96	5.93
» » Hepta » $Zr(NH_4)_3F_7$...	0	–	0.425	1.230
» » » » » ...	20	1.086	0.588	1.756
» » » » » ...	45	–	0.788	2.357

SOLUBILITY OF ZIRCONIUM AMMONIUM HEPTA FLUORIDE IN AQUEOUS SOLUTIONS OF AMMONIUM FLUORIDE AT 20°.

(v. Hevesy, 1925; v. Hevesy, Christiansen and Berglund, 1925.)

The mixtures were constantly agitated in a flask of ebonite.

F

d of sat. sol	Mols per liter			Solid Phase.
	NH_4F.	NH_3 (attached to Zr)	Zr.	
1.086	0.002	1.655	0.551	$Zr(NH_4)_3F_7$
–	0.462	1.125	0.375	»
–	0.966	0.726	0.242	»
–	1.941	0.292	0.0972	»
1.068	4.872	0.0678	0.0226	»
1.105	9.721	0.0515	0.01716	»

SOLUBILITY OF ZIRCONIUM AMMONIUM FLUORIDE IN AQUEOUS SOLUTIONS OF ZIRCONIUM AMMONIUM HEXA FLUORIDE AT 20° AND VICE VERSA.

(v. Hevesy, 1925; v. Hevesy, Christiansen and Berglund, 1925.)

Mols. per liter (found)		Mols. per liter (calculated)		Solid Phase
Zr.	NH_3	$Zr(NH_4)_3F_7$.	$Zr(NH_4)_2F_6$.	
0.551	1.655	0 551	0.0	$Zr(NH_4)_3F_7$
0.733	4.831	0.365	0.368	»
1.109	2.383	0.165	0.944	» $+Zr(NH_4)_2F_6$
1.050	2.115	0.0	1.05	$Zr(NH_4)_2F_6$

ZIRCONIUM NITRATE $Zn(NO_3)_4$.

100 cc of a saturated solution of zirconium-nitrate in ethyl ether, prepared by frequent agitation and allowing to stand over night at about 20°, contain 0.003 gm. ZrO_2. A saturated ethereal solution prepared as above, but using zirconium nitrate which had been dehydrated at 150°, contain 0.004 gm. ZrO_2 per 100 cc. (Wells, 1930.)

ZIRCONIUM PHOSPHATE $ZrO(H_2PO_4)_2$.

SOLUBILITY OF ZIRCONIUM PHOSPHATE IN AQUEOUS HYDROCHLORIC ACID AT 20°.

(v. Hevesy and Kimura, 1925.)

About 0.1 gm. of the compound was shaken with about 150 cc. of the hydrochloric acid in a thermostat for 3 days. 100 cc. of the sat. solution were evaporated and the residue ignited.

Normality of aq. HCl.	Gms. ignited residue from 100 cc. sat. sol.	Mol. $ZrO(H_2PO_4)_2$ per liter sat. sol.
6.01	0.0033	0.00012
10.00	0.0061	0.00023

ZIRCONIUM SULFATE $Zr(SO_4)_2$.

SOLUBILITY OF ZIRCONIUM SULFATE IN AQUEOUS SULFURIC ACID AT 37.5°.

(Hauser, 1907.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
ZrO_2.	SO_3.		ZrO_2.	SO_3.	
19.5	25.46	$Zr(SO_4)_2.4H_2O$	0.15	56.7	$Zr(SO_4)_2.4H_2O$
18.8	27	"	0.50	57.5	"
16.2	29.1	"	2	59.5	"
9.6	32.3	"	4.4	61.4	" $+Zr(SO_4)_2.H_2SO_4.3H_2O$
5.3	34.7	"	4.55	61.5	$Zr(SO_4)_2.H_2SO_4.3H_2O$
3.51	36.01	"	3.33	63.8	"
1.03	38.2	"	1.80	64.2	"
0.46	39.8	"	1.12	66.8	"
0.33	42.1	"	0.96	68.4	"
0.14	46.8	"	0.10	81.5	$Zr(SO_4)_2.H_2SO_4.H_2O$

SO

Results at 22° show only slight differences from the above figures, hence, the temperature coefficient for this salt is quite small. In an earlier paper Hauser (1905) gives data for the basic sulfate $4ZrO_2.3SO_3.14H_2O$.

Using mixtures composed of 10 gms. of $ZrOCl_2.8H_2O$ and 16 to 30 cc portions of conc. sulfuric acid (d = 1.83) at 25° Falinski, 1936, obtained a new acid zirconium sulfate of the composition $Zr(SO_4)_2.H_2SO_4.2H_2O$.

ZIRCONIUM Thallium SULFATE.

SOLUBILITY OF ZIRCONIUM THALLIUM SULFATE IN AQUEOUS 20 PER CENT SULFURIC ACID.

(Fernandez, 1925.)

A solution of zirconium sulfate in aqueous sulfuric acid of about 20 per cent concentration was saturated with thallium sulfate at 100° and this solution cooled to several constant temperatures and the weight of ZrO_2 present at each temperature determined. The following three double salts are described, $Zr(SO_4)_2.2Tl_2SO_4.4H_2O$; $2Zr(SO_4)_2.Tl_2SO_4.8H_2O$ and $2Zr(SO_4)_2.7Tl_2SO_4$. The particulier one in contact with each saturated solution is not designated.

t°.	Gms. ZrO_2 per 100 cc. H_2O.	t°.	Gms. ZrO_2 per 100 cc. H_2O.	t°.	Gms. ZrO_2 per 100 cc. H_2O.
0	0.62	40	0.85	80	2.45
10	0.62	50	1.15	90	2.88
20	0.65	60	1.57	100	3.20
30	0.72	70	2.02		

AUTHOR INDEX

Abbott, G. A. and Bray, W. C.
(1909) J.Am.Chem.Soc.,31,729-63

Abe, Ryuji.
(1911) Mem.Coll.Sci.Eng. (Kyoto), 3,212.
(1911) J.Tok.Chem.Soc.,32,980.
(1911-12) Mem.Coll.Sci.Eng. (Kyoto),3,13.
(1912) J.Tok.Chem.Soc.,33,1087.

Abegg, R.
(1903) Z.Elektrochem.,9,550.

Abegg, R. and Cox, A. J.
(1903) Z.physik.Chem.,46,11.

Abegg, R. and Pick, H.
(1905) Ber.,38,2573.
(1906) Z.anorg.Chem.,51,1.

Abegg, R. and Riesenfeld, H.
(1902) Z.physik.Chem.,40,84.

Abegg, R. and Sherrill, M. S.
Z.Elektrochem.,9,550.

Abegg, R. and Spencer.
(1905) Z.anorg.Chem.,46,406.

Abel, E. and Proisl, J.
(1929) Z.Elektrochem.,35,712-15.

Achumow, E. I. and Wassilijew, B. B.
(1932) Zhurnal Obs.Khimii,2,271-89.

Adams, L. H.
(1931) J.Am.Chem.Soc.,53,3769-3813.
(1932) J.Am.Chem.Soc.,54,2229-40.

Adams, L. H. and Gibson, R. E.
(1932) J.Am.Chem.Soc.,54,4520-37.

Adams, L. H. and Hale, R. E.
(1931) J.Wash.Acad.Sci.,21,183-194.

Adeney, W. E. and Becker, H. C.
(1916-20) Sci.Proc.Roy.Soc.(Dublin), 15,385,609.
(1919) Phil.Mag.,38,317-37.
(1920) Phil.Mag.,39,384-404.
(1921) Phil.Mag.,42,87-96.

Adolff and Hering, H.
(1934) Compt.rend.,198,1770.

Agde, G. and Barkholt, H.
(1926) Z.angew.Chem.,39,851-5.
(1927) Z.angew.Chem.,40,378.

Agde, G. and Schimmel
(1928) Z.angew.Chem.,41,340.

Ageno, F. and Valla, E.
(1911) Atti accad.Lincei,20,II,706.
(1912) Ist.Ven.(VIII).14,II,331.
(1913) Gazz.chim.ital.,43,II,168.

Agnew, N. and Sachs, G.
(1930) Z.Physik.Chem.63,293

d'Agostino, E.
(1910) Rend.soc.chim.ital.(Roma), 2,II,171.

Ahrens, U.
(1930) Dissertation,Braunschweig

Aita, A.
(1916) Ann.chim.applicata,6,28-44, 119-31
(1917) Ann.Chim.applicata,7,200.

Akerlof, Gosta
(1935) J.Am.Chem.Soc.,57,1196-1201.

Akerlof, G. and Short, O.
(1937) J.Am.Chem.Soc.,59,1912-15.

Akerlof, G., Teare, J. W. and Turck, H.
(1937) J.Am.Chem.Soc.,59,1916-20

Akerlof, G. and Thomas, H. C.
(1934) J.Am.Chem.Soc.,56,593-601.

Akerlof, G. and Turck, H. E.
(1935) J.Am.Chem.Soc.,57,1746-50.

Akhoumow, E. I. and Eserowa, E. A.
(1936) Zhurnal Obs.Khimii,6,1418-29

Aldrich, E. W.
(1931) Ind.Eng.Chem.,(Anal.Ed.) " 3,348.

Alekceevskij, E. V.
(1921) J.Russ.Phys.Chem.Soc., 53,326-31.

Alexejew, Wladimir. (Alexejeff.)
(1886) Wied.Ann.Physik.,28,305,338.

Allen, E. T. and White, W. P.
(1909) Am.Jour.Sci.(4),27,1.

Alleman, E.
(1928) Verslag Chemie. (Berlin)

Allmand, A. J. and Burrage, L. J.
(1933) Trans.Faraday Soc.,29,679-89.

Almkvist, G.
(1918) Z.anorg.allgem.Chem.,103,240.

Altschul.
(1896) Monatsch.Chem.,17,575.

AUTHOR INDEX

Alluard.
(1864) Compt.rend.,**59**,500.
(1865) Liebig's Ann.,**133**, 292.

Amadori,M.
(1912) Atti accad.Lincei,**21**,II,67, 184,769,690.
(1912a) Atti accad.Lincei,**21**,I,467, 667-73.
(1913) Atti accad.Lincei,**22**,I,453, 609;**22**,II,333.
(1915) Atti accad.Lincei,**24**,II,204.
(1916-17) Atti Ist.Ven.,**76**,II,419-33.
(1918) Gazz.chim.ital.,**48**,II,42-53.
(1918) Atti accad.Lincei. 5 ,**27**,I, 131-3,143.
(1919) Gazz.chim.ital.,**49**,I,38-68.
(1919) Atti ist.Ven.,**79**,293.
(1922) Gazz.chim.ital.,**52**,I,387-94.

Amadori,M.and Becarelli,R.
(1912) Atti accad.Lincei,**21**,II,698.

Amadori,M.and Pampanini, G.
(1911) Atti accad.Lincei,**20**,II,475, 572.

Amat,L.
(1887) Compt.rend.,**105**,809.

Anders, Otto.
(1933) Z.physik.Chem.(A),**164**,145-75.

Anderson.
(1888-89) Proc.Roy.Soc.(Edin.),**16**,319.

Anderson,J.T.
(1932) J.Phys.Chem.,**36**,2145-65.

Anderson,E.and Nestell,R.I.
(1920) Ind.Eng.Chem.,**12**,243-6.

Anderson,E.and Story,L.G.
(1923) J.Am.Chem.Soc.,**45**,1104.

Anderson,L.H.and Yost.D.M.
(1938) J.Am.Chem.Soc.**60**, 1822-5

Ando,K.
(1925) Mem.Coll.Sci.Kyoto Imp.Univ. (A), **8**,283-6.

Andrae.
(1884) J.prakt.Chem.[2],**29**, 456.

Andrews,L.W.and Ende,C.
(1895) Z.physik.Chem.,**17**,136.

Ange,see Augé.

Anon.
(1903) Bull.soc.pharm.(Bordeaux),p.7.
(1904) Pharm.Jour.(Lond.),**72**,77.

d'Ans see D'Ans.

Anschutz,R.,Kallen,J.and Riepenkröger,K.
(1919) Ber.,**52B**,1860-75.

Anthony,C.G.
(1916) Bonfort's Wine and Spirit Circular,Apr.10th.

von Antropoff,A.
(1909-10) Proc.Roy.Soc.(London), A **83**,474-83.
(1919) Z.Elektrochem.,**25**,269-97.
(1924) Z.Elektrochem.,**30**,457-67.

von Antropoff,A. and Sommer,W.
(1926) Z.physik.Chem.,**123**,161-198.

Apfel,Otto.
(1911) Dissertation,Technischen .Hochshule,*Darmstadt*.

Applebey,M.P.and Crawford,F.H.
(1934) J.Chem.Soc.(Lond) 1665-71

Applebey,M.P.and Lane,K.W.
(1918) J.Chem.Soc.,**113**,614-22.

Applebey,M.P.and Leishman,M.A.
(1932) J.Chem.Soc.(Lond.) 1603-08

Applebey,M.P.and Powell,H.M.
(1931) J.Chem.Soc.(Lond) **2821-9**

Applebey,M.P.and Reid,R.D.
(1922) J.Chem.Soc.,**121**,2129-36.

Applebey,M.P.and Wilkes,S.H.
(1922) J.Chem.Soc.**121**,337-48.

Applebey,M.P. and Windridge, E.D.
(1932) J.Chem.Soc.(Lond) 1608-13.

Araki,S.
(1925) Mem.Coll.Sci.Kyoto Imp. Univ.(A.),**8**,213-22.

Archibald,E.H.and Gale,W.A.
(1924) J.Am.Chem.Soc.,**46**,1760-71.

Archibald,E.H.and Habasian,Y.
(1917) Trans.Roy.Soc.(Canada),[3], **11** (Sec.III),1-6.

Archibald,E.H.and Hallett,L.T.
(1925) J.Am.Chem.Soc.,**47**,1314-18.

Archibald,E.H.and Kern,J.W.
(1917) Trans.Roy.Soc.(Canada),[3], **11** (Sec.III),7-16.

Archibald,E.H.,Wilcox,W.G.and Buckley,B.G.
(1908) J.Am.Chem.Soc.,**30**,747-60.

AUTHOR INDEX

Archibald,R.C.
(1932) J.Am.Chem.Soc.**54**,3178

Arctowski,H.
(1894) Z.anorg.Chem.,**6**,267,404.
(1895) Compt.rend.,**121**,123.
(1895-6) Z.anorg.Chem.,**11**,272-4.

Arditti,R.
(1933) Compt.rend.,**196**,1388,
197,1209.

Argo,W.L.,James,E.M.and Donnelly,J.L.
(1919) J.Phys.Chem.,**23**,578-85.

Arii,K.
(1932) Sci.Reports Tohoku Univ.,
(1),**21**,783.

Arkadiev,V.
(1918) J.Russ.Phys.Chem.Soc.,**50**,
205-9.

Armit,H.W.
(1907) Jour.Hygiene,**7**,525-51.

Armstrong,H.E.and Eyre,J.V.
(1910-11) Proc.Roy.Soc.(London),(A),
84,123-35.
(1913) Proc.Roy.Soc.(London),(A),**88**,
234.

Armstrong,H.E.,Eyre,J.V.,Hussey,A.V.,
and Paddison,W.P.
(1907) Proc.Roy.Soc.(London),(A),
79,564-76.

Army Air Corps.
(1922) Air Service Inf. Cir.320

Arndt,K.
(1907) Ber.,**40**,427.

Arndt,K.and Loewenstein,W.
(1909) Z.Elektrochem.,**15**,784-90.

Aronowa,S.I.,and Lunskaja,S.N.
(1931) Shurn.Chimitscheskor,
Promyschlewnosti,**8**,
(No.18), 23.
(1933) Kali(russ),**2**,24.

Arrhenius,S.
(1893) Z.physik.Chem.,**11**,396.

Arth,G.and Cretien.
(1906) Bull.soc.chim.[3],**35**,778.

Artmann,P.
(1912-13) Z.anorg.Chem.,**79**,333.
(1915) Z.anal.Chem.,**54**,90.

Aschan,Ossian.
(1913) Chem.Ztg.,**37**,1117.

Ashton,F.W.,Houston,D.F.and Saylor,C.P.
(1933) J.Res.U.S.Bureau of Standards,
11,233-53.

Askenasy,P.and Neisler,F.
(1930) Z.anorg.Chem.,**189**,305-28.

Askew,H.O.
(1923) Trans.New Zealand Inst.,**54**,
791-6.

Assarsson,G.
(1931) Z.anorg.Chem.**200**,385.

Asselin,E.
(1873) Compt.rend.,**76**,884.
(1873) Jahresber.Chem.,1063.

Aten,A.H.W.
(1905) Z.anorg.Chem.,**47**,387.
(1905-06) Z.physik.Chem.,**54**,86,124.
(1909) Z.physik.Chem.,**68**,41.
(1912) Proc. k.Akad.Wet.(Amst.),**15**,572.
(1912-13) Z.physik.Chem.,**81**,268.
(1913) Z.physik.Chem.,**83**,443.
(1914) Z.physik.Chem.,**86**,1-35.
(1914a) Z.physik.Chem.,**88**,321-79.
(1918) Proc.Acad.Sci.(Amsterdam),**20**,
824.

Atkins,W.R.G.
(1924) Nature,**114**,275.

Atkins,W.R.G.and Werner,E.A.
(1912) J.Chem.Soc.(Lond.),**101**,1167.

Atkinson,R.H.,Heycock,C.T.and Pope,W.J.
(1920) J.Chem.Soc.,**117**,1422.

Atsuki,K.and Isshi,N.
(1931) J.Soc.Chem.Ind.(Japan),**34**,331.

Aubert,A.B.
(1902) J.Am.Chem.Soc.,**24**,690.

Auerbach,F.
(1903) Z.anorg.Chem.,**37**,353-77.
(1904) Z.Elektrochem.,**10**,163.

Auerbach,F.and Barschall,H.
(1908) Arb.Kais.Gesundheitsamt.,**27**,
183-230.
(1908) Chem.Abs.,**2**,1125.

Auerbach,F.and Weber,H.
(1925) Z.anorg.allgem.Chem.,**147**,68-80.

Augé,E.
(1890) Compt. rend.,**110**,1139.

AUTHOR INDEX

Auger,V.
1923) Compt.rend.,177,1302.

Auméras,M.
(1927) J.chim.phys.,24,24-49.
(1927a) " " 24,548-571.

Baars,,
(1927) Samml.chem.u.chem.techn.
Vortr.,29,304.

de Baat,W.C.
(1918) Chem..Weekblad,15,463-8.
(1923) Rec.trav.chim.,42,643-46.
(1926) Rec.trav.chim.,45,237-44.

Babaewa,A.W. (Babaev,Babajewa)
(1931) U.S.S.R.Scient.techn.Depart.
Supr.Council Nat.Economy
No.420,p.114. Trans.Inst.
pure Chem.Reagents,No.11
(1936) Zhurnal Obs.Khimii,6,1144-6.

Babaewa,A.W.,and Archako,T.A.
(1935) Zhurnal Obs.Khimii,5,216-9.

Babaewa,A.W.and Daniluschkina,E.I.
(1936) Z.anorg.Chem.226,338-40.

Babaewa,A.W.and Klatchko-Gourvitch,L.P.
(1935) Zhurnal Obs.Khimii,5,220-3.

Babko,A.K.
(1935) Z.anal.Chem.,103,190-6.

Backer,H.J.
(1927) Z.physik.Chem.,130,177-83.
(1930) Rec.trav.chim.,49,730.

Backer,H.J.and Terpstra,P.
(1929) Rec.trav.chim.,48,952,1175.

Bäckström,H.L.J.
(1921) Z.physik.Chem.,97,213.
(1921) Medd.Vetenskapsakad.Nobel
Inst.,4,No.11.

Bahr,F.
(1911) Z.anorg.Chem.,71,85.

Bailar,John,C.Jr.,
(1931) Ind.Eng.Chem.(Anal.Ed.),3,
362-3

Bailey,Chas.R.
(1930) J.Chem.Soc.(Lond.),1534-9.

Bailey,K.C.and Hilton,J.
(1936) J.Chem.Soc.(Lond),1571.

Bailly,O.
(1916) Ann.chim.,[9],6,96-155,240.
(1919) Bull.soc.chim.,[4],25,240-60.

Bailly,O.and Gaumé,J.
(1924) Bull.soc.chim., 4 ,35,594-6.

Bain,J.W.
(1927) J.Am.Chem.Soc.,49,2734-8

Bakke,B.
(1914) Dissertation,Technischen
Hochschule,*Berlin*.

Bakunin,M.and Vitale,E.
(1935) Gazz.chim.ital.,65,593-616.

Balarew,D.
(1925) Z.anorg.allgem.Chem.,145,122-6.

Balcar,F.R.and Stegmann,G.
(1928) J.Phys.Chem.,32,1411-21.

Baly.
(1900) Phil.Mag.[5],49,517.

Bancroft,W.D.and Gould,L.P.
(1934) J.Phys.Chem.,38,205.

Bancroft,W.D.,Scherer,G.A.and Gould,L.P.
(1931) J.Phys.Chem.,35,764-785.

Banthisch.
(1884) J.prakt.Chem.,[2],29,54.

Barkan,G.
(1924) Biochem.Z.,146,446-57.

Barker,T.V.
(1908) J.Chem.Soc.(Lond.),93,15.

Barnes,W.H.and Maass,O.
(1930) Canadian J.Res.2,218-21.

Baroni,A.
(1934) Atti accad.Lincei[6],20,384-90.

Barre,M.
(1909) Compt.rend.,148,1604-6;149,292.
(1910) Compt.rend.,150,1321,1599;
151,871-3.
(1911) Ann.chim.phys.,[8],24,149-67,
202,210-23.
(1912) Bull.soc.chim.[4],11,646.

Basch.
(1901) Dissertation(Berlin),p.17.

Baskerville,C.and Cohen,P.W.
(1921) Ind.Eng.Chem.,13,333.

Baskerville,W.H.and Cameron,F.K.
(1935) J.Phys.Chem.,39,769-79.

Baskov,A.
(1915) J.Russ.Phys.Chem.Soc.,47,
1533-5.
(1917) Bull.soc.chim.,(France)[4],
22,65.

AUTHOR INDEX

Bassett,H.Jr.
(1908) Z.anorg.Chem.,**59**,1-55.
(1917) J.Chem.Soc.(Lond.),**111**,620-42.
(1934) J.Chem.Soc.(Lond.),1270-5.

Bassett,H.and Bagnall,D.J.T.
(1924) J.Chem.Soc.,**125**,1366-73.

Bassett,H.,Barton,G.W.,Foster,A.R. and Pateman,R.J.
(1933) J.Chem.Soc.,151-165.

Bassett,H.and Bedwell,W.L.
(1931) J.Chem.Soc.,2479-2492.

Bassett,H.and Corbet,A.S.
(1924) J.Chem.Soc.,**125**,1660-75.

Bassett,H.and Dodé,M.
(1936) Compt.rend.,**203**,775-7.

Bassett,H.,Gordon,H.F.and Henshall,J.H.
(1937) J.Chem.Soc.(Lond.)**58**,971-3.

Bassett,H.and Halton,P.
(1923) J.Chem.Soc.,**123**,1291-1304.

Bassett,H.and Harry,H.
(1930) J.Chem.Soc.(Lond.),1784-1819.

Bassett,H,Henry, and Lemon,J.T.
(1933) J.Chem.Soc.(Lond.),1423-7.

Bassett,H.,Henshall,J.H.and Sargeant,G.A.
(1939) J.Chem.Soc.(Lond.),653-60.

Bassett,H.,Henshall,J.H.,Sergeant,G.A., and Shipley,R.H.
(1939) J.Chem.Soc.(Lond.),646-53.

Bassett,H.and Sanderson,I.
(1932) J.Chem.Soc.(Lond.),1855-1864.
(1934) J.Chem.Soc.(Lond.),1116-1120.

Bassett,H.Jr.and Taylor,H.S.
(1912) J.Chem.Soc.(Lond.),**101**,576.
(1914) J.Chem.Soc.(Lond.),**105**,1926-41.

Bathrick.
(1896) J.Phys.Chem.,**1**,159.

Baubigny H.
(1908) Bull.soc.chim.(4),**3**,772.
(1908) Compt.rend.,**146**,1263.

Baume,G.
(1911) J.chim.phys.,**9**,245.
(1914) J.chim.phys.,**12**,216.

Baume,G.and Borowski,W.
(1914) J.chim.phys.,**12**,276-81.

Baume,G.and Georgitses,N.
(1912) Compt.rend.,**154**,650.
(1914) J.chim.phys.,**12**,250.

Baume, G.and Germann,F.O.
(1911) Compt.rend.,**153**,569
(1914) J.chim.phys.,**12**,242.

Baume,G.and Pamfil,G.P.
(1911) Compt.rend.,**152**,1095.
(1914) J.chim.phys.,**12**,256.

Baume,G.and Perrot,F.L.
(1911) Compt.rend.,**152**,1763-5.
(1914) J.chim.phys.,**12**,225.

Baume,G.and Robert, M.
(1919) Compt.rend.,**169**,968.

Baume,G.and Tykociner,A.
(1914) J.chim.phys.,**12**,270-5.

Baup.
(1858) Ann.chim.phys.(3),**53**,468.

Baur,Emil.
(1926) Z.Elektrochem.,**32**,428-30.

Bayley,C.H.and Hopkins,C.Y.
(1934) Canadian J.Res. **11**,505-19.

Baxter,G.P.
(1907) J.Am.Chem.Soc.,**29**,129.

Baxter,G.P.,Boylston,A.C.and Hubbard,R.A.
(1906) J.Am.Chem.Soc.,**28**,1343.

Baxter,G.P.and Grose,M.R.
(1915) J.Am.Chem.Soc.,**37**,1061.

Baxter,W.P.
(1926) J.Am.Chem.Soc.,**48**,615-21.

Beach,H.T.and Bond,P.A.
(1925) Proc.Iowa Acad.Sci.**32**,328.

Beans,H.T.and Oakes,E.T.
(1920) J.Am.Chem.Soc.,**42**,2116-31.

Beck,K.and Stegmüller,Ph.
(1910) Arb.Kais.Gesundheitsamt., **34**,447.
(1911) Z.Elektrochem.,**17**,843-48.

Beckmann,E.and Stock,A.
(1895) Z.physik.Chem.,**17**,130.

Bedel,Chas.
(1937) Compt.rend.**204**,1651-3.
(1938) Compt.rend.**207**,632-4

AUTHOR INDEX

Behrend,R.
(1893) Z.physik Chem.,11,466.

Bell,H.C.
(1923) J.Chem.Soc.,123,2719.

Bell,
(1867) Chem.News.,16,69.

Bell,J.M.
(1905) J.Phys.Chem.,9,544.
(1911) J.Am.Chem.Soc.,33,940.

Bell,J.M.and Buckley,M.L.
(1912) J.Am.Chem.Soc.,34,10.

Bell,J.M.and Spry,F.H.
(1921) Ind.Eng.Chem.,13,308.

Bell,J.M.and Taber,W.C.
(1906) J.Phys.Chem.10, 119.
(1907) J.Phys.Chem.,11,637-8.
(1908) J.Phys.Chem.,12,174.

Bell,R.P.
(1930) Z.physik.Chem.(A),150,20-30.
(1931) J.Chem.Soc.(Lond.),1371-1382.

Bell,W.R.G.,Rowlands,C.B.,Bamford,J.J., Thomas,W.G.and Jones,W.J.
(1930) J.Chem.Soc.(Lond.),1927-31.

Belladen,L.
(1922) Gazz.chim.ital.,52,II,160-4.

Bellucci,I.
(1912) Atti accad.Lincei,[5],21,II,610.
(1913) Gazz.chim.ital.,43,I,521.

Bellucci,I.,and Grassi,L.
(1913) Atti accad.Lincei,[5],22,II,676.
(1914) Gazz.chim.ital.,44,I,559.

Belopokki,A.P.
(1933) Chem.Jour.Ser.B.,J.Angew Chem. Russ,Chimit Shurn,Ser.B., Shurm prikladnoi Chim,6,397.

Bennett,W.H.
(1932) Trans.Faraday Soc.28,889.

Benrath,A.
(1924) Z.anorg.allgem.Chem.,135,248-54.
(1924) Z.anorg.allgem.Chem.,136,358-66.
(1926) Z.anorg.allgem.Chem.,151,343-8.
(1927) Z.anorg.Chem.,163,396-404.
(1928) Z.anorg.Chem.,170,257.
(1929) Caliche,11,99.
(1929a) Z.anorg.Chem.,183,296-300.
(1930) Z.anorg.Chem.,189,82-90.
(1931) Z.anorg.Chem.,202,161-71.
(1931a) Z.anorg.Chem.,195,247-54.
(1932) Z.anorg.Chem.,208,169.

Benrath,A.and Ammer,G.
(1929) Z.anorg.Chem.,177,129-36.

Benrath,A.and Benrath,H.
(1929) Z.anorg.Chem.,179,369-78.
(1929a) Z.anorg.Chem.,184,359-68.
(1930) Z.anorg.Chem.,189,72-81.

Benrath,A.and Blankenstein,A.
(1934) Z.anorg.Chem.,216,41-48.
(1934a) Z.anorg.Chem.,217,170-174.

Benrath,A.and Espenschied,H.
(1922) Z.anorg.allgem.Chem.,121,361-72

Benrath,A.,Gjedebo,F.,Schiffers,B.and Wunderlich,H.
(1937) Z.anorg.Chem.,231,285-97.

Benrath,A.and Neumann.
(1938-9) Z.anorg.Chem.,240,80-86

Benrath,A.and Ritter,G.
(1939) J.prakt.Chem.,152,177-89.

Benrath,A.and Schackmann,H.
(1934) Z.anorg.Chem.,218,139-45.
(1935) Z.anorg.Chem.,221,418-22.

Benrath,A.and Schiffers,B.
(1938) Z.anorg.Chem.,240,67-79.

Benrath,A.and Schröder,W.
(1924) Z.anorg.allgem.Chem.,135, 205-25.

Benrath and Sichelschmidt,A.
(1931) Z.anorg.Chem.,197,113-28.

Benrach,A.and Thiemann,W.
(1932) Z.anorg.Chem.,208,177-93.
(1934) Z.anorg.Chem.,217,347-52.
(1935) Z.anorg.Chem.,221,423-6.

Benrath,A.and Thönnessen,C.
(1932) Z.anorg.Chem.,203,405-16.

Benrath,A.and Würzburger,A.
(1924) Z.anorg.allgem.Chem.,135, 226-32.

Benrath,Hanna.
(1932) Z.anorg.Chem.,205,421.
(1932a) Z.anorg.Chem.,205,417-424.
(1934) Z.anorg.Chem.,220,142-44.
(1934a) Z.anorg.Chem.,216,207.
(1934b) Z.anorg.Chem.,220,145-53.
(1938-9) Z.anorg.Chem.,240,87-96.

Berg,Leo
(1926) Z.anorg.Chem.,155,311.
(1929) Z.anorg.Chem.,181,131-6.

AUTHOR INDEX

Bergius, F.
(1910) Z.physik.Chem.,**72**,338-61.

Bergman, A. G.
(1921) J.Russ.Phys.Chem.Soc.,**53**, 180-91.
(1922-4) J.Russ.Phys.Chem.Soc.,**54**, 200-18,414-92,625-37.
(1926) Z.anorg.allgem.Chem.,**157**, 83-116.

Bergman, A. G., Genke, T. A. and Isaikin, F. M.
(1922-4) J.Russ.Phys.Chem.Soc.,**54**, 466-73.

Bergmann-Gönke
(1926) Zhurnal Obs.Khimii,**58**,83.

Berju and Kosminiko.
(1904) Landw.Vers.Sta.,**60**,422.

Berkeley, Earl of.
(1904) Phil.Trans.Roy.Soc.(Lond.), **203**,A,189-215.

Berkeley, Earl of, and Appleby, M. P.
(1911) Proc.Roy.Soc.,**85**,503.

Berl, E. and Saenger, H. H.
(1929) Monatshefte Chem.,**54**,1036-49.

Bernardis, G. B.
(1912) Atti accad.Lincei[5],**21**, II,442.

Bernfeld.
(1898) Z.physik.Chem.,**25**,72.

Berthelot, M.
(1904) Ann.chim.phys.[8],**3**,146.
(1904) Compt.rend.,**138**,1649.

Bertisch, B.
(1926) Rocz. Chem.,**6**,705-10.

Bezner-Löwy, Miss Rosa.
(1923) Bul.soc.chim.(Romania),**5**,81-2.

Bertrand.
(1868) Monit.Scientific[3],**10**,447.

Bevade, J. (Bewad).
(1884) Ber.,**17**,R.,406.
(1885) Bull.soc.chim.[2],**43**,123.

Bhagwat, W. V. and Dhar, N. R.
(1929) J.Indian Chem.Soc.,**6**,807-22.

Bibere, V. and Neumann, J.
(1937) Zhurnal Obs.Khimii,**7**,2658-64.

Billiter, J.
(1920) Monatshefte Chem.,**41**,287-95.

Biltz, Wm. and Braütigam, M.
(1927) Z.anorg.Chem.,**162**,49-56.

Biltz, Wm. and Fischer, W.
(1927) Z.anorg.Chem.,**166**,290.

Biltz, W. and Friedrich, H.
(1924) Z.anorg.allgem.Chem.,**136**,416-20.

Biltz, W. and Marcus, E.
(1911) Z.anorg.Chem.,**71**,167.

Biltz, W. and Meinecke, E.
(1923) Z.anorg.allgem.Chem.,**131**,1-21.

Biltz, W. and Wilke-Dörfurt, E.
(1906) Z.anorg.Chem.,**48**,297-313.

Binder, O.
(1936) Ann.chim.,[11],**5**,337-85.

Birckenbach, A. and Hüttner, K.
(1930) Z.anorg.Chem.,**190**,26.

Birger, Carlson, *see* **Carlson, Birger.**

Biron.
(1899) J.Russ.Phys.Chem.Soc.,**31**,517.

Bissell, D. W. and James, C.
(1916) J.Am.Chem.Soc.,**38**,873.

Bjerrum, N. and Josefowicz, E.
(1932) Z.physik.Chem(A),**159**,194-222.

Blarez.
(1891) Compt.rend.,**112**,434,939,1213.

Blasdale, W. C.
(1918) Ind.Eng.Chem.,**10**,344-7.
(1920) Ind.Eng.Chem.,**12**,164-7.
(1923) J.Am.Chem.Soc.,**45**,2935.

Blasdale, W. C. and Robson, H. L.
(1928) J.An.Chem.Soc.,**50**,35-46.

Blechta, F.
(1919) Chemicke listy,Roc.,**13**,125.

Blumberg, J. B. and Zdanovskij, A. B.
(1939) Zhurnal Obs.Khimii,**9**,814-8.

Bobtelsky, M. and Malkowa-Janowski.
(1927) Z.angew.Chem.,**40**,1434-7.

Bodländer, G.
(1891) Z.physik.Chem.,**7**,317,361.
(1892) Z.physik.Chem.,**9**,734.
(1898) Z.physik.Chem.,**27**,66.
(1905) Z.angew.Chem.,**18**,1138.

Bodländer, G. and Eberlein, W.
(1903) Ber.,**36**,3948.

Bodländer, G. and Fittig, R.
(1901-02) Z.physik.Chem.,**39**,597-612.

AUTHOR INDEX

Bodlander,G.and Storbeck.
(1902) Z.anorg.Chem.,**31**,22,460.

Bödtker,E.
(1897) Z.physik.Chem.,**22**,510,570.

Boeke,H.E.
(1907) Z.anorg.Chem.,**50**,335.
(1908) Z.Kryst.Min.,**45**,358.
(1908) Ztrbl.Min.Geo.Pal.,**23**,710.
(1911) N.Jahr.Min.,**I**,48,61.
(1911) Sitzber.k.Akad.Wiss.(Berlin), **24**,632-8.

de Boer,J.H.and van Liempt,J.A.M.
(1927) Rec.trav.Chim.,**46**,124.

Bogdan,P.
(1902-3)Ann.Sci.Univ.Jassy,**2**,47.
(1905) Z.Elektrochem.,**11**,925.
(1906) Z.Elektrochem.,**12**,490.

Bogitch,B.
(1915) Compt.rend.,**161**,790-1.

Bogorodsky.
(1894) J.Russ.Phys.Chem.Soc.,**26**,209.
(1894) Chem.Centralbl.,**II**,514.

Bogousky.
(1905) J.Russ.Phys.Chem.Soc.,**37**,92.

Bohr,C.
(1899) Wied.Ann.Physik.[3],**68**,503.
(1900) Wied.Ann.Phys.[4],**1**,247.
(1910) Z.physik.Chem.,**71**,47-50.

Bohr,C.and Bock.
(1891) Wied.Ann.Physik.,[2],**44**,318.

Boks.
(1902) Dissertation,Amsterdam.

Bollinger,G.
(1928) Thèse,Geneve.

Bond,P.A.and Beach,H.T.
(1926) J.Am.Chem.Soc.,**48**,348-56.

Bond,P.A.and Crone,E.B.
(1934) J.Am.Chem.Soc.,**56**,2028-31.

Bond,P.A.and Stowe,V.M.
(1931) J.Am.Chem.Soc.,**53**,30-4.

Bond,P.A.and Stephens,W.R.
(1929) J.Am.Chem.Soc.,**51**,2910-22.

Bonnell,D.G.R.and Jones,W.J.
(1926) J.Chem.Soc.,**129**,318-321.

Bonsdorff,W.
(1904) Z.anorg.Chem.,**41**,180.

Boomer,E.H.,Johnson,C.A.,and Piercey,A.G.A
(1938) Canadian J.Res.(B),**16**,396-410.

Booth,H.S.and Starrs,B.A.
(1931) J.Phys.Chem.,**35**,3553-7.

Booth,H.S.,Starrs,B.A.and Bahnsen,M.J.
(1933) J.Phys.Chem.,**37**,1103-7.

Bordeianu,C.V.
(1933) Arch.Pharm.,**271**,149-161.

Botschwar.
(1933) Z.anorg.Chem.,**210**,163.

Botta.
(1911) Zentralbl.Min.Geol.,p.123.

Bottger,W.
(1903) Z.physik.Chem.,**46**,521-619.
(1906) Z.physik.Chem.,**56**,83-94.

Boubnoff,N.and Guye,Ph.A.
(1911) J.chim.phys.,**9**,304.

Boulanger,Jeanne.
(1936) Compt.rend.,**202**,2156.
(1936a) Compt.rend.,**203**,87-90.

Boulouch,R.
(1902) Compt.rend.,**135**,165.
(1903) Compt.rend.,**136**,1577.
(1906) Compt.rend.,**142**,1045.

Bourgoin.
(1884) Bull.Soc.chim.,[2],**42**,620.

Bousfield,W.R.
(1919) J.Chem.Soc.(Lond.),**115**,54.

Boutaric,A.
(1911) Compt.rend.,**153**,876-7.

Bovalini,E.and Fabris,E.
(1933) Gazz.chim.ital.,**63**,338-44.
(1935) Gazz.chim.ital.,**65**,617-23.

Bowen,N.L.
(1914) Am.Jour.Sci. 4 ,**38**,207-64.
(1926) J.Phys.Chem.,**30**,726-37.

Bowen,N.L.and Anderson,Olaf.
(1914) Am.Jour.Sci.[4],**37**,487.

Bowman,A.A.and Hastings,A.B.
(1937) J.Biol.Chem.,**119**,241-6.

Boye,Erich.
(1933) Z.anorg.Chem.,**215**,75-80.
(1934) Z.anorg.Chem.,**216**,29-32.

Boyer-Guillon,A.
(1900) Ann.conserv.Arts Metiers 3
2,187-211.

AUTHOR INDEX

Boyle,Mary.
(1909) J.Chem.Soc.(Lond.),95,1696.

Boyle,R.W.
(1911) Phil.Mag.[6],22,840-854.

Bozorth,R.M.
(1923) J.Am.Chem.Soc.,45,2653.

Bozza,G.
(1934) Gior.chim.ind.applicata,16,
109-116.

Bradley,W.P.and Alexander,W.B.
(1912) J.Am.Chem.Soc.,34,17.

Braley and Schneider.
(1921) J.Am.Chem.Soc.,43,740.

Brand,H.
(1911) Neues Jahrb.Min.Geol.(Beil.
Bd.),32,627-700.
(1912) Zentralbl.Min.Geol.and Pal.,
26-32.
(1913) Neues Jahrb.Min.Géol., I,9-27.

Brandan.
(1869) Liebig's Ann.,151,340.

Braun,L.
(1900) Z.physik.Chem.,33,732.

Braune,H.and Strassmann,F.
(1929) Z.physik.Chem.(A),143,225-43.

Braunschweig,M.
(1922) These-Zurich.

Bray,Wm.C.
(1905-06) Z.physik.Chem.,54,569-608.

Bray,W.C.and Connolly,E.L.
(1910) J.Am.Chem.Soc.,32,937.
(1911) J.Am.Chem.Soc.,33,1485.

Bray,W.C.and MacKay,G.M.T.
(1910) J.Am.Chem.Soc.,32,914,1207.

Bray,Wm.C.and Winninghoff.
(1911) J.Am.Chem.Soc.,33,1663.

Breithaupt,J.
( ) These,Univ. of Geneve,,38,
No.446.

Breuner,G.
(1920) These,Zurich.
(1926) "Tabelles Annuelles",5,922.

Breitenbach,W.C.
(1925) Chem.Met.Eng.,32,704.

Briegleb.
(1856) Liebig's Ann.,97,95.

Briggs,T.R.
(1930) J.Phys.Chem.,34,2260-6.

Briggs,T.R.and Greenawald,J.A.
(1930) J.Phys.Chem.,34,1951-60.

Briggs,T.R.and Patterson,E.S.
(1932) J.Phys.Chem.,36,2621-4.

Briner,E.and Agathon.
(1926) Helv.chim.acta,9,905.

Briner, E.and Perrottet,E.
(1939) Helv.chim.acta,22,397-404.

Brinkley,S.R.
(1922) J.Am.Chem.Soc.,44,1210-6.

Brinton,Paul H.M.P.
(1916) J.Am.Chem.Soc.,38,2365.

Brintzinger,H.and Eckart,W.
(1937) Z.anorg.Chem.,231,327-336

**Briscoe,H.V.A.,Evans C.,and
Robinson,P.L.**
(1932) J.Chem.Soc.(Lond.),1100-3.

Briscoe,H.V.A.and Madgin,W.M.
(1923) J.Chem.Soc.,123,1608-18.

Brissemoret,M.
(1898) J.pharm.chim.[6],7,176-8.

Britton,H.T.S.
(1921) J.Chem.Soc.,119,1967-71.
(1922) J.Chem.Soc.,121,982.
(1922a) J.Chem.Soc.,121,2612-16.
(1923) J.Chem.Soc.,123,1429-35.
(1924) J.Chem.Soc.,125,1875.
(1925) J.Chem.Soc.,127,2796-2807.

Britton,H.T.S.and Allmand,A.J.
(1921) J.Chem.Soc.,119,1463-70.

Britton,H.T.S.and Jarrett,M.E.D.
(1936) J.Chem.Soc.(Lond.),1489-1493.
(1936a) J.Chem.Soc.(Lond.),1494-5

Britton,H.T.S.and McBain.
(1926) J.Am.Chem.Soc.,48,593.

Britton,H.T.S.and Robinson,R.A.
(1930) J.Chem.Soc.(Lond),2328-2343.
(1932) Trans.Faraday Soc.,28,531-45.

Broderson.
(1911) Masters Thesis Univ.of Kansas.

Brodsky,A.E.
(1929) Z.Elektrochem.,35,833-7.

Brodsky,A.E.and Scherschewer,J.M.
(1926) Z.Elektrochem.,32,1-4.

AUTHOR INDEX

Bump,C.K.
(1932) J.Phys.Chem.,36,1851-2.

Bunsen,Robert.
(1877) "Gasometrische Methoden," 2nd Ed.

Bunsen-Heurich.
(1892) Z.physik.Chem.,9,438.

Bureau,Jean
(1934) Compt.rend.,198,1918-20.
(1935) Compt.rend.,201,67,1193.
(1935a) Compt. rend., 200,395.
(1936) Compt.rend.,203,999.
(1937) Ann.chim, 11 ,8,97-142.

Burgess,S.G.and Hunter,H.
(1929) J.Chem.Soc.(Lond),2838-52.

Burkhardt,G.N.and Lapworth,A.
(1926) J.Chem.Soc.,129,684-90.

Burrage,L.J.
(1926) J.Chem.Soc.,129,1703-9,1896.
(1932) Trans.Faraday Soc.,28,529-31.

Bury,Chas.R.
(1924) J.Chem.Soc.,125,2538-41.

Bury,C.R.and Davies,E.R.H.
(1932) J.Chem.Soc.(Lond.),2008-15.
(1933) J.Chem.Soc.(Lond.),701-5.

Bury,C.R.and Mends,J.R.
(1939) J.Chem.Soc.(Lond.),742-4.

Bury,C.R.and Owens,R.D.J.
(1935) Trans.Faraday Soc.,31,480-2.
(1936) Trans.Faraday Soc.,32,782-7.

Bury,C.R.and Redd,R.
(1933) J.Chem.Soc.,1160-2

Busch,Werner.
(1927) Z.anorg.Chem.,161,161-79.

Butler,J.A.V.and Hiscocks,E.S.
(1926) J.Chem.Soc.,129,2554-62.

Butler,K.H.and Maass,O.
(1930) J.Am.Chem.Soc.,52,2188.

Büttgenbach,E.
(1925) Z.anorg.allgem.Chem.,145, 141-50.

Cabot,G.L.
(1897) J.Soc.Chem.Ind.,16,417.

Cadenhead,A.F.G.and Vining,W.H.
(1924) Canadian Chem.Met.,8,64-5.

Cady,G.H.
(1934) J.Am.Chem.Soc.,56,1431-4.

Cady,G.H.and Hildebrand,J.H.
(1930) J.Am.Chem.Soc.,52,3843-6.

Cady,H.P.,Elsey,H.M.and Berger,E.V.
(1922) J.Am.Chem.Soc.,44,1456-16.

Cady,H.P.and Jones,E.A.
(1933) J.Phys.Chem.,37,303-20.

Cagle,W.C.,Tarbutton,G.and Vosburgh,W.C.
(1934) J.Am.Chem.Soc.,56,2331.

Cagle,W.C.and Vosburgh,W.C.
(1935) J.Am.Chem.Soc.,57,414.

Cagliotti,V.and Malossi,L.
(1929) Atti accad.Lincei,[6],10,97-100.

Cagliotti,V.and Stolfi,A.
(1927) Atti accad.Lincei,[6],5,896-901.

Caillart,M.
(1918) Bull.soc.franç.min.,41,21-30.

Calcagni,G.
(1912) Gazz.chim.ital.,42,II,653,661.
(1912a) Atti accad.Lincei,[5],21,II,72.
(1920) Gazz.chim.ital.,50,II,331-40.
(1923) Gazz.chim.ital.,53,114-19.

Calcagni,G.and Mancini,G.
(1910) Atti accad.Lincei,[5],19,II,424.

Calcagni,G.and Marotta,D.
(1912) Gazz.chim.ital.,42,II,669-80.
(1912) Atti accad.Lincei,[5],21,II,93, 243,284.
(1913) Gazz.chim.ital.,43,II,380.
(1913) Atti accad.Lincei,[5],22,II, 373,443.
(1914) Gazz.chim.ital.,44,I,487.

Callender and Barnes.
(1897) Proc.Roy.Soc.,62,149.

Calvert,H.T.
(1901) Z.physik.Chem.,38,521-540.

Calzolari,F.
(1912) Gazz.chim.ital.,42,II,85-92.
(   ) Acc.sc.med.e.nat.di Ferora, 85,150.

Cambi,L.
(1912) Atti accad.Lincei,[5],21,I, 776,791.
(1912) Atti accad.Lincei,[5],21,II,839.
(1912) Atti Inst.Lombardo,45,II,182.

Cambi,L.and Bozza,G.
(1923) Ann.chim.applicata,13,221-38.

Cambi,L.and Speroni,G.
(1915) Atti accad.Lincei,[5],24,I,736.

Cameron,F.K.
(1898) J.Phys.Chem.,**2**,413.
(1901) J.Phys.Chem.,**5**,556.
(1930) J.Phys.Chem.,**34**,692-710.
(1936) J.Phys.Chem.,**40**,689-96.

Cameron,F.K.and Bell,J.M.
(1905) J.Am.Chem.Soc.,**27**,1512.
(1906) J.Am.Chem.Soc.,**28**,1220,1222.
(1906a) J.Phys.Chem.,**10**,210.
(1907) J.Phys.Chem.,**11**,363.
(1910) J.Am.Chem.Soc.,**32**,869.

Cameron,F.K.,Bell,J.M.,and Robinson,W.O.
(1907) J.Phys.Chem.,**11**,396-420.

Cameron,F.K.and Breazeale,J.F.
(1903) J.Phys.Chem.,**7**,574.
(1904) J.Phys.Chem.,**8**,335.

Cameron,F.K.and Brown,
(1905) J.Phys.Chem.,**9**,210.

Cameron,F.K.and Crockford,H.D.
(1929) J.Phys.Chem.,**33**,709-16.

Cameron,F.K.and Patten,H.E.
(1911) J.Phys.Chem.,**15**,67.

Cameron,F.K.and Robinson,W.O.
(1907) J.Phys.Chem.,**11**,577,641,691.
(1907a) J.Phys.Chem.,**11**,273-8.
(1909) J.Phys.Chem.,**13**,157,251.

Cameron,F.K.and Seidell,A.
(1901) Bull.No.18,Division of Soils, U.S.Dept.Agr.
(1901a) J.Phys.Chem.,**5**,643.
(1902) J.Phys.Chem.,**6**,50.
(1904) J.Am.Chem.Soc.,**26**,1460.
(1905) J.Am.Chem.Soc.,**27**,1508.

Campardou,J.
(1933) Bull.Soc.chim.(France)(4), **53**,1400-4.

Campbell,A.N.and Campbell,A.J.R.
(1932) J.Am.Chem.Soc.,**54**,3834-41.

Campbell,A.N.,Downs,K.W.and Samis,C.S.
(1934) J.Am.Chem.Soc.,**56**,2507-12.

Campbell,A.N.and Slotin,L.
(1933) J.Am.Chem.Soc.,**55**,3961-70.

Campbell,A.N.and Yanick,N.S.
(1932) Trans.Faraday Soc.,**28**,657-60.

Canneri,G.
(1928) Gazz.chim.ital.,**58**,6-25.

Canneri,G.and Bigalli,D.
(1936) Ann.chim.applicata,**26**,430-6.

Canneri,G.and Fernandez,L.
(1925) Atti accad.Lincei, 6 ,**1**,671-6.

Canneri,G.and Morelli,R.
(1922) Atti accad.Lincei, 5 ,**31**,I, 109-11.

Cantoni,H.and Basadonna.
(1906) Bull.soc.chim., 3 ,**35**,731.

Cantoni,H.and Diotalevi,D.
(1905) Bull.soc.chim., 3 ,**33**,27-36.

Cantoni,H.and Goguelia,G.
(1905) Bull.soc.chim., 3 ,**33**,13.

Cantoni,H.and Jolkowsky.
(1907) Bull.soc.chim., 4 ,**1**,1181.

Cantoni,H.and Passamanik.
(1905) Ann.chim.anal.appl.,**10**,258.

Cantoni,H.and Zachoder.
(1905) Bull.soc.chim.,(3),**33**,747.

Carlson,Birger,
(1910) Klason-Festschrift,247-66 (Stockholm).
(1910) "Tables annuelles," **1**,379.

Carnelly.
(1873) Liebig's Ann.,**166**,(116?),155.
(1873) J.Chem.Soc.(Lond.), 2 ,**11**,323.

Carnelly and Thomson.
(1888) J.Chem.Soc.(Lond.),**53**,799.

Caro.
(1874) Arch.Pharm., 3 ,**4**,145.

Carobbi,G.
(1924) Atti accad.Lincei, 5 ,**33**,II, 416-20.
(1926) Gazz.chim.ital.,**56**,76-81.
(1928) Gazz.chim.ital.,**58**,45.

Carpenter.
(1886) J.Soc.Chem.Ind.,**5**,286.

Carpenter,C.and Lehrman,A.
(1925) Trans.Am.Inst.Chem.Eng.,**17**,35.

Carpenter,C.B.and Hayward,C.R.
(1923) Eng.Min.J.Press,**115**,1055-61.

Carpenter,D.C.and Kucera,J.J.
(1934) J.Am.Chem.Soc.,**56**,324-7.

Carpenter,D.C.and Mack,G.L.
(1934) J.Am.Chem.Soc.,**56**,311-3.

Carrara and Minozzi.
(1897) Gazz.chim.ital.,**27**,II,958.

Carter,J.S.
(1925) J.Chem.Soc.,**127**,2861-66.
(1928) J.Chem.Soc.(Lond.),2227-30.

Carter,J.S.and Hoskins,C.R.
(1929) J.Chem.Soc.(Lond.),580-5.

Carter,R.H.
(1928) Ind.Eng.Chem.,**20**,1195.
(1930) Ind.Eng.Chem.,**22**,886-9.

Carter,S.R.and Hartshorne,N.H.
(1923) J.Chem.Soc.,**123**,2223-33.
(1926) J.Chem.Soc.,**129**,363-74.

Carter,S.R.and Megson,N.J.L.
(1928) J.Chem.Soc.,(Lond.),**131**,
2954-67.

Carveth,H.R.
(1898) J.Phys.Chem.,**2**,213.

Caspari,W.A.
(1924) J.Chem.Soc.,**125**,2381-7.

Casparis,P.
(1919) Schweiz,Apoth.Ztg.,**57**,255.

Cassuto,L.
(1913) Nuovo cimento,**6**,1903.

Cauquil,Germaine.
(1927) J.chim.phys.,**24**,53-5.

Causse.
(1892) Compt.rend.,**114**,414.

Cavanagh,B.
(1924) Proc.Roy.Soc.(Lond.),Ser.A.
106,243-250.

Cavazzi,A.
(1916) Gazz.chim.ital.,**46**,II,122-35.
(1917) Gazz.chim.ital.,**47**,II,49-63.

Caven,R.M.
(1932) J.Chem.Soc.(Lond.),2417-20.

Caven,R.M.and Johnston,W.
(1926) J.Chem.Soc.,**129**,2628-32.
(1927) J.Chem.Soc.,**130**,2358,2902.
(1928) J.Chem.Soc.,**131**,2506.

Caven,R.M.and Mitchell,T.C.
(1924) J.Chem.Soc.,**125**,1428-31.
(1925) J.Chem.Soc.,**127**,527-31.
(1925a) J.Chem.Soc.,**127**,2549-51.

Centnerszwer,M.
(1910) Z.physik.chem.,**72**,437.

de Cesari,P.
(1911) Atti accad.Lincei,[5],**20**,I,
597,749.

Chadwell,H.M.
(1927) J.Am.Chem.Soc.,**49**,2795-2801.

Chamberlain,N.H.,Hume,J.and Topley,B.
(1926) J.Chem.Soc.,**129**,2620-23.

Chambon,M.,Bouvier,J.and Duron,L
(1937) Bull.soc.chim.,[5],**4**,1401-7.

Chambon,M.and Duron,P.
(1937) Bull.soc.chim.,[5],**4**,1407-10.

Chancel and Parmentier.
(1885) Compt.rend.,**100**,473,773.
(1887) Compt.rend.,**104**,474.

Chandler,E.E.
(1908) J.Am.Chem.Soc.,**30**,696.

Chaney,A.L.and Mann,C.A.
(1931) J.Phys.Chem.,**35**,2289-2314.

Chassenent,L.
(1926) Ann.chim.[10],**6**,272, 313-51.

Chatlet,M.
(1934) Ann.chim.[11],**2**,5-25.

Chikashigi, M.and Yamanchi,Y.
(1916) Mem.Coll.Sci.Kyoto,**1**,341-7.

Chilesotti,A.
(1908) Atti accad.Lincei,[5],**17**,II,475.

Chlopin,W.
(1925) Z.anorg.allgem.Chem.,**148**,108.

Chlopin,W.and Nikitin,B.
(1927) Z.anorg.Chem.,**166**,311-35.

Chlopin,W.,and Polessitsky,A.
(1928) Z.anorg.Chem.,**172**,310-20.

Chlopin,W.,Pollessitsky,A.and Tolmatscheff,P.
(1929) Z.physik.Chem.,(A),**145**,57.

Chloupek,J.B.and Danes,V.Z.
(1932) Coll.Czechoslovak.Chem.Com.,**4**,8-19.

Chloupek,J.B.,Danes,V.Z.and Danesova,B.A.
(1932) Chem.Listy,**26**,531.
(1932) Coll.Czechoslovak.Chem.Com.,
4,473-9.
(1933) Coll.Czechoslovak.Chem.Com.,
5,339-42.

Chrétien,Andre.
(1926) Caliche,**7**,439,**8**,355,390.
(1927) Caliche,**9**,248.
(1929) These,Paris.
(1929) Ann.chim[10],**12**,9-155.

AUTHOR INDEX

Chretien,A.and Hoffer,O.
(1935) Compt.rend.,**201**,1131-3.

Chretien,A.and Varga,G.
(1935) Compt.rend.,**201**,1491-3.

Chretien,A.and Weil,R.
(1935) Bull.Soc.Chim.[5],**2**,1577-91.

Christensen.
(1885) J.prakt.Chem.,[2],**31**,166.

Christoff,A.
(1905) Z.physik.Chem.,**53**,321.
(1906) Z.physik.Chem.,**55**,627.
(1912) Z.physik.Chem.,**79**,459.

Christy,S.B.
(1901) Elektrochem.Ztschr.,**7**,205.

Chugaev,L.and Khlopin,W.
(1914) Z.anorg.Chem.,**88**,159.

Cingolani,M.
(1908) Gazz.chim.ital.,**38**,I,305.
(1908) Atti accad.Lincei,[5],**17**,I,265.

Cirikov,F.V.
(1918) J.Agriculture experimental (Petrograd),**19**,173.

Claasen,H.
(1911) Z.Ver.Zuckerind.,**61**,489-509.

Clark,G.L.
(1919) J.Am.Chem.Soc.,**41**,1477-91.

Clark,L.M.and Hunter,H.
(1935) J.Chem.Soc.(Lond.),383-91.

Clark,N.A.
(1931) J.Phys.Chem.,**35**,1232-8.

Clayton,W.J.and Vosburgh,W.C.
(1937) J.Am.Chem.Soc.,**56**,2414-21.

Clendinnen,F.W.J.
(1922) J.Chem.Soc.,**121**,801-5.
(1923) J.Chem.Soc.,**123**,1338-44.

Clendinnen,F.W.J.and Rivett,A.C.D.
(1921) J.Chem.Soc.,**119**,1329-39.
(1923) J.Chem.Soc.,**123**,1344-51.

Cleve.
(1866?) K.Svenska Vetenskaps-Akad.Handl.(Stockholm),**10**,9,7.
(1874) Bull.soc.chim.,[2],**21**,344.
(1885) Bull.soc.chim.,[2],**43**,166.

Cleve,Astrid,
(1902) Z.anorg.Chem.,**32**,157.

Clifford,A.T.and Cameron,F.K.
(1929) Ind.Eng.Chem.,**29**,69.

Clifford,Chas.W.
(1921) Ind.Eng.Chem.,**13**,628-32.

Clifford,I.L.and Hunter,E.
(1933) J.Phys.Chem.,**37**,101-118.

Cloez.
(1903) Bull.soc.chim.[3],**29**,167.

Clowes,F.and Biggs,J.W.H.
(1904) J.Soc.Chem.Ind.,**23**,358.

Coates,J.E.and Hartshorne,N.H.
(1931) J.Chem.Soc.(Lond.),657-665.

Cocheret,D.H.
(1911) Dissertation,Leiden.
(1911) "Tables Annuelles"**2**,439,444.

Cohen,Ernst.
(1900) Z.physik.Chem.,**34**,189,622.
(1903) Z.Elektrochem.,**9**,433.
(1909) Z.Elektrochem.,**15**,600.

Cohen,Ernst and Bredée,H.L.
(1925) Z.physik.Chem.,**117**,143-55.
(1925) Proc.Acad.Sci.Amsterdam,**28**,573-586.

Cohen,E.,Hetterschij,B.W.G.and Moesveld,A.L.Th.
(1920) Z.physik.Chem.,**94**,224.
(1925) Z.physik.Chem.,**115**,440-3.

Cohen,E.and Inouye,K.
(1910) Z.physik.Chem.,**72**,411-24.
(1910) Chem.Weekblad.,**7**,277.

Cohen,E.Inouye,K.and Euwen,C.
(1910) Z.physik.Chem.,**75**,257.

Cohen,E., de Meester,W.A.T.and Moesveld,A.L.Th.
(1924) Z.physik.Chem.,**112**,150-5.

Cohen,E.and Miyake.
(1925) Proc.Acad.Sci.Amst.,**28**,936-41.

Cohen,E.and Moesveld,A.L.Th.
(1925) Proc.Acad.Sci.(Amsterdam),**28**,461-6.
(1925) Verslag.Akad.Wetenschappen (Amsterdam),**34**,143-9.

Cohen,E.and Sinnige,L.R.
(1910) Trans.Faraday Soc.,**5**,269.

Cohen,Ernst and Van der Bosch,J.C.
(1925) Z.physik.Chem.,**114**,453-484.

AUTHOR INDEX

Cohen, E., Voller, D.H.P. and Moesveld, A.L.Th.
(1923) Z.physik.Chem., **104**, 323-33.

Cohen, E. and Wolters, J.J.
(1920) Z.physik.Chem., **96**, 256.
(1917) Verslag.Akad.Wetenschappen (Amsterdam), **26**, 797.

Cohn, E.
(1895) Z.physik.Chem., **18**, 61.

Colani, A.
(1913) Compt.rend., **156**, 1075, 1908.
(1916) Bull.soc.chim., [4], **19**, 405.
(1916a) Compt.rend., **163**, 123-5.
(1917) Compt.rend., **165**, 111-3, 234-6.
(1925) Bull.soc.chim., [4], **37**, 856-61.
(1926) Bull.soc.chim., **39**, 1243-5.
(1927) Compt.rend., **185**, 1475-6.
(1928) Bull.soc.chim. [4], **43**, 194-9, 754-62.
(1934) Compt.rend., **198**, 1510-12.
(1934) Bull.soc.chim. [5], **1**, 1376-9.

Cole, H.I.
(1932) Philippine J.Sci., **47**, 351-5.

Collins, S.C. and Cameron, F.K.
(1928) J.Phys.Chem., **32**, 1705-16.

Colson, A.
(1907) Compt.rend., **145**, 1167.

de Coninck, Oechsner.
(1900) Compt.rend., **130**, 1304; **131**, 59, 1219.
(1901) Bull, acad, roy. (Belgique), **350**.
(1903) Ann.chim.phys., [7], **28**, 7.
(1905) Chem.Centralbl., **76**, II, 883.
(1905) Bull.acad.roy. (Belgique), pp. 257, 359.
(1906) Compt.rend., **142**, 571.

Conrad, F.H. and Beuschlein, W.L.
(1934) J.Am.Chem.Soc. **56**, 2554-62

Conroy.
(1898) J.Soc.Chem.Ind., **17**, 104.

Cooke, W.T.
(1921) J.Soc.Chem.Ind., **40**, 56, 239.

Cooper, E.A. and Nicholas, S.D.
(1925) Biochem., J. **19**, 533-7.

Cooper, H.C., Shaw, R.I., and Loomis, N.E.
(1909) Am.Chem.Jour., **42**, 461.
(1909) Ber., **42**, 3991.

Copisarow, M.
(1915) Chem.News., **112**, 247.

Coppadoro, A.
(1909) Gazz.chim.ital., **39**, II, 625.
(1911) Rend.soc.chim.ital., [2], 3a, 207.
(1912) Gazz.chim.ital., **42**, I, 240.
(1912) Atti accad.Lincei, [5], **21**, II, 842.
(1913) Gazz.chim.ital., **43**, I, 138.

de Coppet, L.C.
(1872) Ann.chim.phys., [4], **25**, 528.532.
(1883) Ann.chim.phys., [5], **30**, 417.
(1899) Ann.chim.phys., [7], **16**, 275.

Corbet, A.S.
(1926) J.Chem.Soc., **129**, 3190-3202.

Cornec, E. and Chretien, A.
(1924) Caliche, **6**, 358-69.

Cornec, E. and Urbain, G.
(1919) Bull.soc.chim., [4], **25**, 215-22.

Cornec, E. and Dickeley, J.
(1926) Caliche, **8**, 99.
(1927) Compt.rend., **184**, 1555-7.
(1927) Bull.soc.chim., **41**, 1017-27

Cornec, E. and Hering, H.
(1925-6) Revista Caliche, **7**, 299.
(1926-7) Revista Caliche, **8**, 51.

Cornec, E. and Krombach, H.
(1928) Caliche, **10**, 59.
(1929) Ann.chim, [10], **12**, 203-295.
(1932) Compt.rend., **194**, 714-6.
(1932) Ann.chim., [10], **18**, 5-31.

Corneck, E., Krombach, H. and Spack, A.
(1930) Ann.chim., [10], **13**, 526-623.

Cornec, E. and Neumeister, A.
(1929) Revista Caliche (Chile), **10**, 492-9.

Cornec, E. and Spack, A.
(1931) Bull.soc.chim. (France), [4], **49**, 582-94.

Cossa, A.
(1868) Ber., **1**, 138.
(1869) Z.anal.Chem., **8**, 145.

Costachescu, N.
(1910) Ann.Sci.Univ. (Jassy), **7**, 1.

Coste, J.H.
(1917) J.Soc.Chem.Ind., **36**, 846-53.
(1918) J.Soc.Chem.Ind., **37**, 170.
(1927) J.Phys.Chem., **31**, 81-7.

Coste, J.H. and Andrews, E.R.
(1924) J.Phys.Chem., **28**, 285-6.

Cottrell,et al.
(1901) Sitzber.k.Akad.Wiss.(Berlin), p.1035.

Couch,J.F.
(1917) Am.Jour.Pharm.,89,243-51.

Courtois,
(1914) Compt.rend.,158,1511.

Cox,G.J.,Dodds,M.L.and Clasper,C.
(1934) J.Am.Pharm.Assoc.,23,662-4.

Craig,D.N.,Vinal,G.W.and Vinal,F.E.
(1936) J.Research U.S.Bureau Stand., 17,709-720.

Cranston,J.A.and Livingstone,A.Y.
(1926) J.Chem.Soc.,129,501-3.

Craven,R.M.and Bryce,G.
(1934) J.Chem.Soc.(Lond.),514-7.

Craven,R.M.and Gardner,W.K.
(1933) J.Chem.Soc.(Lond.),943-6.

Creighton,H.J.M.,and Ward,W.H.
(1915) J.Am.Chem.Soc.,37,2333.

Cremer,H.W.and Duncan,D.R.
(1931) J.Chem.Soc.(Lond.),2243-54.

Crew,M.C.and Steine,H.E.and Hopkins,B.S.
(1925) J.Phys.Chem.,29,34-8.

Crockford,H.D.and Addlestone,J.A.
(1936) J.Phys.Chem.,40,303-5.

Crockford,H.D.and Brawley,D.J.
(1932) J.Phys.Chem.,36,1594.
(1934) J.Am.Chem.Soc.,56,2600-1.

Crockford,H.D.and Warrick,L.E.
(1930) J.Phys.Chem.,34,1064-70.

Crockford,H.D.and Webster,M.M.
(1930) J.Phys.Chem.,34,2375.

Croft.
(1842) Phil.Mag.,[3],21,356.

Crommelin,C.A.,Martinez,J.P.and Kamerlingh-Onnes,H.
(1919) Verslag.Akad.Wetenschappen (Amsterdam),27,1316-26.
(1920) Proc.Acad.Sci.Amsterdam, 22,108-118.

Crookes,Wm.
(1864) J.Chem.Soc.(Lond.),2,134.

Crowell,R.D.
(1918) J.Am.Chem.Soc.,40,455.

Cuno,E.
(1908) Ann.physik.,[4],25,346-76.
(1908-09) Ann.physik.,[4],28,663-4.
(1907) Ber.physik.Ges.,5,735-8.

Cupples,H.L.
(1929) J.Am.Chem.Soc.,51,1026-33.

Cupr,Vaclav.
(1925) Rec.trav.chim.,44,478.
(1925a) Pub.fac.Sci.Univ.Masaryk.63.
(1926) Pub.fac.Sci.Univ.Masaryk.68,8.
(1928) Rec.trav.chim.,47,55.
(1929) Z.anal.Chem.,76,177.

Curry,James and Hazelton,C.L.
(1938) J.Am.Chem.Soc.,60,2771-3.

Curtis,H.A.and Titus,E.Y.
(1915) J.Phys.Chem.,19,740.

Curtius,Th.and Rissom,J.
(1898) J.prakt.Chem,,(2),58,277-87.

Cuttica,V.
(1920) Atti accad.Lincei., 5 ,29,II, 89-92.

Cuvelier,B.V.J.
(1933) Natuu rwetensch.Tijdschr.,15,1
(1935) Z.anal.chem.,102,16-19.
(1936) Z.anorg.Chem.,226,197-200.

Dalton,R.H.,Pomeroy,R.and Weymouth,L.E.
(1924) J.Am.Chem.Soc.,46,60-4.

Damiens,A.
(1920) Compt.rend.,171,1140.
(1921) Bull.soc.chim.,[4],29,512,696.
(1921a) Bull.soc.chim.,[4],29,976-87 1063-70.
(1921) Compt.rend.,172,448,1105;173, 300,583.
(1923) Ann.chim.,[9],19,44-119.

van Damm,W.and Donk,A.D.
(1911) Chem.Weekblad,8,846.

Dancaster,E.A.
(1932) J.Phys.Chem.,36,1712-32.

Danneel,H.and Fröhlich,K.W.
(1930) Z.anorg.Chem.,188,14-31.

Dancer.
(1862) J.Chem.Soc.(Lond.),15,477.

D'Ans, J.
(1908) Ber.,41,1776-7.
(1909) Z.anorg.Chem.,62,129-167.
(1909a) Z.anorg.Chem.,63,225-9.
(1909b) Z.anorg.Chem.,65,228.
(1909c) Z.anorg.Chem.,61,91-5.
(1913) Z.anorg.Chem.,80,235.
(1915) Kali,9,163,177.

AUTHOR INDEX

D'Ans,J.and Busch,F.
(1937) Z.anorg.Chem.,**232**,359-68.

D'Ans,J.and Dawihl,W.
(1929) Z.anorg.Chem.,**178**,252-6.

D'Ans,J.and Fritsche,O.
(1909) Z.anorg.Chem.,**65**,231.

D'Ans,J.and Hofer,P.
(1934) Z.angew.Chem.,**47**,71.
(1937) Angewandte Chem.,**50**,101-4.

D'Ans,J.and Schreiner,O.
(1910) Z.anorg.Chem.,**67**,437.
(1910a) Z.physik.Chem.,**75**,95-107.

D'Ans,J.,Shepherd,L.D'Arey and Gunther,P.
(1905) Z.anorg.Chem.,**49**,356-61.

D'Ans,J.and Siegler,R.
(1913) Z.physik.Chem.,**82**,35-44.

d'Anselme.
(1903) Bull.soc.chim.,[3],**29**,372.

Dave,P.C.and Krishnaswami,K.R.
(1933) J.Indian Inst.Sci.(A),**16**,153.

Davidsohn,J.and Wrage,W.
(1915) Chem.Rev.Fett.Harz.Ind.,**22**, 9-14.

Davidson,A.W.and Chappell,W.
(1933) J.Am.Chem.Soc.,**55**,3531-7, 4524-5.
(1938) J.Am.Chem.Soc.,**60**,2043-6.
(1939) J.Am.Chem.Soc.,**61**,2164-7.

Davidson,A.W.and Geer,H.A.
(1933) J.Am.Chem.Soc.,**55**,642-9.
(1938) J.Am.Chem.Soc.,**60**,1211-4.

Davidson,A.W.and Griswold,E.
(1931) J.Am.Chem.Soc.,**53**,1341-9.
(1935) J.Am.Chem.Soc.,**57**,423-7.

Davidson,A.W.and Holm,V.
(1931) J.Am.Chem.Soc.,**53**,1350-7.

Davidson,A.W.and McAllister,W.H.
(1930) J.Am.Chem.Soc.,**52**,507-526.

Davies,C.W.
(1938) J.Chem.Soc.(Lond.) 277-81.

Davies,C.W.and Robinson,R.A.
(1937) Trans.Faraday Soc.,**33**,633-5.

Davis,H.S.
(1916) J.Am.Chem.Soc.,**38**,1169.

Davis,R.O.E.and Black,C.A.
(1931) Ind.Eng.Chem.,**23**,1280-2

Davis,T.W.and Ricci,J.E.
(1939) J.Am.Chem.Soc.,**61**,746-8.

Dawkins,A.E.
(1922) J.Chem.Soc.,**121**,776-81.

Dawkins,A.E.and Weldon,P.R.
(1922) Proc.Soc.Chem.Ind.(Victoria), **22**,940-8.
(1925) Chem.Abs.,**19**,1079.

Dawson,H.M.
(1901) J.Chem.Soc.(Lond.),**79**,242.
(1902) J.Chem.Soc.(Lond.),**81**,1086-1097.
(1904) J.Chem.Soc.(Lond.),**85**,467.
(1905) J.Chem.Soc.(Lond.),**89**,1668.
(1908) J.Chem.Soc.(Lond.),**93**,1310.
(1909) Z.physik.Chem.,**69**,110-22.
(1909a) J.Chem.Soc.(Lond.),**95**, 370-81.
(1909b) J.Chem.Soc.(Lond.),**95**,874.
(1918) J.Chem.Soc.,**113**,675-88.

Dawson,H.M.and Gawler,R.
(1902) J.Chem.Soc.(Lond.),**81**,524.

Dawson,H.M.and Goodson,E.E.
(1904) J.Chem.Soc.(Lond.),**85**,796.

Dawson,H.M.and McCrae,J.
(1900) J.Chem.Soc.(Lond.),**77**, 1239-62.
(1901a) J.Chem.Soc.(Lond.),**79**,493.
(1901b) J.Chem.Soc.(Lond.),**79**,1069.

Deacon,G.E.R.
(1927) J.Chem.Soc.(Lond.),**130**,2063-5.

DeCarli,F.
(1931) Ann.chim.applicata,**21**,447-53.
(1932) Atti accad.Lincei[6],**15**,579-583, 747-52.
(1932a) Atti accad.Lincei,[6],**15**,584-90.

Dede,L.and Walther,Th.
(1927) Z.anorg.Chem.,**163**,185-194.

Dehn,Wm.M.
(1917) J.Am.Chem.Soc.,**39**,1400.
(1917a) J.Am.Chem.Soc.,**39**,1378.

De Jong (see de Jong).

Delange,Leon.
(1908) Bull.soc.chim.,[4],**3**,910-5.

Delaplace,R.
(1922) J.pharm.chim.,[7],**26**,139.

Delepine,M.
(1892) J.pharm.chim.,[5],25,496.
(1895) Bull.soc.chim.,[3],13,353.
(1908) Bull.soc.chim.,[4],3,904.

Delepine,M.and Arquet,M.
(1928) Bull.soc.pharmacol.,35,625.

Delwaulle,Marie Louise.
(1934) Compt.rend.,199,948.
(1935) Compt.rend.,201,341.
(1936) Bull.soc.chim.[5],3,1820-2.

Delyon,M.L.
(1936) Bull.Soc.Chim.[5],3,1632-8, 1811-7.

Demarcay.
(1883) Compt.rend.,96,1860.

Demassieux,N.
(1913) Compt.rend.,156,892.
(1914) Compt.rend.,158,183,702.
(1923) Ann.chim.,[9],20,233-96.
(1923) Compt.rend.,177,51.

Demassieux,N.and Roger,L.
(1937) Compt.rend.,204,1818-9.

Denham,H.G.
(1917) J.Chem.Soc.(Lond.),111,39.
(1918) J.Chem.Soc.(Lond.),113, 249-56.

Denham,H.G.and Dick,D.A.
(1931) J.Am.Chem.Soc.(Lond.),1753-7.

Denham,H.G.and Fife,C.V.
(1933) J.Chem.Soc,(Lond.),1416-19.

Denham,H.G.and Kidson,J.O.
(1931) J.Chem.Soc.(Lond.),1757-61.

Denham,H.G.and King,W.E.
(1935) J.Chem.Soc.(Lond.),1251-3.

Dennis,L.M.and Bridgman,J.A.
(1918) J.Am.Chem.Soc.,40,1557-60.

De Right,R.E.
(1933) J.Phys.Chem.,37,405-16.

Dernby,K.G.
(1918) Medd.k.Vetenkapsakad.Nobel inst.,3,No.18.

Desvergnes,L.
(1920) Ann.Chim.anal.,[2],2,279-85.

Deszathy.
(1893) Monatsh.Chem.,14,249.

Dhar,N.R.
(1926) Z.anorg.allgem.Chem.,153, 323-331.
(1926a) Z.anorg.allgem.Chem.,155, 42-7.

Dhar,N.and Datta,K.
(1913) Z.Elektrochem.,19,584.

Diacon.
(1866) Jahrsber.Chem.,61.

Diaz de Rada F.and Bermejo,A.G.
(1929) Anales.soc.Espan.fis.quim. 27,701-11.

Dibbits.
(1874) Z.anal.Chem.,13,139.
(1874) J.prakt.Chem.,[2],10,417,439.

Di Capua, Clara.
(1929) Gazz.chim.ital.,59,164-9.

Di Capua,C.and Bertoni,A.
(1928) Gazz.chim.ital.,58,249.

Di Capua,C.and Scaletti,U.
(1927) Gazz.chim.ital.,57,391-9.

Dice,M.E.and Hildebrand,J.H.
(1928) J.Am.Chem.Soc.,50,3023-7.

Dieterich.
(1890) Pharm.Centrh.,31,395.

Dietrich,H.G.
(1929) J.Phys.Chem.,33,95-8.

Dietrich,H.G.and Johnston,J.
(1927) J.Am.Chem.Soc.,49,1419-31.

Dietz.
(1898) Pharm.Ztg.,43,290.
(1899) Z.anorg.Chem.,20,260.
(1899) Ber.,32,95.
(1900) Wiss.Abt.p.t.Reichanstalt,3, 433.

Dietzel,R.and Sedlmeyer,J.
(1928) Arch.Pharm.,266,507-517.

Distanow,G.K.
(1937) Zhurnal.Obs.Khimii,7,676-80.

Ditte,A.
(1875) Compt.rend.,30,1164.
(1877) Compt.rend.,85,1069.
(1881) Compt.rend.,92,242,718.
(1881) Ann.chim.phys.[5],24,226.
(1896) Compt.rend.,123,1282.
(1897) Compt.rend.,124,30.
(1898) Ann.chim.phys.,[7],14,294.

AUTHOR INDEX

Dittmar.
(1888) J.Soc Chem.Ind.,7,730.

Dittrich,C.
(1899) Z.physik.Chem.29,485.

Divers.
(1870) J.Chem.Soc.(Lond.),23,171.
(1899) J.Chem.Soc.(Lond.),75,86.

Dobbins,J.T.and Addleston,J.A.
(1935) J.Phys.Chem.,39,637-42.

Dobbins,J.T.and Byrd,R.M.
(1931) J.Phys.Chem.,35,3673-6.

Dobbins,J.T.and Thomas,L.C.
(1937) J.Phys.Chem.,41,655-661.

Dobroserdow,D.and Erdmann,W.O.
(1926) Ukrainskii.Chim.J.,2,119.

Dobson,H.J.S.and Masson,J.
(1924) J.Chem.Soc.(Lond.),125,675.

Doerinckel,F.
(1907) Metallurgie,8,201-9,408.

Dolezalek,F.and Finckli,K.
(1906) Z.anorg.Chem.,51,320-7.

Dolique,R.
(1934) Bull.Soc.Chim.(France)[5]
1,1745-52.

Dombrovskaya,O.S.
(1933) Zhurnal.Obs.Khimii,3,1017-25.

Dombrovskaya,O.S.and Klatchko,M.A.
(1933) Zhurnal.Obs.Khimii,3,1007-39.

Dominik,W.
(1922) Przemysl.Chem.,6,317-27.

Domontovitch,M.K.and Sarubina,O.V.
(1925) Biochem.Z.,163,464-9.

Donald,M.B.
(1937) J.Chem.Soc.(Lond.),1325.

Donath,E.
(1911) Chem.Ztg.,35,773-4.

Donk,A.D.
(1908) Chem.Weekblad,5,529,629,767.
(1916) Chem.Weekblad,13,92-97.

Donk,M.G.
(1905) Bull.No.90,Bureau Chem.
U.S.Dept.Agr.

Donnan,F.G.and Burt,B.C.
(1903) J.Chem.Soc.(Lond.),83,335.

Donnan,F.G.and Thomas,J.S.
(1911) J.Chem.Soc.(Lond.),99,1788.

Donnan,F.G.and White,A.S.
(1911) J.Chem.Soc.(Lond.),99,1669.

Donskaja,D.B.and Portnow,M.A.
(1939) Zhurnal Obs.Khimii.,9,526-31.

Dorfman,M.E.and Hildebrand,J.H.
(1927) J.Am.Chem.Soc.,49,729-37.

Dornte,R.W.and Ferguson,C.V.
(1939) Ind.Eng.Chem.,31,112-3.

van Dorp,G.C.A.
(1910) Z.physik.Chem.,73,284-289.
(1911) Chem.Weekblad.,8,269.
(1912) 8th Internat.Cong.Appl.Chem.,
22,239.
(1913-14) Z.physik.Chem.,86,109.

Dott,D.B.
(1906) Pharm.Jour.(Lond.),76,345.

Doyer,J.W.
(1890) Z.physik.Chem.,6,481.

Draper.
(1887) Chem.News.,55,169.

Dresser,A.L.,Browne,A.W.and Mason,C.W.
(1933) J.Am.Chem.Soc.,55,1963-7.

van Driel,M.
(1935) Z.anorg.Chem.,223,318.

Driot.
(1910) Compt.rend.,150,1426.

Drucker,K.
(1901) Z.anorg.Chem.,28,362.
(1912) Z.Elektrochem.,18,246.

Drucker,K.and Moles,E.
(1910) Z.physik.Chem.,75,405.

Duboin,A.
(1905) Compt.rend.,141,385.
(1906) Compt.rend.,142,395,573,
887,1338.

Dubourg,J.
(1931) Bull.Assoc.Chemists.Suc.
Dist.Ind.Agr.48,297-306.

Duboux,M.and Cuttat,L.
(1921) Helv.Chim.Acta,4,735-61.

Dubrisay,René.
(1911) Compt.rend.,153,1077.
(1912) Compt.rend.,154,431.

Dubrisay,R.and Francois,R.
(1931) Compt.rend.,192,741.

Dubrisay,R.and Saint Maxen,A.
(1936) Compt.rend.,203,584-6.

AUTHOR INDEX

Dubrisay and Toquet.
(1919) Bull.soc.chim.,[4],25,354-64.

Dukelski,M. P.
(1906) Z.anorg.Chem.,50,42.
(1907) Z.anorg.Chem.,53,327-337;
54,45-9.
(1907) J.Russ.Phys.Chem.Soc.,39,
975-88.
(1909) Z.anorg.Chem.,62,114-8.

Duncan,M. L.
(1923) J.Am.Chem.Soc.,45,2660.

Dundon,M. L. and Henderson,W. E.
(1922) J.Am.Chem.Soc.,44,1196-1203.

Dunn.
(1882) Chem.News,45,272.

Dunn,L. J. and Philip,J.C.
(1934) J.Chem.Soc.(Lond.),658-666.

Dunnicliff,H.B.,Aggarval,A. L. and Hoon,R.C.
(1928) J.Phys.Chem.,32,1697-1704.

Dunnicliff,H.B. and Hoon,I.S.C.
(1926) J.Phys.Chem.,30,1211-18.

Dunningham,A.C.
(1912) J.Chem.Soc.(Lond.),101,431-43.
(1914) J.Chem.Soc.(Lond.),105,368-79,
733,2630.

Dunnington and Long.
(1899) Am.Chem.Jour.,22,217.

Duparc,L.,Wenger,P. and Graz,G.
(1925) Helv.Chim.Acta,8,280-294.

Dupre and Bialas.
(1903) Z.angew.Chem.,16,55.

Early,R.G. and Lowry,T.M.
(1919) J.Chem.Soc.,115,1387-1404.
(1922) J.Chem.Soc.,121,963-9.

Ebelmen.
(1852) Liebig's.Ann.,[3],5,189.

Eberly,M.E.,Gross,C.V. and Crowell,W.S.
(1920) J.Am.Chem.Soc.,42,1433-9.

Edeleanu,L.
(1923) Z.angew.Chem.,36,573-80.

Eder.
(1876) Dingler polyt.J.,221,89,189.
(1878) J.prakt.Chem.,[2],17,45.
(1880) Sitzber.k.Akad.Wiss.(Wien),
82,Abt.II,1284.

Eggink,B.G.
(1908) Z.physik.Chem.,64,492.

Ehlert,H. and Hempel,W.
(1912) Z.Elektrochem.,18,727.

Ehret,Wm. F.
(1932) J.Am.Chem.Soc.,54,3126-34.

Eichelberger,W.C.
(1934) J.Am.Chem.Soc.,56,801.

Eitel.
(1922) N.Jahrb. Min.II,45
(1923) N.Jahrb.Min.Beil.Bd.,48,63.
(1925) Tscherm.Min.Petr.Mitt.,38,1-36.

Ekwald,Per
(1933) Z.anorg.Chem.,210,337-49.

Ekwald,Per and Mylius,W.
(1932) J.prakt.Chem.,135,133-6.

Elchardus,E. and Lafitte,P.
(1932) Bull.soc.chim.(France),51,
1572-9.

Elgersma,J.N.
(1929) Rec.trav.chim.,48,765-9

Elliott,G.A.,Kleist,L. L.,Wilkins,F.J. and Webb,H.W.
(1926) J.Chem.Soc.,129,1231.

Elliott,L. D.
(1924) J.Phys.Chem.,28,887-8.

Elöd,E. and Acker,E.
(1928) Z.anorg.chem.,176,305-24.

Elöd,E. and Tremmel,K.
(1927) Z.anorg.Chem.,165,161-170.

Emerson,W.H.
(1907) J.Am.Chem.Soc.,29,1750-6.

von Ende,C. L.
(1901) Z.anorg.Chem.,26,148.

v. Endredy,A.
(1934) Z.anorg.Chem.,217,59.

Engel.
(1886) Compt.rend.,102,114.
(1887) Compt.rend.,104,507,913.
(1888) Ann.chim.phys.,[6],13,
348-85.
(1889) Ann.chim.phys.,[6],17,347.
(1891) Bull.soc.chim.,[3],6,17.

Englund,B.
(1930) J.prakt.Chem.,127,191.

AUTHOR INDEX

Epik,P.A.
(1932) Z.anal.Chem.,**89**,17-23.

Eppel.
(1899) Dissertation,Heidelberg.

Epstein,D.A.
(1939) Zhur.Obs.Khimii,**9**,788-91.

Epstein,D.A.and Kosterina,Z.M.
(1939) Zhur.Obs.Khimii,**9**,625-7.

Erbacher,O.
(1930) Ber.**63**,141-56.

Erbacher,O.and Nikitin,B.
(1931) Z.physik.Chem.(A),**158**,
216-30.

Erdmann.
(1893) Ber.,**26**,2439.

Erdmann and Bedford.
(1904) Ber.,**37**,1184.

Eskola,
(1922) Am.J.Sci.,[5],**204**,331.

Estreicher.
(1899) Z.physik.Chem.,**31**,184.

Etard.
(1877) Compt.rend.,**84**,1090.
(1884) Compt.rend.,**98**,1434.
(1894) Ann.chim.phys.,[7],**2**,526-70;
3,275.

Ettinger,J.
(1932) Z.anorg.Chem.,**206**,260-2.

Enell.
(1899) Pharm.Centralh.,**38**,181.
(1899) Z.anal.Chem.,**38**,386.

Enklaar,J.E.
(1901) Rec.trav.chim.,**20**,183.

Ephraim,F.
(1923) Ber.,**56B**,1530-42.

Ephraim,F.and Flügel,W.
(1924) Helv.Chim.Acta,**7**,724-40.

Ephraim,F.and Mosimann,P.
(1922) Ber,**55B**,1608-19.

Ephraim,F.and Pfister,A.
(1925a) Helv.Chim.Acta.,**8**,229-41.
(1925) Helv.Chim.Acta.,**8**,369-83.

Ephraim,F.and Seger,E.
(1925) Helv.Chim.Acta,**8**,724-39.

von Euler,H.
(1903) Ber.,**36**,2879,3400.
(1904) Z.physik.Chem.,**49**,315.
(1916) Z.physik.Chem.,**97**,291.

Euwes,P.C.J.
(1909) Rec.trav.chim.,**28**,298-338.

Evans,T.W.
(1936) Ind.Eng.Chem.,**8**,206-8.

Eversole,W.G.and McLachlan,R.W.
(1932) J.Am.Chem.Soc.,**54**,864-9.

E'we,George E.
(1920) Proc.Penn.Pharm.Assoc.

Ewers,Erich.
(1910) Milchwirschaft.Zentr.,**6**,
(3?),155.

Ewing,W.W.
(1927) J.Am.Chem.Soc.,**49**,1963-73.

**Ewing,W.W.,Brander,J.D.Slichter,C.B.
and Griesinger,W.K.**
(1933) J.Am.Chem.Soc.,**55**,4822-4.

Ewing,W.W.and Klinger,E.
(1933) J.Am.Chem.Soc.,**55**,4825-7.

Ewing,W.W.,Krey,N.L.,Law,H.and Lang,E.
(1927) J.Am.Chem.Soc.,**49**,1958-62.

Ewing,W.W.,McGovern,J.J.and Mathews,G.E.
(1933) J.Am.Chem.Soc.,**55**,4827-30.

**Ewing,W.W.,Richard,A.J.,Taylor,Wm.J.,Jr.
and Winkler,D.W.**
(1933) J.Am.Chem.Soc.,**55**,4830-2.

van Eyk, see **Van Eyk.**

Fabris,E.
(1921) Gazz.chim.ital.,**51**,II,374-80.
(1931) Gazz.chim.ital.,**61**,527-37.
(1932) Gazz.chim.ital.,**62**,909-12.

Fahrion,W.
(1916) Chem.Umschau,**23**,34-5.

Failey,C.F.
(1932) J.Am.Chem.Soc.,**54**,576-9.
(1932a) J.Am.Chem.Soc.,**54**,2367-71.
(1933) J.Am.Chem.Soc.,**55**,4374-8.
(1933a) J.Am.Chem.Soc.,**55**,3112-6.

Fairbrother,F.and Balkin,M.
(1931) J.Chem.Soc.(Lond.),1564.

Fairhall,L.T.
(1924) J.Am.Chem.Soc.,**46**,1593-8.
(1924a) J.Biol.Chem.,**60**,481-4.

AUTHOR INDEX

Fajans,K.Fischler,J.and Lembert,M.,
(1916) Z.anorg.allgem.Chem.,**96**,284-339.

Fajans,K.and Karagunis.
(1931) Z.physik.Chem.(Bodenstein),553.

Falciola,P.
(1910) Gazz.chim.ital.,**40**,II,218.
(1910) Seifens Ztg.,**38**,506.

Falinski,Marie.
(1936) Compt.rend.,**203**,877-9.

Farrow,M.
(1926) J.Chem.Soc.,**129**,49-55.
(1927) J.Chem.Soc.(Lond.),1153-8.

Fastert,C.
(1912) Kali,[6],454.
(1912) Neue.Jahrb.Min.Geol.(Beil.Bd.), **33**,286.

Faust,O.and Esselmann,P.
(1926) Z.anorg.allgem.Chem.,**157**,290-8.

Fauzer.
(1888) Math.u.Natur.Wiss.Ber.(Ungarn), **6**,154.

Fedotieff,P.P.
(1904) Z.physik.Chem.,**49**,168.
(1910-11) Z.anorg.Chem.,**69**,26.
(1911-12) Z.anorg.Chem.,**73**,178.
(1928) Z.anorg.Chem.,**173**,81.

Fedotieff,P.P.and Iljinsky.
(1913) Z.anorg.Chem.,**80**,119.
(1923) Z.anorg.Chem.,**129**,93-107.

Fedotieff,P.P.and Kolossoff,A.
(1923) Z.anorg.allgem.Chem.,**130**, 39-46.

Fedotieff,P.P.and Koltunoff,J.
(1914) Z.anorg.Chem.,**85**,251.

Fedotieff,P.P.and Timofieff,K.
(1932) Z.anorg.Chem.,**206**,263.

Feit,W.
(1931) Z.anorg.Chem.,**199**,268.

Feit,W.and Przibylla,K.
(1909) Z.Kali,**3**,393-8.

Feitknecht,W.
(1930) Helv.chim.acta.,**13**,22-43.

Felsing and Durban.
(1926) J.Am.Chem.Soc.,**48**,2885.

Fenton,H.J.H.
(1898) J.Chem.Soc.(Lond.),**73**,479.

Ferchland.
(1902) Z.anorg.Chem.,**30**,133.

Fernandes,L.
(1925) Gazz.chim.ital.,**55**,1-6.

Ferner,S.W.and Mellon,M.G.
(1934) Ind.End.Chem.Anal.Ed.,**6**,345-8.

Ferrari,A.and Baroni.
(1928) Atti.accad.Lincei[6],**7**,848, 1040.

Ferrari,A.Celeri and Giorgi.
(1929) Atti accad.Lincei[6],**9**,782.

Ferrari,A.and Colla,C.
(1931) Atti accad.Lincei[6],**13**,78-80.
(1933) Atti accad.Lincei[6],**17**,312-7, 473-5.
(1937) Gazz.Chim.Ital.**67**,88-94.

Ferrari,A.and Inganni.
(1928) Atti accad Lincei,[6],**10**,253-8.
(1930) Atti accad Lincei[6],**12**,668-71.

Ferrero,P.and Bolliger,G.
(1928) Helv.Chim.acta.,**11**,1143-51.

Feulgen,R.and Rossenbeck,H.
(1923) Z.physiol.Chem.,**125**,284-8.

Fialkow,J.A.and Kensmenko,A.A.
(1936) Zhur.Obs.Khimii,**6**,265-72.

Field.
(1859) J.Chem.Soc.(Lond.),**11**,6.

Fierz-David,H.E.,Krebser,A.and Anderau,W.
(1927) Helv.chim.acta,**10**,197-227.

Findlay,Alex.
(1902) J.Chem.Soc.(Lond.),**81**,1217.
(1904) J.Chem.Soc.(Lond.),**85**,403.
(1908) Chem.News,**98**,163.
(1908) Analyst,**33**,391.

Findlay,Alex.and Campbell,A.N.
(1930) J.Chem.Soc.(Lond.),2721-4.

Findlay,Alex.and Creighton,H.J.M.
(1910) J.Chem.Soc.(Lond.),**97**,536-61.
(1911) Biochem.Jour.,**5**,294.

Findlay,A.and Cruickshank,J.
(1926) J.Chem.Soc.,**129**,316-8.

Findlay,A.and Howell,O.R.
(1914) J.Chem.Soc.(Lond.),**105**,291-98.
(1915) J.Chem.Soc.(Lond.),**107**,282-4.

AUTHOR INDEX

Findlay, Alex. and King, G.
(1913) J.Chem.Soc.(Lond.), **103**, 1170.
(1914) J.Chem.Soc.(Lond.), **105**, 1297.

Findlay, Alex., Morgan, I. and Morris, I.P.
(1914) J.Chem.Soc.(Lond.), **105**, 779-82.

Findlay, Alex. and Shen, B.
(1911) J.Chem.Soc.(Lond.), **99**, 1313.
(1912) J.Chem.Soc.(Lond.), **101**, 1459-68.

Findlay, Alex. and Williams, T.
(1913) J.Chem.Soc.(Lond.), **103**, 636.

Firth, J.B. and Watson, F.S.
(1923) J.Soc.Chem.Ind., **42**, 308.

Fischer, Emil.
(1906) Ber., **39**, 4144-5.

Fischer, E. and Plähler, E.
(1920) Ber., **53B**, 1616-7.

Fischer, F. and Pfleiderer, G.
(1922) Z.anorg.allgem.Chem., **124**, 61-9.

Fischer, V.M.
(1914) J.Russ.Phys.Chem.Soc., **46**, 1250-1270.
(1918) Z.physik.Chem., **92**, 581-99.

Fisher, V.M. and Miloszewski, F.
(1910) Kosmos (Lemberg), **35**, 538-42.
(1910) Chem.Zentr., II, 1048.

Flatt, R.
(1923) Dissertation, Zurich

Flatt, R. and Jordan, A.
(1930) Bull.Soc.Chim., [4], **47**, 246.
(1933) Helv.chim.acta, **16**, 37-53.

Flawitzki, F.
(1909) J.Russ.Phys.Chem.Soc., **41**, 739.

Fleck, J.
(1937) Bull.soc.chim., [5], **4**, 558-60.

Fleckenstein.
(1905) Physik.Z., **6**, 419.

Flint, E.P. and Wells, L.S.
(1934) J.Res.U.S.Bureau Standards, **12**, 751-783.

Flöttmann, Fr.
(1928) Z.anorg.Chem., **73**, 1-39.

Flückiger.
(1887) Arch.Pharm., [3], **25**, 542.

Fock.
(1897) Z.Kryst.Min., **28**, 365, 397.

Foerster, F., Brosche, A. and Norberg-Schulz, Chr.
(1924) Z.physik.Chem., **110**, 435-496.

Foerster, F. and Kubel, K.
(1924) Z.anorg.allgem.Chem., **139**, 269.

Fonda, G.
(1910) Dissertation, Karlsruhe.

Fontein, F.
(1910) Z.physik.Chem., **73**, 212-251.

Fonzes-Diacon.
(1895) J.pharm.chim., [6], **1**, 59.

Foote, H.W.
(1903) Am.Chem.Jour., **30**, 341.
(1903) Z.physik.Chem., **46**, 81.
(1904) Am.Chem.Jour., **32**, 252.
(1907) Am.Chem.Jour., **37**, 124.
(1910) J.Am.Chem.Soc., **32**, 618-22.
(1912) J.Am.Chem.Soc., **34**, 880.
(1915) J.Am.Chem.Soc., **37**, 290, 1200.
(1919) Ind.Eng.Chem., **11**, 629-31.
(1920) J.Am.Chem.Soc., **42**, 266.
(1921) J.Am.Chem.Soc., **43**, 1031-8.
(1923) J.Am.Chem.Soc., **45**, 663-7.
(1925) Am.J.Sci., [5], **9**, 441-7.
(1927) Am.J.Sci., [5], **13**, 158.

Foote, H.W. and Andrew, I.A.
(1905) Am.Chem.Jour., **34**, 153, 165.

Foote, H.W. and Bradley, W.M.
(1932) J.Phys.Chem., **36**, 673-8.
(1933) J.Phys.Chem., **37**, 29-31.
(1936) J.Am.Chem.Soc., **58**, 930-1.

Foote, H.W., Bradley, W.M. and Fleischer, M.
(1933) J.Phys.Chem., **37**, 21-7.

Foote, H.W. and Brinkley, S.R.
(1921) J.Am.Chem.Soc., **43**, 1018-31.

Foote, H.W. and Chalker, W.C.
(1908) Am.Chem.Jour., **39**, 564, 567.

Foote, H.W. and Fleischer, J.
(1931) J.Am.Chem.Soc., **53**, 1752-63.
(1934) J.Am.Chem.Soc., **56**, 870-3.

Foote, H.W. and Haigh, F.L.
(1911) J.Am.Chem.Soc., **33**, 459.

Foote, H.W. and Hickey, F.C.
(1927) J.Am.Chem.Soc., **56**, 648-50.

Foote, H.W. and Hunter, M.A.
(1920) J.Am.Chem.Soc., **42**, 69-78.

AUTHOR INDEX

Foote,H.W.and Levy.
(1907) Am.Chem.Jour.,**37**,119.

Foote,H.W.and Saxon,Blair.
(1914) J.Am.Chem.Soc.,**36**,1695.

Foote,H.W.and Schairer,J.F.
(1930) J.Am.Chem.Soc.,**52**,4202-17.

Foote,H.W.and Smith,S.B.
(1924) J.Am.Chem.Soc.,**46**,84-8.

Foote,H.W.and Vance,J.E.
(1928) Am.J.Sci.,[5],**16**,68-72.
(1929) Am.J.Sci.,[5],**17**,425-30.
(1929a) Am.J.Sci.,[5],**18**,375-82.
(1930) Am.J.Sci.,[5],**19**,203-13.
(1933) Am.J.Sci.,[5],**25**,499-502.
(1933a) Am.J.Sci.,[5],**26**,16-18.

Foote,H.W.and Walden,P.T.
(1911) J.Am.Chem.Soc.,**33**,1032.

Forbes,G.S.
(1911) J.Am.Chem.Soc.,**33**,1937.

Forbes,G.S.and Cole,H.I.
(1921) J.Am.Chem.Soc.,**43**,2492-7.

Forbes,J.C.
(1931) J.Biol.Chem.,**93**,255-68.

de Forcrand,R.
(1909) Compt.rend.,**149**,719.
(1909a) Compt.rend.,**149**,1344.
(1911) Compt.rend.,**152**,1210.

de Forcrand,and Fonzes-Diacon.
(1902) Ann.chim.phys.,[7],**26**,253.

Foret,Mlle.
(1931) Compt.rend.,**193**,1423.

Formanek.
(1887) Chem.Centralbl.,**18**,270.

Foster,B.and Neville,H.A.D.
(1910) Proc.Chem.Soc.,**26**,236.

Fox,Chas.J.J.
(1902) Z.physik.Chem.,**41**,458.
(1903) Z.anorg.Chem.,**35**,130.
(1909) J.Chem.Soc.(Lond.),**95**,
878-89.
(1909a) Trans.Faraday Soc.,**5**,68.

Fox,Chas.J.J.and Gauge,A.J.H.
(1910) J.Chem.Soc.(Lond.),**97**,
377-85.

Fraenckel,F.
(1907) Z.anorg.Chem.,**55**,223-32.

Freeman,D.,Laybourn,K.and Madgin,W.M.
(1933) J.Chem.Soc.(Lond.),648-50.

Freese.
(1920) Chem.Ztg.,**44**,294.

Freeth,F.A.
(1922) Phil.Trans.Roy.Soc.(Lond.),
Ser.A,**223**,35-87.
(1924) Dissertation,Leiden.
(1924) Rec.trav.chim.,**43**,475-507.

Frere,Francis.J.
(1936) J.Am.Chem.Soc.,**58**,1695-7.

Fresenius.
(1846) Liebig's Annalen,**59**,118.
(1890) Z.anal.Chem.,**29**,418.
(1891) Z.anal.Chem.,**30**,672.

Francois,M.
(1900) Compt.rend.,**130**,1024.
(1935) Compt.rend.,**200**,393-5.
(1935) Compt.rend.,**201**,215-6,1489-91.
(1937) Bull.Soc.Chim.,[5],**4**,736-8.

Francois,F.and Delwaulle,M.L.
(1936) Bull.soc.chim.,[5],**3**,687-96.

Francois,M.and Lormand,Ch.
(1923) J.pharm.chim.,[7],**28**,438.
(1923) Ann.fals.,**16**,602-9.

Frankforter,G.B.and Cohen,Lillian.
(1914) J.Am.Chem.Soc.,**36**,1103-34.
(1916) J.Am.Chem.Soc.,**38**,1139.

Frankforter,G.B.and Frary,F.C.
(1913) J.Phys.Chem.,**17**,402-73.

Frankforter,G.B.and Temple,S.
(1915) J.Am.Chem.Soc.,**37**,2697-2716.

Fraps,G.S.
(1901) Am.Chem.Jour.,**27**,290.

Frear,G.L.and Johnston,J.
(1929) J1Am.Chem.Soc.,**51**,2082-93.

Fredenhagen,Karl.
(1931) Z.Elektrochem.,**37**,686.
(1933) Z.physik.chem.,**165**(A),179.

Fredenhagen,K.and Cadenbach,G.
(1930) Z.physik.Chem.,**146**(A)245-280.

Fredholm,H.
(1934) Z.anorg.Chem.,**217**,203-13.
(1934) Z.anorg.Chem.,**218**,225-40.

Free,E.E.
(1908) J.Am.Chem.Soc.,**30**,1366-74.

AUTHOR INDEX

Freundlich,H. and Söllner,K.
(1928) Biochem.Ztschr.,**203**,3-13.

Fricke,R.
(1928) Z.anorg.Chem.,**172**,234.

Fricke,R. and Blencke,W.
(1925) Z.anorg.allgem.Chem.,**143**,193.

Fricke,R. and Brummer,F.
(1933) Z.anorg.Chem.,**213**,319-20.
(1935) Z.anorg.Chem.,**223**,397-8.

Fricke,R. and Humme,H.
(1929) Z.anorg.Chem.,**178**,400-10.

Fricke,R. and Jucaitis,P.
(1930) Z.anorg.Chem.,**191**,129-149.

Fricke,R. and Rode,O.
(1927) Z.anorg.Chem.,**163**,31-9.

Fricke,R. and Windhausen,O.
(1924) Z.anorg.allgem.Chem.,**132**,226.

Fridel.
(1869) Liebig's Ann.,**149**,96.

Friedel and Lachburg.
(1869) Bull.soc.chim.,[2],**12**,92.

Friedländer,T.
(1901) Z.physik.Chem.,**38**,389.

Friedlander,F.V.
(1918) J.Am.Chem.Soc.,**40**,1945-7.

Friedman,H.B. and LaMer,V.K.
(1931) J.Am.Chem.Soc.,**53**,103-5.

Friedrich,K.
(1907) Metallurgie,4,480,671.
(1908) Metallurgie,5,114.
(1914) Metallurgie u.Erz.,**11**,79,
196-200.

Friedrichs,F.
(1921) Z.anorg.allgem.Chem.,**116**,
141-60.

Friend,J.A.N.
(1929) J.Chem.Soc.(Lond.),2330-3,
2782-3.
(1930) J.Chem.Soc.(Lond.),1633-42,
1903-8.
(1931) J.Chem.Soc.(Lond.),1802-9,
2225-6.
(1932) J.Chem.Soc.(Lond.),1597-1602.
(1935) J.Chem.Soc.(Lond.),824-6,
1430-2.

Friend,J.A.N. and Colley,A.T.W.
(1931) J.Chem.Soc.(Lond.),3148-9.

Friend,J.A.N.,Hale,R.W. and Ryder,S.E.A.
(1937) J.Chem.Soc.(Lond.),970.

Friend,J.A.N. and Smirles,W.N.
(1928) J.Chem.Soc.(Lond.),**131**,2242-5.

**Friend,J.A.N.,Townley,J.E. and Vallance,
R.H.**
(1929) J.Chem.Soc.(Lond.),2326-30.

Friend,J.A.N. and Wheat,W.N.
(1935) J.Chem.Soc.(Lond.),356-9.
(1939) J.Chem.Soc.(Lond.),501-2.

Frisak,A.
(1922) Metal.u.Erz.,**19**,200.

Frisch,Franz.
(1930) Helv.Chim.acta,**13**,768-85.

Froehlich,W.
(1929) Mitt.Kali Forsch.Anstalt,**68**,37.

Fröhlich,K.W.
(1929) Dissertation,Münster.

**Frolich,K.,Tauch,E.J.,Hogan,J.J. and Peer,
A.A.**
(1931) Ind.Eng.Chem.,**23**,548-550.

Frommuller.
(1878) Ber.,**11**,92.

Frost,O.I.
(1936) Zhur.Obs.Khimii,**6**,1910-12.

Frost,W.S.,Cothran,J.C. and Browne,A.W.
(1933) J.Am.Chem.Soc.,**55**,3516.

Frowein,Fr.
(1928) Z.anorg.Chem.,**169**,336-44.

Frowein,F. and von Muhlendahl,E.
(1926) Z.angew.Chem.,**39**,1488-1500.

Frumkin,A. and Kulvarskaja,R.
(1924) Z.anorg.allgem.Chem.,**138**,
278-80.

Fuchs,Paul.
(1929) Ber.,**62**,1535.

Führer,
(1924) Ber.,**57**,510.

Fujimura,T.
(1914) Mem.Col.Sci.Kyoto,**1**,63-68.

Fulda,W.
(1909) Arb.Kais.Gesundheitsamt,**30**,31.

Funk,R.
(1899) Z.anorg.Chem.,**20**,412.
(1900) Wiss.Abh.p.t.Reichanstalt,**3**,
440.
(1900a) Ber.,**33**,3697.

AUTHOR INDEX

Furcht,M.and Lieben,A.
(1909) Sitzber.k.akad.wiss (Wien), **118**,IIb,383.
(1909) Monatsh.Chem.,**30**,555.

Fürth.
(1888) Monatsh.Chem.,**9**,311.

Fuseya,G.
(1920) J.Am.Chem.Soc.,**42**,368-71.

Fuseya,G.,Mori and Imamura.
(1933) J.Soc.Chem.Ind.(Japan) Suppl. **36**,175.B.

Gahl,R.
(1900) Z.physik.Chem.,**33**,178-214.

Galeotti,C.and Giampalmo,G.
(1908) Z.Chem.Ind.Kolloide,**3**,118-25.

Gallo,G.
(1935) Ann.chim.applicata.,**25**,628-31.

Garner,W.E.and Masson,I.
(1921) Phil.Mag.,**41**,484.

Garran,R.R.
(1926) J.Chem.Soc.,**129**,848-55.

Garrett,A.B.and Hirschler,A.E.
(1938) J.Am.Chem.Soc.,**60**,299-306.

Garrett,A.B.and Howell,W.W.
(1939) J.Am.Chem.Soc.,**61**,1730-4.

Garrett,A.B.,Vellenga,S.and Fontana,C.M.
(1939) J.Am.Chem.Soc.,**61**,367-73.

Garrick,F.J.and Wilson,C.L.
(1932) J.Chem.Soc.(Lond.),835-41.

Garside,
(1875) Chem.News,**31**,245.

Gaudechon,H.
(1910) Compt.rend.,**150**,467.

Gaus.
(1900) Z.anorg.Chem.,**25**,236.

Gay-Lussac.
(1819) Ann.chim.phys.,**11**,314.

Geffcken,G.
(1904) Z.physik.Chem.,**49**,271-296.

Geiger.
(1904) Dissertation (Berlin).

Geilmann,W.and Wrigge,F.W.
(1931) Z.anorg.Chem.,**197**,353-63.

Geller,R.F.,Creamer,A.S.and Bunting,E.N.
(1934) J.Res.U.S.Bureau of Standards, **13**,237-244.

Gemsky,H.
(1914) Neues Jahrb.Min.Geol.(Beil. Bd.),**36**,513-58.

Genke,F.A.
(1926) J.russ.phys.chem.Soc.,**58**,596.

Gerard.
(1901) Ann.chim.anal.,**6**,59.

Geradin.
(1865) Ann.chim.phys.,[4],**5**,129,134, 147,158.

Gerassimow,J.I.
(1930) Z.anorg.Chem.,**187**,321-33.
(1931) U.S.S.R.Sci.Res.Dept.Supreme Council Nat.Econ.,No. 420; Trans.Inst.pure chem. Res. No.11, 34.
(1934) Zhur.Obs.Khimii,**4**,721-2.

Gerlach.
(1869) Z.anal.Chem.,**8**,250,281.
(1889) Z.anal.Chem.,**28**,473.

Germann,F.E.E.and Metz,C.F.
(1931) J.Phys.Chem.,**35**,1944-52.

Germann,A.F.O.and Booth,H.S.
(1926) J.Phys.Chem.,**30**,369-77.

Germs,H.C.
(1917) Dissertation,Gröningen.

Germuth,F.G.
(1931) J.Franklin,Inst.,**212**,346.

Getman,F.H.
(1935) Rec.trav.chim.,**54**,866-72.

Ghiron,D.and Mangili,L.
(1935) Gazz.chim.ital.,**65**,1244-9.

Ghiron,D.and Monticelli,M.
(1938) Gazz.chim.ital.,**68**,555-9.

Gibby,C.W.
(1934) J.Chem.Soc.(Lond.),9-10.

Gibson,G.C.,Driscoll,J.O.and Jones,W.J.
(1929) J.Chem.Soc.(Lond.),1440-3.

Gibson,W.H.,Duckham,R.and Fairbairn,R.
(1922) J.Chem.Soc.,**121**,270-283.

Gilbert,E.C.
(1929) J.Phys.Chem.,**33**,1235-46.
(1929a) J.Am.Chem.Soc.,**51**,3394-3400.

Gilbert,E.C.and Hoffman,E.H.
(1932) J.Phys.Chem.,**36**,2789-92.

Gilbert,L.F.
(1925) J.Chem.Soc.,**127**,1541.

AUTHOR INDEX

Gilbert,L.F.,Buckley,H.and Masson,I.
(1922) J.Chem.Soc.,**121**,1934-8.

Gill,H.W.
(1914) J.Chem.Met.Soc.(S.Africa),
14,290-2.

van Ginneken,P.J.H.
(1911) Verslag.K.Akad.Wet.(Amst.),
20,337.

Ginnings,P.M.and Chen,Z.T.
(1931) J.Am.Chem.Soc.,**53**,3765-9.

Ginnings,P.M.and Dees,Mary
(1935) J.Am.Chem.Soc.,**57**,1038-40.

Ginnings,P.M.,Herring,Ethel and Webb,B.
(1933) J.Am.Chem.Soc.,**55**,875-8.

Ginnings,P.M.and Robbins,D.
(1930) J.Am.Chem.Soc.,**52**,2282-6.

Ginnings,P.M.,Webb,B.and Hinohara,E.
(1933) J.Am.Chem.Soc.,**55**,4898-9.

Ginsberg,A.S.
(1906) Ann.Inst.Polyt.(Petrograd),**6**,
493.
(1908) Z.anorg.Chem.,**59**,346.
(1909) Z.anorg.Chem.,**61**,122.

Ginsberg,H.
(1932) Z.anorg.Chem.,**204**,225-31.

Giolitti,F.and Bucci,G.
(1905) Gazz.chim.ital.,**35**,II,162-9.

Giolitti,F.and Vecchiarelli,V.
(1905) Gazz.chim.ital.,**35**,II,170.

Giran,H.
(1903) Jour.physique,[4],**2**,807.
(1903a) Ann.chim.phys.,[7],**30**,249.
(1906) Compt.rend.,**142**,398.
(1908) Compt.rend.,**146**,270,1270.
(1913) Bull.soc.chim.,[4],**13**,1050.

Giraud,H.
(1885) Bull.soc.chim.,[2],**43**,552.

von Girsewald,C.and Wolokitin,A.
(1909) Ber.,**42**,856-9.

Giua,M.and Guastalla,G.
(1925) Gazz.chim.ital.,**55**,646-52.

Gjalbaek,J.K.
(1925) Z.anorg.allgem.,Chem.,**144**,
145,269.

Gladstone.
(1854) J.Chem.Soc.(Lond.),**6**,11.

Glass,H.M.,Laybourn,K.and Madgin,W.M.
(1932) J.Chem.Soc.(Lond.),874,2713-5.
(1933) J.Chem.Soc.,(Lond.),199-202.

Glasstone,S.
(1921) J.Chem.Soc.,**119**,1689,1914.
(1922) J.Chem.Soc.,**121**,58-66.
(1922a) J.Chem.Soc.,**121**,1456-80.

Glasstone,S.and Riggs,E.J.
(1925) J.Chem.Soc.,**127**,2846-54.

Glasstone,S.and Saunders,R.N.
(1923) J.Chem.Soc.,**123**,2134-40.

Glauser,R.Th.
(1910) Z.anorg.Chem.,**66**,437.

Glowezynski,Z.
(1914) Kolloidchem.Beihefte,**6**,147-76.

Gniewosz,St.and Walfisz,Al.
(1887) Z.physik.Chem.,**1**,70.

Godeffroy.
(1876) Ber.,**9**,1337,1369.
(1886) Z.öster.Apoth.Ver.,No.9.

Goldblum,H.and Stoffella,G.
(1910) J.chim.phys.,**8**,154.

Goldblum,H.and Terlikowski,F.
(1912) Bull.soc.chim.,[4],**11**,146-59.

Goldschmidt,H.
(1895) Z.physik.Chem.,**17**,154.
(1898) Z.physik.Chem.,**25**,95.

Goldschmidt,H.and Eckardt,M.
(1906) Z.physik.Chem.,**56**,389.

Goodman,J.B.and Krase,N.W.
(1931) Ind.Eng.Chem.,**23**,401-4.

Goodwin,H.M.and Horsch,W.G.
(1919) Chem.Met.Eng.,**21**,181.

Goodwin,W.L.
(1882) Ber.,**15**,3039.

van der Goot,Tetta Polak.
(1913) Z.physik.Chem.,**84**,419-450.

Gordon,V.
(1895) Z.physik.Chem.,**18**,1-16.

Gordon.N.S.and Reid,E.E.
(1922) J.Phys.Chem.,**26**,773-89.

Gore.
(1870) Proc.Roy.Soc.,**18**,158.

Goria,C.
(1935) Gazz.chim.ital.,**65**,865,1226.

Gothe,E.
(1915) Chem.Ztg.,**39**,305-7.

AUTHOR INDEX

Gott, B. S. and Muir, M. P.
(1888) J.Chem.Soc.(Lond.),**53**,138.

Goudriaan, F.
(1919) Verslag.Akad.Wetenschappen (Amsterdam),**28**,159.
(1919) Proc.Acad.Sci.(Amsterdam), **22**,179-189.
(1920) Rec.trav.chim.,**39**,505-14.
(1922) Rec.trav.chim.,**41**,82-95.

Goubeau, J., Kolle, H. and Krall, H. G.
(1938) Z.anorg.Chem.,**236**,45-56.

Grace, N. S.
(1931) J.Chem.Soc.(Lond.),594-608.

Graff, W.
(1933) Compt.rend.,**196**,1390.
(1933) Compt.rend.,**197**,754.

Grahmann, W.
(1913) Z.anorg.Chem.,**81**,257-314.

Grant, A. J. and James, C.
(1917) J.Am.Chem.Soc.,**39**,934.

Graziadei, A.
(1935) Chimie et Ind.,**33**,183-92.
(1935) Chimie et Ind.,**34**,29-36.
(1936) Chimie et Ind.,**36**,31-6,72-80.

Greene, Chas. H.
(1937) J.Am.Chem.Soc.,**56**,1186-8.

Green, W. F.
(1908) J.Phys.Chem.,**12**,655-60.

Greenish, H. G.
(1900) Pharm.Jour.(Lond.),**65**,190-95.

Greenish, H. G. and Smith, F. A. U.
(1901) Pharm.Jour.(Lond.),**66**,774-7, 806-11.
(1902) Pharm.Jour.(Lond.),**68**,510-32.
(1903) Pharm.Jour.(Lond.),**71**,881.

Gregg-Wilson and Wright, R.
(1928) J.Chem.Soc.(Lond.),3111.

Grehant, N.
(1894) Compt.rend.,**118**,594.

Greig.
(1927) Am.J.Sci.[5],**214**,473-84.

Grieve, A. D., Gurd, G. W. and Maass, O.
(1933) Canadian J.Res.,**8**,577-82.

Griffith, R. O., McKeown, A. and Winn, A. G.
(1932) Trans Faraday Soc.,**28**,101-7.

Grimbert, L., Malmy, M. and Poirot, G.
(1924) J.pharm.chim.,[7],**29**,1-9.

Gröger, Max.
(1911) Z.anorg.Chem.,**70**,135.

Groh, J.
(1927) Z.anorg.Chem.,**162**,287-300.

Grollman, A.
(1929) J.Biol.Chem.,**82**,317-25.

Groschuff, E.
(1901) Ber.,**34**,3318.
(1903) Ber.,**36**,1791,4351.
(1904) Ber.,**37**,1488.
(1905) Z.anorg.Chem.,**47**,331-52.
(1908) Z.anorg.Chem.,**58**,102,113.
(1910) Chem.Weekblad.,**7**,687.
(1911) Z.Elektrochem.,**17**,348.

Gross, P. and Iser, Maria.
(1930) Monatsheft,Chem.,**55**,329-337.

Gross, P. and Klinghoffer, St. S.
(1930) Monatsheft.Chem.,**55**,338-41.

Gross, P. and Schwarz, K.
(1930) Monatsheft.Chem.,**55**,287-306.

Grossmann.
(1905) Z.anorg.Chem.,**43**,357.

Grube, G.
(1914) Z.Elektrochem.,**20**,342.
(1927) Z.Elektrochem.,**33**,482.

Grube, G. and Heune, H.
(1930) Z.Elektrochem.,**36**,129-35.

Grube, G. and Herrmann, W.
(1936) Z.Elektrochem.,**42**,233-6.

Grube, G. and Nussbaum, M.
(1928) Z.Elektrochem.,**34**,91-98.

Grube, G. and Rüdel, W.
(1924) Z.anorg.allgem.Chem.,**133**,375-88.

Grube, G. and Staesche, M.
(1927) Z.physik.Chem.,**130**,572-83.

Gruttner, G.
(1914) Ber.,**47**,3259.

Gudzeit, F.
(1908) Z.physiol.Chem.,**56**,150-179.
(1909) Z.physiol.Chem.,**60**,27,38-68.

Guemple, O.
(1929) Bull.soc.chim.,Belg.,**38**,443-7.

Guerassimow, J. I.
(1934) Zhur.Obs.Khimii,**4**,723-7.

Guerin, H.
(1938) Compt.rend.,**206**,1300.
(1939) Compt.rend.,**208**,1016-8.

AUTHOR INDEX

Guerini,B.
(1912) Thesis,Lausanne.

Guertler,W.and Schack,H.
(1923) Metall u Erz.,**20**,162.

Guertler.
(1904) Z.anorg.Chem.,**40**,337.

Guigues,P.
(1927) Bull.sci.Pharmacol.,**34**,210-2.

Guillier,R.
(1927) Caliche,**9**,292.

Güntelberg,E.and Pedersen,K.O.
(1926) Z.physik.Chem.,**123**,225-8.

Guntz,A.and Guntz,Jr.,A.A.
(1914) Ann.chim.,**2**,101.

Gurwitsch,L.
(1914) Z.physik.Chem.,**87**,329.

Guthrie,
(1875) Phil.Mag.,[4],**49**,210.
(1876) Phil.Mag.,[5],**1**,366.
(1878) Phil.Mag.,[5],**6**,40.
(1884) Phil.Mag.,[5],**18**,30,504.

Guthrie,A.
(1901) J.Soc.Chem.Ind.,**20**,224.

Guyer,A.,Bieler,A.and Schmid,G.
(1934) Helv.chim.Acta,**17**,1530-44.

Gyngell,E.S.
(1928) J.Chem.Soc.(Lond.),1785-91.

Haber-Chuwis,Q.
(1926) Rosz.Chem.,**6**,700-4.

Haber,F.(Jänicke,Matthias)
(1925) Z.anorg.Chem.,**147**,156.
(1926) Z.anorg.Chem.,**153**,153.

Haber,F.and van Ordt,G.
(1904) Z.anorg.Chem.,**38**,387.

Hachmeister,K.
(1920) Z.anorg.allgem.Chem.,**109**,145-86.

Hackspill,L.
(1933) Helv.chim Acta,**16**,1096.

Haehnel,O.
(1920) Centr.Min.Geol.,25-30.
(1924) J.prakt.Chem.,[2],**107**,165-76.
(1924) J.prakt.Chem.,[2],**108**,61-74,187-193.
(1937 J.prakt.Chem.,[2],**148**,295-309.

Haffert,H.H.
(1922) J.Soc.Chem.Ind.,**41**,334.

Hagen,H.and Sieverts,A.
(1930) Z.anorg.Chem.,**185**,225,238.

Hager.
(1875) Chem.Zentralbl.,135.
(1903) "Handbuch de Pharmaceutischen Praxis." 3rd.Ed.

Hager,G.and Kern,J.
(1916) J.Landw.,**64**,325-42.
(1920) Chem.Abs.,**14**,792.

Hagisawa,H.
(1934) Sci.Reports Tohoku Univ.(1),**23**,182.

Hahn.
(1877) Wyandotte Silver Smelting Works.

Hahn,F.L.and Brunngässer,K.
(1926) Z.anorg.allgem.Chem.,**153**,77-96.

Hahn,F.L.and Klockmann,R.
(1930) Z.physik.Chem.,(A),**148**,394.

Hahn,F.L.and Schulze,R.
(1927) Z.anorg.Chem.,**166**,213-8.

Halberstadt.
(1884) Ber.,**17**,2965.

Hall,R.E.,Robb,J.A.and Coleman,C.E.
(1926) J.Am.Chem.Soc.,**48**,927-38.

Halla,F.
(1935) Z.physik.Chem.,**175**,63-82,396-9.
(1936) Z.anorg.Chem.,**226**,139-40.

Haller,H.L.and Lynch,D.F.J.
(1924) Ind.Eng.Chem.,**16**,273.

Halpern,E.
(1926) Rosz.Chem.,**6**,661-77.

Hamai,S.
(1935) Bull.Chem.Soc.(Japan),**10**,5-16,207-11.

Hamberg.
(1885) J.prakt.Chem.,[2],**33**,433.

Hamberger,Anna.
(1906) Z.anorg.Chem.,**50**,427.

Hamburger,E.
(1911) Arch.ges.Physiol.(Pfluger's),**143**,187.

AUTHOR INDEX

Hamid,M.Abdul.
(1926) J.Chem.Soc.,**129**,199-214.

Hamid,M.Abdul and D'as Ras.
(1930) J.Indian Chem.Soc.,7,881.

Hammarsten,Greta.
(1929) C.r.trav.lab.Carlsberg,**17**,
No.11.

von Hammel,A.
(1915) Z.physik.Chem.,**90**,121.

Hammick,D.L.,Cousins,W.and Langford,E.
(1928) J.Chem.Soc.(Lond.),797.

Hammick,D.L.and Currie,J.A.
(1925) J.Chem.Soc.,**127**,1623-8.

Hammick,D.L.,Goadby,H.K.,and Booth,H.
(1920) J.Chem.Soc.,**117**,1589-92.

Hammick,D.L.and Holt,S.E.
(1926) J.Chem.Soc.,**129**,1995-2003
(1927) J.Chem.Soc.(Lond.),**130**,493-7.

Hammick,D.L.and Howard,J.
(1932 J.Chem.Soc.(Lond.),2915.

Hammick,D.L.and Mullaby.
(1921) J.Chem.Soc.,**119**,1802-6.

Hammick,D.L.and Zvegintzov,M.
(1928) J.Chem.Soc.(Lond.),1785-91.
(1930) J.Chem.Soc.(Lond.),273-7.

Hampshire,C.H.and Pratt,W.R.
(1913) Pharm.Jour.(Lond.),**91**,140.

Handy and Hoyt.
(1927) J.Am.Pharm.Assoc.,**16**,7.

Hansen,H.
(1930) Z.anorg.Chem.,**186**,41.

Hansen,L.A.and Williams,J.W.
(1930) J.Am.Chem.Soc.,**52**,2759.

Hantzsch,A.
(1902) Chem.Zentrbl.II,922.

Hantzsch,A.and Sebalt,F.
(1899) Z.physik.Chem.,**30**,258-99.

Hantzsch,A.and Vagt,A.
(1901) Z.physik.Chem.,**38**,705-42.

Harkins,W.D.
(1911) J.Am.Chem.Soc.,**33**,1807-27.

Harkins,W.D.and Clark,Geo.L.
(1915) J.Am.Chem.Soc.,**37**,1816.

Harkins,W.D.and Paine,H.M.
(1916) J.Am.Chem.Soc.,**38**,2709.
(1919) J.Am.Chem.Soc.,**41**,1155-68.

Harkins,W.D.and Pearce,W.T.
(1916) J.Am.Chem.Soc.,**38**,2694,2717.

Harkins,W.D.and Winninghoff,W.J.
(1911) J.Am.Chem.Soc.,**33**,1827-36.

Harman,R.W.
(1927) J.Phys.Chem.,**31**,511-8.

Harpuder,K.
(1923) Klin.Wochschr.,**2**,1268.
(1924) Biochem.Z.,**148**,354-60.

Harrass,Paul.
(1903) Arch.Internat.Pharmacodyamie
et Therapie,**11**,431-63.

Harris,I.W.H.
(1932) J.Chem.Soc.(Lond.),582-5,1694-7,
2709-13.

Harris,S.E.and Christiansen,W.G.
(1934) J.Am.Pharm.Assoc.,**23**,563-5.

Hart,E.and Huselton,H.B.
(1914) J.Am.Chem.Soc.,**36**,2082-4.

Hartley,G.S.
(1931) Trans.Faraday Soc.,**27**,10-29.

Hartley,H.
(1908) J.Chem.Soc.(Lond.),**93**,741-5.

Hartley,H.and Barrett,W.H.
(1909) J.Chem.Soc.(Lond.),**95**,1178-85.

**Hartley,H.,Drugman,J.,Vlieland,C.A.,
and Bourdillon,Robt.**
(1913) J.Chem.Soc.(Lond.),**103**,1749.

Hartley,H.,Jones,B.M.and Hutchinson,G.A.
(1908) J.Chem.Soc.(Lond.),**93**,825.

Hartley,H.and Thomas.
(1906) J.Chem.Soc.(Lond.),**89**,1028.

Hartshorn,N.H.
(1927) J.Chem.Soc.(Lond.),1759-68.

Haslam.
(1886) Chem.News.,**53**,87.

Haslam,R.T.,Calingaert,G.and Taylor,C.M.
(1924) J.Am.Chem.Soc.,**46**,308.

**Haslam,R.T.,Whitman,W.C.and Cochran,
J.D.,Jr.**
(1924) J.Proc.Nat.Lime Assoc.,6th,
Ann.Conv.,53-62.
(1924) Bull.Mass.Inst.Techn.,**60**,No.52.

Hasselblatt,M.
(1921) Z.anorg.allgem.Chem.,**119**,
313-24.

AUTHOR INDEX

Hastings,A.B.,Murray,C.D.and Sendroy,J.Jr.
(1927) J.Biol.Chem.,71,723-781.

v.Hauer.
(1858) J.prakt.Chem.,74,433.

Haupt,W.
(1914) Z.angew.Chem.,27,535-6.

Hauser,O.
(1905) Z.anorg.Chem.,45,194.
(1907) Z.anorg.Chem.,54,196-212.

Hauser,O.and Herzfeld.
(1912) "Die Seltenen Erden and Erdsäuren". p.61.
(Ferdinand Enke,Stuttgart)

Hauser,O.and Wirth,F.
(1908) Z.anal.Chem.,47,389.
(1909) J.prakt.Chem.,[2],79,358-68.
(1909a) Z.angew.Chem.,22,484.
(1912) Z.anorg.Chem.,78,75-94.

Hauslick,R.S.
(1935) Dissertation,Columbia Univ.N.Y.

Hawkins,F.S.and Partington,J.R.
(1928) Trans.Faraday Soc.,24,518-30.
(1930) Trans.Faraday Soc.,26,78-86.

Hawkins,J.A.and Schilling,C.W.
(1936) J.Biol.Chem.,113,273-8,649-53.

Hayami,R.
(1921) J.Chem.Soc.Japan,42,421-44.
(1921) Mem.Coll.Sci.Kyoto,Imp.Univ., 4,359-69.

Heath,W.P.
(1915) Privately Printed,Atlanta,Ga.

Hecht,
(1882) Ann.(Liebigs),213,72.

Hehner,O.and Mitchell,C.A.
(1897) J.Am.Chem.Soc.,19,40.

van der Heide.
(1893) Z.physik.Chem.,12,418.

Heidenhain,H.
(1918) Ind.Eng.Chem.,10,426-9.

Hein,Fr.and Daniel,W.
(1937) Z.anorg.Chem.,234,155-60.

Heise,G.W.
(1912) J.Phys.Chem.,16,373.

Helberg,H.
(1925) Ann.chim.,[10],4,121.

Helff,A.
(1893) Z.physik.Chem.,12,217.

Hellwig.
(1900) Z.anorg.Chem.,25,166-83.

Hempel,W.
(1901) Z.angew.Chem.,14,865.

Hempel,W.and Tedesco,H.
(1911) Z.angew.Chem.,24,2469.

Henderson,W.N.and Taylor,H.S.
(1916) J.Phys.Chem.,20,670.

Hendricks,S.B.
(1926) J.Phys.Chem.,30,248-53.

Hendrixon,W.S.
(1897) Z.anorg.Chem.,13,73.
(1920) J.Am.Chem.Soc.,42,724-7.

Henkel,H.
(1905) Dissertation,Berlin.
(1912) Landolt & Bornstein's, "Tabellen,"4th Ed.,602.

Henry.
(1884) Compt.rend.,99,1157.

Henstock,H.
(1934) J.Chem.Soc.(Lond.),1340-3.

Hering,E.
(1925-27) Revista Caliche,Chili.
(1926) These,Univ.Strasbourg.

Hering,H.
(1936) These,Paris.
(1936) Ann.chim.,[11],5,483-586.

Hermans,P.H.
(1925) Z.anorg.allgem.Chem.,142, 111-4.

Herold,J.
(1905) Z.Elektrochem.,11,417.

Herrero,G.
(1931) Anales,soc.Esp.fis.quim., 29,616-20.
(1932) Anales soc.Esp.fis.quim., 30,880-5.
(1933) Anales soc.Esp.fis.quim., 31,5-10,416-21.
(1936) Anales,soc.Esp.fis.quim., 34,549-52.

Herrmann,Gottfried.
(1911) Z.anorg.Chem.,71,257-302.

Hertel,E.
(1932) Z.physik.Chem.,(B),15,56.
(1932) Ann.(Liebigs),499,136.

Herz,W.
(1898) Ber.,31,2671.
(1900) Z.anorg.Chem.,25,155.
(1901) Z.anorg.Chem.,28,475.
(1902) Z.anorg.Chem.,30,281.
(1903) Z.anorg.Chem.,33,355.
(1905) Dissertation (Berlin).
(1910) Z.anorg.Chem.,68,69,165.
(1910a) Z.anorg.Chem.,66,93,358.
(1910b) Z.anorg.Chem.,65,341-4.
(1910c) Z.anorg.Chem.,67,365.
(1911) Z.anorg.Chem.,70,70,170.
(1911a) Z.anorg.Chem.,71,206.
(1911b) Z.anorg.Chem.,72,106.
(1911-12) Z.anorg.Chem.,73,274.
(1917) Z.Elektrochem.,23,23-4.

Herz,W.and Anders,G.
(1907) Z.anorg.Chem.,52,164-72, 271-8.

Herz,W.and Bulla,A.
(1909) Z.anorg.Chem.,63,282-4.
(1911) Z.anorg.Chem.,71,255.

Herz,W.and Fischer,H.
(1904) Ber.,37,4747.
(1905) Ber.,38,1140.

Herz,W.and Hellebrandt,Marie.
(1923) Z.anorg.allgem.Chem.,130, 188-9.

Herz,W.and Hiebenthal,F.
(1928) Z.anorg.Chem.,177,368-80.

Herz,W.and Knoch.
(1904) Z.anorg.Chem.,41,319.
(1905) Z.anorg.Chem.,45,263-8.

Herz,W.and Kuhn,F.
(1908) Z.anorg.Chem.,58,159-67.
(1908) Z.anorg.Chem.,60,152-62.

Herz,W.and Kurzer,A.
(1910) Z.Elektrochem.,16,240,869.

Herz,W.and Lewy.
(1905) Z.Elektrochem.,11,818.

Herz,W.and Lorentz,E.
(1929) Z.physik.Chem.(A),140,406,420.

Herz,W.and Martin,Edith.
(1924) Z.anorg.allgem.Chem.,140, 339-40.

Herz,W.and Muhs,G.
(1903) Ber.,36,3717.

Herz,W.and Paul,W.
(1913) Z.anorg.Chem.,82,431.
(1914) Z.anorg.Chem.,86,214.

Herz,W.and Rathmann,W.
(1913) Z.Elektrochem.,19,553,887.

Herzfeld.
(1892) Z.Ver.Zuckerind.,181.
(1897) Z.Ver.Zuckerind.,34,820.

von Hevesy,Geo.
(1900) Z.physik.Chem.,73,537.
(1909) Z.Elektrochem.,15,529.
(1911) Phys.Ztschr.,12,1214.
(1912) J.Phys.Chem.,16,429.
(1923) Chem.and Ind.,42,929.
(1925) K.Danske,Videnska.Selskah. Mat.fys.Medd.,6,No.7,1-149.

von Hevesy,G.,Christiansen,J.A.and Berglund,V.
(1925) Z.anorg.allgem.Chem.,144, 69-74.

von Hevesy,G.and Kimura,K.
(1925) J.Am.Chem.Soc.,47,2540.
(1925) Z.angew.Chem.,38,775.

von Hevesy,G.and Rona,E.
(1915) Z.physik.Chem.,89,303.

von Hevesy,G.and Wagner,O.H.
(1930) Z.anorg.Chem.,191,194-200.

Heyl,F.W.and Greer,F.E.
(1922) Am.J.Pharm.,94,80.

Heyrovsky,J.and Berezicky,S.
(1929) Coll.Czechoslovak.Chem.Com., 1,19-46.

Hicks,W.B.
(1915) J.Am.Chem.Soc.,37,844.

Hildebrand,J.H.
(1917) J. Am. Chem.Soc.,39,2297.
(1937) J.Am.Chem.Soc.,56,2033-5.

Hildebrand,J.H.and Buehrer,T.F.
(1920) J.Am.Chem.Soc.,42,2213-8.

Hildebrand,J.H.,Ellefson,E.T.and Beebe,C.W.
(1917) J.Am.Chem.Soc.,39,2302.

Hildebrand,J.H.and Jenks,C.A.
(1920) J.Am.Chem.Soc.,42,2180-9.
(1921) J.Am.Chem.Soc.,43,2172-7.

AUTHOR INDEX

Hildebrand,J.H.and Negishi,G.R.
(1937) J.Am.Chem.Soc.,58,339-41.

Hill,A.E.
(1908) J.Am.Chem.Soc.,30,68-74.
(1917) J.Am.Chem.Soc.,39,218-31.
(1921) J.Am.Chem.Soc.,43,263.
(1928) J.Am.Chem.Soc.,50,2678-92.
(1930) J.Am.Chem.Soc.,52,3813-7.
(1930a) J.Am.Chem.Soc.,52,3817-25.
(1934) J.Am.Chem.Soc.,56,1071-8.
(1937) J.Am.Chem.Soc.,59,2242-4.

Hill,A.E.and Bacon,L.R.
(1927) J.Am.Chem.Soc.,49,2487-95.

Hill,A.E.and Brown,S.F.
(1931) J.Am.Chem.Soc.,53,4316-20.

Hill,A.E.and Distler,E.F.
(1935) J.Am.Chem.Soc.,57,2203-4.

Hill,A.E.and Donovan,J.E.
(1931) J.Am.Chem.Soc.,53,934-41.

Hill,A.E.and Hill,D.G.
(1927) J.Am.Chem.Soc.,49,967-9,

Hill,A.E.and Kaplan,N.
(1936) J.Am.Chem.Soc.,58,1644-5.
(1938) J.Am.Chem.Soc.,60,550-4.

Hill,A.E.and Loucks,C.M.
(1937) J.Am.Chem.Soc.,59,2094-98.

Hill,A.E.and Miller,F.W.,Jr.
(1925) J.Am.Chem.Soc.,47,2702-12.
(1927) J.Am.Chem.Soc.,49,669-86.

Hill,A.E.and Moskowitz,S.
(1929) J.Am.Chem.Soc.,51,2396-8.
(1931) J.Am.Chem.Soc.,53,941-6.

Hill,A.E.and Ricci,J.E.
(1931) J.Am.Chem.Soc.,53,4305-15.

Hill,A.E.and Simmons,J.D.
(1909) J.Am.Chem.Soc.,31,821-39.
(1909) Z.physik.Chem.,67,594-617.

Hill,A.E.and Smith,S.B.
(1929) J.Am.Chem.Soc.,51,1625-36.

Hill,A.E.and Taylor,W.J.Jr.
(1938) J.Am.Chem.Soc.,60,1099-1104.

Hill,A.E.and Wills,J.H.
(1938) J.Am.Chem.Soc.,60,1647-55.

Hill,A.E.,Willson,H.S.and Bishop,J.A.
(1933) J.Am.Chem.Soc.,55,520-6.

Hill,A.E.and Yanick,N.S.
(1935) J.Am.Chem.Soc.,57,645-51.

Hill,A.E.and Zink,W.A.M.
(1909) J.Am.Chem.Soc.,31,44.

Hill,C.A.and Cocking,T.T.
(1912) Pharm.Jour.(Lond.),89,155.

Hilpert,S.
(1916). Z.angew.Chem.,29,I,57-9.
(1916) Chem.Abs.,10,1924.

Hinrichsen,F.W.and Sachsel,E.
(1904-05) Z.physik.Chem.,50,81-99.

Hirai,M.
(1926) Bull.Chem.Soc.(Japan),1,123-5.

Hissink,D.J.
(1900) Z.physik.Chem.,32,557.

Hitchcock,F.R.M.
(1895) J.Am.Chem.Soc.,17,529.

Hoermann,Fritz.
(1929) Z.anorg.Chem.,177,145-86.

van't Hoff,J.H.
(1901) Sitzber.k.Akad.Wiss.(Berlin), p.1035.
(1905) Z.anorg.Chem.,47,247.
(1912) "Untersuchungen uber die Bildungsverhaltnisse der Ozeanischen Salzablagerungen, inbesondere des Staasfurter Salzlagers." von J.H.van't Hoff et al Herausgegeben von H, Precht & E.Cohn.(Liepzig, 1912).

van't Hoff,J.H.and Goldschmidt,H.
(1895) Z.physik.Chem.,17,508.

van't Hoff,J.H.and Meyerhoffer,W.
(1898) Z.physik.Chem.,27,75.
(1899) Z.physik.Chem.,30,64-88.

van't Hoff,J.H.and Kenrick,F.B.
(1912) "Ozeanischen Salzablagerungen," pp.37-40.

Hoffert,W.H.
(1922) J.Soc.Chem.Ind.,41,334.

Hofmann.
(1927) N.Jahrb.Min Beilg,55,A,149.

Hofmann,K.A.,Höbold,K.and Quoos.
(1911-12) Liebig's Ann.,386,304-17.

Hofmann,K.A.and Höbold,K.
(1911) Ber.44,1776.

Hofmann,K.A.,Kirmreuther,K.and Thal,A.
(1910) Ber.,43,183.

AUTHOR INDEX

Hogg,A.R.
(1926) J.Chem.Soc.,129,855-62.

Hoitsema,C.
(1895) Z.physik.Chem.,17,651.
(1898) Rec.trav.chim.,17,310.
(1898a) Z.physik.Chem.,27,315.

Holde,D.and Selim,M.
(1925) Ber.,58B,523-8.

Holde,D.and Takehara,K.
(1925) Ber.,58B,1788-91.

Hölemann,H.and Kleese,W.
(1938) Z.anorg.Chem.,237,172-6.

Holmes,J.
(1918) J.Chem.Soc.,113,263-75.

Holmes,W.C.
(1920) Ind.Eng.Chem.,12,781-3.

Holmes,W.C.,Hutchinson,G.F.and Zieber,B.
(1931) Ind.Eng.Chem.,23,1102-4.

Holland,A.
(1897) Ann.chim.anal.,2,243.

Holland,H.C.
(1930) J.Chem.Soc.(Lond.),643-8.

Holleman,A.F.
(1893) Z.physik.Chem.,12,135.
(1896) Rec.trav.chim.,15,159.

Holleman,Kohlrausch and Rose.
(1893) Z.physik.Chem.,12,129,241.

Holleman,R.
(1903) Z.physik.Chem.,43,129-59.
(1905-06) Z.physik.Chem.,54,98-110.

Holluta,J.and Mautner,S.
(1927) Z.physik.Chem.,127,455-75.

Holluta,J.and Peter,F.
(1929) Z.physik.Chem.,143,(A),119-34

Holmberg,O.
(1907) Z.anorg.Chem.,53,83-134.

Holt,L.Emmett,Jr.
(1925) J.Biol.Chem.,66,23-8.

Holt,L.E.,Jr.,Le Mer,V.K.and Chown,H.B.
(1925) J.Biol.Chem.,64,509-89.
(1925) Proc.Soc.Exp.Biol.Med.,22,283-7.

Höltje,R.
(1929) Z.anorg.Chem.,181,395.

Holty,J.G.
(1905) J.Phys.Chem.,9,764.

Hölzl,F.
(1931) Monatshefte Chem.,58,29-46,249.
(1937) Z.Elektrochem.,43,302-4.

Hölzl,F.and Crotogino,H.
(1927) Z.anorg.Chem.,159,78-86.

Homfray,I.F.
(1910) J.Chem.Soc.(Lond.),97,1669.

Hönigschmid,O.and Stribel,H.
(1930) Z.anorg.Chem.,194,295.

Horiuti,J.
(1928) Bull.Inst.Phys.Chem.Res.,7,131.
(1931-32) Sci.Papers Inst.Phys.Chem. Res.(Tokoyo),17,125-264.

Horn,D.W.
(1907) Am.Chem.Jour.,37,471.

Horn,D.W.and Van Wagener.
(1903) Am.Chem.Jour.,30,347.

Houston,D.F.
(1936) J.Res.U.S.Bureau of Standards, 17,55-8.

Houston and Trichborne.
(1890) Brit.Med.Jour.,1063.

Howard,D.H.,Jr.and Bowne,A.W.
(1934) J.Am.Chem.Soc.,56,2348-57.

Howard,D.H.Jr.,Friederich,F.and Browne,A.W.
(1934) J.Am.Chem.Soc.,56,2332-40.

Howe,Jas.L.
(1894) J.Am.Chem.Soc.,16,388.

Howells,W.J.
(1929) J.Chem.Soc.(Lond.),910-5
(1930) J.Chem.Soc.(Lond.),2010-6
(1931) J.Chem.Soc.(Lond.),3208-12.

Huber,H.
(1921) Z.anorg.allgem.Chem.,116,139.

Hudson,J.C.
(1925) J.Chem.Soc.,127,1332-47.

Huecke.
(1884) J.prakt.Chem.,[2],29,49.

Hüfner,G.
(1895) Archiv.anat.u.physiol.,209-12.
(1906-07) Z.physik.Chem.,57,615-22.
(1907) Z.physik.Chem.,59,416.

AUTHOR INDEX

Hüfner,G.and Kulz.
(1895) J.prakt.Chem.,**28**,256.

Hughes,O.L.and Mead,T.H.
(1929) J.Chem.Soc.(Lond.),2282-4.

Hulett,G.A.
(1901) Z.physik.Chem.,**37**,406.
(1904) Trans.Am.Electrochem Soc.,**6**, 109.

Hulett,G.A.and Allen,L.E.
(1902) J.Am.Chem.Soc.,**24**,674.

Hülsmann,O.and Biltz,Wm.
(1934) Z.anorg.Chem.,**218**,369-78.

Hume-Rothery.
(1928) J.Chem.Soc.(Lond.),**131**,947-62.

Hunt.
(1870) Am.Jour.Sci.,[2],**40**,154.

Hunt,H.
(1932) J.Am.Chem.Soc.,**54**,3509-12.

Hunt,H.and Boncyk,L.
(1933) J.Am.Chem.Soc.,**55**,3528-30.

Husain,S.
(1929) Z.anorg.Chem.,**177**,215.

Hüttig,Gustav,F.
(1914) Z.physik.Chem.,**87**,144.

Hüttig,G.F.and Pohle,F.
(1924) Z.anorg.allgem.Chem.,**138**,14.

Hüttig,G.F.and Renscher,F.
(1924) Z.anorg.Chem.,**137**,155-80.

Hüttig,G.F.and Steudemann,W.
(1927) Z.physik.Chem.,**126**,105-17.

Huybrechts,M.and Andrault de Langeron,N.
(1930) Bull.soc.chim.(Belg.),**39**,43-57.

Huybrechts,M.and Degard,Ch.
(1933) Bull.soc.chim.(Belg.),**42**,331-46.

Huybrechts,M.and Ramelot,H.
(1926) Bull.soc.chim.Belg.,**35**,239-60.

Hyrnakowski,Kand Adamanis,F.
(1934) Roczniki chem.,**14**,194.

Igelsrud,I.and Thompson,T.G.
(1936) J.Am.Chem.Soc.,**58**,318-22.
(1936a) J.Am.Chem.Soc.,**58**,2003-9.

Iitsuka,D.
(1919) Mem.Coll.Sci.Kyoto,Imp.Univ., **4**,61-4.

Iljinsky,V.P.
(1924) J.Russ.Phys.Chem.Soc.,**54**,29-60.

Iljinsky,V.P.and Sagaldotschuy,A.F.
(1931) Zhur.Obs.Khimii,**1**,584.

Illingworth,B.and Howard,A.
(1884) Phil.Mag.,[5],**18**,124.

Imadsu,A.
(1911-12) Mem.Col.Sci.Eng.(Kyoto), **3**,257-63.

Imre,L.
(1927) Z.anorg.Chem.,**164**,214.
(1927) Z.anorg.Chem.,**166**,1-15.

Inamura,K.
(1919) Mem.Coll.Sci.,Kyoto,Imp. Univ.,**3**,105-12.

Ingham,J.W.
(1928) J.Chem.Soc.,(Lond.),**131**, 1917-30.

Inglis,J.K.H.
(1903) J.Chem.Soc.(Lond.),**83**,1010.

Inouye,R.
(1925) Mem.Coll.Sci.,Kyoto,Imp. Univ.(A),**8**,287-90.

Ionescu,V.and Slusanschi,H.
(1933) Bull.Soc.Chim.(France),[4], **53**,1087-96.

Ipatiew,W.W.,Drushina-Artemowitsch,S.I. and Tichomirow,W.I.
(1931) Zhur.Obs.Khimii,**1**,594-7.
(1932) Ber.,**65**,568-71.

Ipatiew,W.W.and Theodorowitch,W.P.
(1932) Zhur.Obs.Khimii,**2**,305-10.
(1934) Zhur.Obs.Khimii,**4**,395-9.

Irvin,N.N.and Russell,A.S.
(1932) J.Chem.Soc.,(Lond.),891-7.

Irving and Young.
(1888) J.Chem.Soc.(Lond.),**58**,344.

Irving,L.
(1926) J.Biol.Chem.,**68**,239,513.

Isaac,Florence.
(1908) J.Chem.Soc.(Lond.),**93**,398,927.

Isbekow,W.
(1913) Z.anorg.Chem.,**84**,24.
(1925) Z.anorg.allgem.Chem.,**143**,80-8.

Ishikawa,T.
(1926) Bull.Chem.Soc.Japan,**1**,139-42.

Ishikawa,F.and Hagisawa,H.
(1931) Bull.Inst.Phys.Chem.Res. (Tokyo),**10**,10.

Ishikawa, F. and Murooka, T.
(1928) Bull.Inst.Phys.Chem.Res. (Tokyo),7,1167.
(1929) Bull.Inst.Phys.Chem.Res. (Tokyo),8,77.
(1933) Sci.Reports Tohoku Univ.(1) 22,201,220,235.

Ishikawa, F. and Oku, M.
(1927) Bull.Inst.Chem.Res.(Tokyo),6, 80.

Ishikawa, F. and Shibata, E.
(1932) Sci.Reports Tohoku Univ.(1) 21,507.

Ishikawa, F. and Ueda, Y.
(1930) J.Chem.Soc.(Japan),51,634.
(1933) Sci.Reports Tohoku Univ.(1) 22,270.

Ishikawa, F. and Yoshida, T.
(1930) Bull.Inst.Phys.Chem.Res. (Tokyo),9,12.

van Itallie, E.J.
(1908) Z.anorg.Chem.,60,358-65.

Iwaki, J.
(1914) Mem.Col.Sci.(Kyoto),1,81-8.

Iwase, E.
(1930) Bull.Inst.Phys.Chem.Res. (Tokyo),9,542.

Iwig and Hecht.
(1886) Liebig's Ann.,233,167.

Jacek, W.
(1915) Bull,intern.acad.sci.Cracovie (A),26-43.
(1926) Rocz.Chem.,6,501-9.

Jackman, D.N. and Browne, A.
(1922) J.Chem.Soc.,121,694-7.

Jackson, K.S. and Rienacker, G.
(1930) J.Chem.Soc.(Lond.),1687.

Jackson, R.F.
(1914) J.Am.Chem.Soc.,36,2350.
(1914) Bull.Bureau Standards,2,331-45.

Jackson, R.F. and Silsbee, C.G.
(1925) Chem.Abs.,16,3022.

Jacobs, W.
(1917) Chem.Weekblad.,14,208-12.

Jacobson, C.A. and Holmes, A.
(1916) J.Biol.Chem.,25,29-53.

Jaeger, A.
(1901) Z.anorg.Chem.,27,25,33.

Jaeger, F.M. and Blumendal, H.B.
(1928) Z.anorg.Chem.,175,194,211.

Jaeger, F.M. and Doornbosch, H.J.D.
(1912) Z.anorg.Chem.,75,261.

Jaeger, F.M. and Germs, H.C.
(1921) Z.anorg.allgem.Chem.,119, 145-73.

Jaeger, F.M. and van Klooster, H.S.
(1912) Z.anorg.Chem.,78,245.

Jaeger, F.M. and Menke, J.B.
(1912) Z.anorg.Chem.,75,241-260.
(1912) Proc.k.Akad.Wet.(Amst.), 14,724.

Jaeger, F.M. and Thomas, W.
(1918) Verslag.Akad.Wetenschappen (Amsterdam),27,675.
(1919) Proc.Acad.Sci.,Amsterdam, 21,693-706.
(1919) Rec.trav.chim.,38,249.

Jahn-Held, W. and Jellinke, K.
(1936) Z.Elektrochem.,42,608-11.

Jaisle.
(1926) Dissertation,Stüttgart.

Jakowkin, A.A.
(1895) Z.physik.Chem.,18,588.
(1896) Z.physik.Chem.,20,38.
(1899) Z.physik.Chem.,29,630.

Jakowkin, A.A. and Archangelsky, P.A.
(1936) Z.anorg.Chem.,226,350-2.

James, C., Fogg, H.C., McIntire, B.W., Evans, R.H. and Donovan, J.S.
(1927) J.Am.Chem.Soc.,49,132.

James, C. and Holden, H.C.
(1913) J.Am.Chem.Soc.,35,559.

James, C. and Pratt, L.A.
(1910) J.Am.Chem.Soc.,32,873.

James, C. and Robinson, J.E.
(1913) J.Am.Chem.Soc.,35,754.

James, C. and Whittemore, C.F.
(1912) J.Am.Chem.Soc.,34,1168.

James, C., Whittemore, C.F. and Holden, H.C.
(1914) J.Am.Chem.Soc.,36,1854.

James, C. and Willand, P.S.
(1916) J.Am.Chem.Soc.,38,1499.

Jander, G. and Ruppolt, W.
(1937) Z.physik.Chem.(A),179,43-50.

AUTHOR INDEX

Jander,G.and Wickert,K.
(1936) Z.physik.Chem.,**178**,63.

Jänecke,E.
(1908) Z.physik.Chem.,**64**,343.
(1912) Z.physik.Chem.,**80**,1.
(1917) Z.anorg.allgem.Chem.,**100**, 161-236.
(1918) Z.anorg.allgem.Chem.,**102**, 41-65.
(1918) Z.anorg.allgem.Chem.,**103**, 1-54.
(1923) Rec.trav.chim.,**42**,740-4.
(1927) Z.physik.Chem.,**127**,71-92.
(1928) Z.angew.Chem.,**41**,916-24.
(1929) Z.angew.Chem.,**42**,1169-72.
(1929) Z.Elektrochem.,**35**,332-4.
(1929a) Z.Elektrochem.,**35**,716-27.
(1930) Z.Elektrochem.,**36**,645-54.
(1930) Z.anorg.Chem.,**188**,72-85.
(1932) Rec.trav.chim.,**51**,579-84.
(1933) Z.anorg.Chem.,**213**,149.
(1933a) Z.Elektrochem.,**39**,682-86.
(1936) Z.physik.Chem.,**177**,7-16.
(1937) Z.Elektrochem.,**43**,924.
(1938) Z.Elektrochem.,**44**,183-93.

Jänecke,E.,Eissner,W.and Brill,R.
(1927) Z.anorg.Chem.,**160**,171-184.

Jänecke,E.Hamacher,H.and Rahlfs,E.
(1932) Z.anorg.Chem.,**206**,357-68.

Jänecke,E.and Hoffmann,A.
(1932) Z.Elektrochem.,**38**,880.

Jänecke,E.and Mühlhausser,W.
(1936) Z.anorg.Chem.,**228**,241-8.

Janecke,E.and Rahlfs,E.
(1930) Z.Elektrochem.,**36**,648.
(1932) Z.Elektrochem.,**38**,9-12.

Janickis, J.
(1932) Z.anorg.Chem.,**205**,49-75.
(1934) Z.anorg.Chem.,**218**,89-103.

Janickis,J.and Gutmanaite,H.
(1936) Z.anorg.Chem.,**227**,1-16.

Jantsch,G.
(1912) Z.anorg.Chem.,**76**,321.
(1926) Z.anorg.allgem.Chem.,**153**,9-16.

Jantsch,G.and Grünkraut,A.
(1912-13) Z.anorg.Chem.,**79**,309-21.

Jaques,A.
(1910) Trans.Faraday Soc.,**5**,235.

Jarry,R.
(1897) Compt.rend.,**124**,288-91.
(1899) Ann.Chim.phys.,[7],**17**,342.

Jatlov,V.S.and Poljakova,E.M.
(1938) Zhur.Obs.Khimii,**8**,774-6.

Jatlov,V.S.and Pinsevskaja,E.N.
(1938) Zhur.Obs.Khimii,**8**,1665-9.

Jegorow,W.S.
(1931) Chem.Jour.(Russ.),A,**1**,1266.

Jehn,D.B.and Huddleston,L.J.
(1924) J.Chem.Soc.,**125**,1451-6.

Jellinek,K.
(1911) Z.anorg.Chem.,**70**,86-134.

Jellinek,K.and Czerwinski.
(1922) Z.physik.Chem.,**102**,438.

Jellinek,K.and Gordon,H.
(1924) Z.physik.Chem.,**112**,247.

Jellinek,K.and Kühn,W.
(1923) Z.physik.Chem.,**105**,340.

Jelissejew,A.G.
(1926) Ber.Inst.Phys.Chem.Analyse (Leningrad),**3**,443.

Jensen,K.A.
(1934) Z.anorg.Chem.,**219**,238-42.

Jencic,S.
(1934) Arhiv.Hemiju Formicyn,**8**,62-6.

Jirsa,F.and Buryanek,O.
(1923) Z.Elektrochem.,**29**,129.

Jirsa,F.and Jelinek,H.
(1924) Z.Elektrochem.,**30**,286,534.

Jo,Inohiko.
(1911) Mem.coll.sci.Eng.(Kyoto),**3**, 41-9,212.
(1912) Tokyo Chem.Soc.,**33**,No.7,July.

Joannis,A.
(1882) Ann.chim.phys.,[5],**26**,489.
(1906) Ann.chim.phys.,[8],**7**,41.

Johns,L.B.,Peterson,W.D.and Hixon,R.M.
(1930) J.Phys.Chem.,**34**,2218.

Johnson.
(1886) Chem.News.,**54**,75.

Johnson,C.R.and Hulett,G.A.
(1933) J.Am.Chem.Soc.,**55**,2258-62.

Johnson,C.R.and Low,Geo.W.Jr.
(1933) J.Am.Chem.Soc.,**55**,2262-5.

AUTHOR INDEX

Johnson,W.C.and Krumboltz,O.F.
(1933) Z.physik.Chem.(A),167,249-59.

Johnson,W.C.and Piskur,M.M.
(1933) J.Phys.Chem.,37,93-9.

Johnson,W.C.and Wheatley,A.C.
(1934) Z.anorg.Chem.,216,273.

Johnston,H.L.,Cuta,Frantisck and Garrett,A.B.
(1933) J.Am.Chem.Soc.,55,2311-25.

Johnston,H.L.and Leland,H.L.
(1938) J.Am.Chem.Soc.,60,1439-45.

Johnston,J.
(1915) J.Am.Chem.Soc.,37,2001-20.
(1916) J.Am.Chem.Soc.,38,947-75.

Johnston,J.and Grove,C.
(1931) J. Am.Chem.Soc.,53,3976-91.

Johnston,J.and Williamson,E.D.
(1916) J.Am.Chem.Soc.,38,975-83.

Johnstone,A.F.and Leppla,P.W.
(1934) J.Am.Chem.Soc.,56,2233-8.

Jolin.
(1889) Arch.anat.u.physiol.,262.

Jones,B.M.
(19089 J.Chem.Soc.(Lond.),93,1744.

Jones,F.E.,Hamer,W.E.,Davies,C.W.and Bury,C.R.
(1930) J.Phys.Chem.,34,564.

Jones,G.and Baeckström,S.
(1934) J.Am.Chem.Soc.,56,1517-23.

Jones,G.and Hartmann,M.L.
(1915) J.Am.Chem.Soc.,37,241.
(1916) Trans.Am.Electrochem.Soc., 30,295-325

Jones,G.and Schumb,W.C.
(1921) Proc.Am.Acad.,56,199.

Jones,H.C.
(1907) Carnegie Publication No.60, Washington,D.C.

Jones,H.C.and Getman,F.H.
(1904) Z.physik.Chem.,49,419.

Jones,W.J.
(1911) J.Chem.Soc.(Lond.),99,392.

de Jong,A.W.K.
(1909) Rec.trav.chim.,28,343.
(1912) Rec.trav.chim.,31,256.

Jonker,W.P.A.
(1909) Z.anorg.Chem.,62,84.

Jordis,E.
(1903) Ber.,36,2542.

Jörgensen.
(1879) J.prakt.Chem.,[2],18,205.
(1879) J.prakt.Chem.,[2],19,49.
(1879) J.prakt.Chem.,[2],20,195.
(1884) J.prakt.Chem.,[2],30,1.
(1890) J.prakt.Chem.,[2],42,208.

Jordis,E.
(1903) Ber.,36,2542.

Joseph,A.F.
(1920) J.Chem.Soc.,117,377-81.

Joulin.
(1873) Ann.chim.phys.,[4],30,260.

Jowett,M.and Price,H.I.
(1932) Trans.Faraday Soc.,28,668-81.

Joyner,R.A.
(1912) Z.anorg.Chem.,77,108.

Jucaitis,P.
(1934) Z.anorg.Chem.,220,257-67.

Jungfleisch,E.
(1912) Compt.rend.,155,801.

Jungfleisch,E.and Landrieu,Ph.
(1914) Ann.chim.,2,1-56,333.
(1914a) Compt.rend.,158,1306-11.

Jürgens.
(1885) Jahresber.Chem.,1722.

Jurisch.
(1912) Dissertation,Leipzig.

Just,G.
(1901) Z.physik.Chem.,37,342-367.

Justin-Mueller,E.
(1918) Compt.rend.,167,779.

Kachtanow,L.I.and Obstchouk,O.N.
(1937) Zhur.Obs.Khimii,7,839-41.

Kagan and Kamyschau.
(1932) Chim.Shurn.Ser.B. Shurn.prikaadnoiChim.,5,347.

Kahlenberg,L.and Brewer,R.K.
(1908) J.Phys.Chem.,12,283-9.

Kahlenberg,L.and Krauskopf,F.C.
(1908) J.Am.Chem.Soc.,30,1104-15.

Kahlenberg,L.and Wittich,W.J.
(1909) J.Phys.Chem.,13,421-5.

AUTHOR INDEX

Kahlukow, I. and Sachanow, A.
(1909) J.Russ.Phys.Chem.Soc.,41,1755.

Karandeeff, B.
(1909) Zentralbl.Min.Geol.,p.728.
(1910) Z.anorg.Chem.,68,188.

Karaoglanow, Z.
(1917) Z.anal.Chem.,56,228.

Karaoglanow, Z. and Sagortschev. V.
(1932) Z.anorg.Chem.,205,270.

Karantassis, Tryphon.
(1927) Ann.chim.[10],8,71-105.

Karl, G.
(1910) Z.anorg.Chem.,68,57.

Karrer, P.
(1922) Ber.,55B,2861.

Karsten.
(1864-5) Ann.derChem.u.Pharm.Suppl.
Bd.,3,170.

Karsten, B. J.
(1907) Z.anorg.Chem.,53,367.

Kasarnowsky, J.
(1924) Z.physik.Chem.,109,289.

Katz, S. H. and James, C.
(1913) J.Am.Chem.Soc.,35,872.

Kaufmann, H. P.
(1935) Archiv.pharm.,273,22-31.

Kaveler, H. H. and Monroe, C. J.
(1928) J.Am.Chem.Soc.,50,2421-6.

Kazantzev, A. A.
(1923) Trans.Inst.Chem.Reagents,
Moscow,No.2,10-27.
(1925) Chem.Abs.,19,1218.
(1938) Zhur.Obs.Khimii,8,1230-1.

Kazanzeff.
(1878) Ber.11,1255.

Keitel, H.
(1923) Kali,17,248,261.

Kellner, Geo.
(1917) Z.anorg.allgem.Chem.,99,
137-183.

Kelly, W. J. and Ayers, K. B.
(1924) Ind.Eng.Chem.,16,148-50.

Kendall, J.
(1911) Proc.Roy.Soc.(Lond.),A,85,
200-19.
(1912) Phil.Mag.[6],23,958.

Kendall, J. and Davidson, J. G.
(1920) J.Am.Chem.Soc.,42,1141-5.

Kendall, J. and Davidson, A. W.
(1921) J.Am.Chem.Soc.,43,979-90.

Kendall, J. and Carpenter.
(1914) J.Am.Chem.Soc.,36,2498.

Kendall, J., Crittenden, E. D. and Miller, H. K.
(1923) J.Am.Chem.Soc.,45,963-96.

Kendall, J. and Landon, M. L.
(1920) J.Am.Chem.Soc.,42,2131-42.

Kendall, J. and Sloan, C. H.
(1925) J.Am.Chem.Soc.,47,2306-17.

Keppish.
(1888) Monatsh.Chem.,9,589.

Kernot, G., d'Agostino, E. and Pellegrino, M.
(1908) Gazz.chim.ital.,38,I,532-54.

Kernot, G. and Pomilio, M.
(1912) Rend.accad.sci.fis.nat.(Napoli),[3],17,353-8.

Kern, E. and Jones, T.
(1930) Trans.Am.Electrochem.Soc.,57.

Keschan, A.
(1925) Z.anal.Chem.,67,81.

Ketner.
(1901-02) Z.physik.Chem.,39,645.

Kettner, A.
(1919) Dissertation,Amsterdam.

Keyes, D. B. and James, C.
(1914) J.Am.Chem.Soc.,36,634.

Kiang-su Chang and Yen-Ming Liu.
(1934) J.Chinese Chem.Soc.,2,307-10.

Kiehl, S. J. and Manfredo, E. J.
(1937) J.Am.Chem.Soc.,56,2118-26.

Kielland, J.
(1936) J.Am.Chem.Soc.,58,426.

Kilde, G.
(1934) Z.anorg.Chem.,218,113-23.
(1936) Z.anorg.Chem.,229,321-9.

King, Harold and Pyman, F. L.
(1914) J.Chem.Soc.(Lond.),105,1238-59.

King, F. E. and Partington, J. R.
(1926) J.Chem.Soc.,129,20-22.
(1927) Trans.Faraday Soc.,23,522-31.

King, G. B.
(1937) J.Phys.Chem.,41,797-801.

AUTHOR INDEX

King,G.B.and Walton,J.H.
(1931) J.Phys.Chem.,35,1745-55.

Kirejew,S.A.and Romantchonk,M.A.
(1936) Zhur.Obs.Khimii,6,78-84.

Kirejew,S.A.and Wagranskaja,L.I.
(1935) Zhur.Obs.Khimii,5,963-6.

Kirn,E.R.and Dunlop,H.L.
(1931) J.Am.Chem.Soc.,53,391-4.

Kirschfeld,L.and Sieverts,A.
(1929) Z.physik.Chem.(A),145,229.
(1930) Z.Elektrochem.,31,123.

Kirschner,A.
(1912) Z.physik.Chem.,79,247.

v.Kiss,A.,Lajtai,I.and Thury,G.
(1937) Z.anorg.Chem.,233,346-52.

v.Kiss,A.and Urmanczy,A.
(1931) Z.anorg.Chem.,202,172-90.

Kitaigorodski,Popowa and Botwinkin.
(1933) Iswestija,Instituta fisike chimitsch analisi,6,135.

Klapproth,W.
(1922) Z.anal.Chem.,61,1-19.

Klarmann,M.E.
(1924) Z.anorg.Chem.,132,290.
(1930) Z.physik.Chem.,65,358.

Klaus.
(1905) Phys.Ztschr.,6,820.

Klatchko-Gourvitch,L.L.and Gandganov,N.O.
(1935) Zhur.Obs.Khimii,5,1781-5.

Klein,O.
(1912) Z.anorg.Chem.,74,158.

Klein,O.and Svanberg,O.
(1920) Medd.Vetenskapsakad.Nobel Inst.,4,No.1.
(1921) Chem.Abs.,15,1439.

Klemenc,A.and Bankowski,O.
(1932) Z.anorg.Chem.,208,225-35.

Klemenc,A.and Spitzer-Neumann,E.
(1929) Monatshefte.Chem.,53,413-9.

Klemm,W.and Kedeker,M.
(1931) Z.anorg.Chem.,200,345.

Kleven.
(1872) Chem.Centralbl.,434.

Kline,W.D.
(1929) J.Am.Chem.Soc.,51,2093-7.

Klinkenberg,A.
(1929) These,Delft.

van Klooster,H.S.
(1910-11) Z.anorg.Chem.,69,122, 135-57.
(1912-13) Z.anorg.Chem.,79,223-9.
(1917) J.Phys.Chem.,21,513-18.

van Klooster,H.S.and Balon,P.A.
(1934) J.Am.Chem.Soc.,56,591-2.

van Klooster,H.S.and Stearns,E.I.
(1933) J.Am.Chem.Soc.,55,4121-3.

Klose,G.
(1907) Archiv.Internat.Pharmacodynamie et Therapie,17,459-63.

Klosky,S.and Woo,L.
(1926) J.Phys.Chem.,30,1179-80.

Knietsch,R.
(1901) Ber.,34,4099.

Knight,R.W.and Hinshelwood,C.N.
(1927) J.Chem.Soc.(Lond.),466-72.

Knopp.
(1904) Z.physik.Chem.,48,97-108.

Knott,E.
(1932) Pharm.Jour.(Lond.),128,84.

Knox,Joseph.
(1909) J.Chem.Soc.(Lond.),95,1760.

Knox,J.and Will.
(1919) J.Chem.Soc.,115,853.

Kobayashi,M.
(1911-12) Mem.Coll.Sci.Eng.(Kyoto), 3,218.

Koch,F.K.
(1930) J.Chem.Soc.(Lond.),1551-8.
(1930a) J.Chem.Soc.(Lond.),2385-6.

Koenig,P.M.
(1922) Chimie et Industrie,7,49.

Koerker,F.W.and Calderwood,H.N.
(1938) J.Phys.Chem.,42,1151-5.

Kofler,M.
(1913) Monatsh.Chem.,34,389.
(1913) Sitzber.k.Akad.Wiss.(Wien) Abt.,IIa,122,1473-80.

Köhler.
(1879) Z.anal.Chem.,18,242.

Köhler.
(1897) Z.Ver.Zuckerind.,47,447.

AUTHOR INDEX

Kohlrausch,Fr.
(1879) Wied.Ann.,1,
(1891) Ber. 24,3561.
(1891) Wied.Ann.,44,577.
(1897) Sitzber.k.Akad.Wiss.(Berlin),90.
(1903) Z.physik.Chem.,44,197.
(1904-05) Z.physik.Chem.,50,355-6.
(1908) Z.physik.Chem.,64,121-69.

Kohlrausch,F.and Rose,F.
(1893) Z.physik.Chem.,12,129,135,241.

Kohn,M.
(1909) Z.anorg.Chem.,63,337-9.

Kohn,M.and O'Brien.
(1898) J.Soc.Chem.Ind.,17,100.

Kohn,M.and Klein,A.
(1912) Z.anorg.Chem.,77,254.

Kohnstamm and Cohn.
(1898) Wied.Ann.,65,344.

Kolb.
(1872) Bull.soc.ind.Mulhouse,222.

de Kolossovsky,N.
(1911) Bull.soc.chim.(Paris),[4],9, 623-7.
(1911) Bull.soc.chim.(Belg.),25,183, 235.
(1919) Bull.soc.chim.(Belg.),28, 257-64.

de Kolossovsky,N.and Kulikow,F.S.
(1934) Z.physik.Chem.(A),169,459.

Kolthoff,I.M.
(1917) Chem.Weekblad.,14,1081.
(1921) Z.anorg.Chem.,119,202-12.
(1922) Rec.trav.chim.,41,139.
(1922) Chem.Weekblad.,19,449.
(1931) J.Phys.Chem.,35,2711-21.

Kolthoff,I.M.and Bosch,W.
(1932) J.Phys.Chem.,36,1702-11.

Kolthoff,I.M.and Elmquist,R.
(1931) J.Am.Chem.Soc.,53,1217-24.

Kolthoff,I.M.and Rosenblum,C.
(1933) J.Am.Chem.Soc.,55,2656-64.

Kolthoff,I.M.and Stenger,V.A.
(1934) J.Phys.Chem.,38,639-43.

Kolthoff,I.M.and Vogelenzang,E.H.
(1919) Z.anal.Chem.,58,20,51.

Konarzewski.
(1931) Roczniki Chemji,11,516.

Konig.
(1894) Monatsh.Chem.,15,23.

de Koninck,L.L.
(1907) Bull.soc.chim.(Belg.),21,141.

Konno,K.
(1919) Mem.Coll.Sci.,Kyoto,Imp.Univ., 4,51-4.

Konowalow,D.
(1898) Jour.Russ.Phys.Chem.Soc.,[4], 30,367.
(1898) Chem.Zentralbl., II,659.
(1899a) Jour.Russ.Phys.Chem.Soc.,31, 910.
(1899b) Jour.Russ.Phys.Chem.Soc.,31, 985.

Koppel,J.
(1901-02) Z.physik.Chem.,42,8.
(1904) Z.anorg.Chem.,41,377.
(1905) Z.physik.Chem.,52,405.
(1906) Ber.,39,3738.

Koppel,J.and Blumenthal,R.
(1907) Z.anorg.Chem.,53,228-67.

Koppel,J.and Cahn,M.
(1908) Z.anorg.Chem.,60,53-112.

Koppel-Gumpery.
(1905) Z.physik.Chem.,52,413.

Koppel,J.and Holtkamp,H.
(1910) Z.anorg.Chem.,67,274.

Koppel-Wetzel.
(1905) Z.physik.Chem.,52,395.

Korreng,E.
(1914) Neues Jahrb.Min.Geol.(Beil. Bd.),37,51-124.
(1915) Z.anorg.Chem.,91,194.

Körosy,F.
(1937) Trans.Faraday Soc.,33,416-25.

Korvezee,A.E.
(1934) Rec.trav.chim.,53,464-70.

Kosakewitsch, R P.
(1929) Z.physik.Chem.(A),143,216-24.

Kournakov,N.S.and Zemcuznyj,S.F.
(1919) J.Russ.Phys.Chem.Soc.,51,1-59.
(1924) Z.anorg.allgem.Chem.,140,149-82.

Kracek,F.C.
(1931) J.Phys.Chem.,35,417-22,947-9.
(1931) J.Am.Chem.Soc.,53,2609-24.
(1936) J.Wash.Acad.Sci.,26,307-13.

AUTHOR INDEX

Kragen,S.
(1916) Monatshefte.Chem.,37,391.

Krasnicki.
(1887) Monatsh.Chem.,8,597.

Kraus,C.A.and Burgess,W.M.
(1927) J.Am.Chem.Soc.,49,1226-35.

Kraus,C.A.and Glass,S.W.
(1929) J.Phys.Chem.,33,995-9.

Kraus,C.A.and Seward,R.P.
(1927) Trans.Faraday Soc.,23,488-91.
(1928) J.Phys.Chem.,32,1294-1307.

Kraus,C.A.and Lucasse,W.W.
(1922) J.Am.Chem.Soc.,44,1949.

Kraus,C.H.and Cuy,E.J.
(1923) J.Am.Chem.Soc.,45,712.

Krause,Erich.
(1918) Ber.,51,1447-56.

Krause,E.and Pohland,E.
(1922) Ber.,55B,1282-1289.

Krause,E.and Reiszaus,G.G.
(1921) Ber.,54B,2062.

Kremann,R.,Daimer and Beunesch.
(1911) Monatsh.Chem.,32,620.

Kremann,R.and Hofmeier,F.
(1908) Monatsh.Chem.,29,1111.
(1910) Monatshefte.Chem.,31,201.

Kremann,R.and Hüttinger,K.
(1908) Jahrber.k.Geol.Reichsanstalt (Wien),58,637.

Kremann,R.and Kerschbaum,F.
(1907) Z.anorg.Chem.,56,218-22.

Kremann,R.and Kropsch,R.
(1914) Monatsh.Chem.,35,561,823,841.

Kremann,R.and Noss,F.
(1912) Monatsh.Chem.,33,1205.

Kremann,R.and Pogantsch,K.
(1923) Monatsh,44,163-173.

Kremann,R.and Rodemund,H.
(1914) Monatsh.Chem.,35,1065-86.
(1914) Z.anorg.Chem.,86,373.

Kremann,R.and Schinderschitsch,N.
(1916) Monatsh.,37,649-79.

Kremann,R.and Schoultz,R.
(1912) Monatsh.Chem.,33,1063,1081.

Kremann,R.and Zawodsky,O.
(1921) Monatsh.,41,543-53.

Kremann,R.and Zitek,A.
(1909) Monatsh.Chem.,30,311-40.

Kremers.
(1852) Pogg.Ann.,85,248.
(1854) Pogg.Ann.,92,497.
(1855) Pogg.Ann.,94,271;95,468.
(1856) Pogg.Ann.,99,47.
(1856a) Pogg.Ann.,97,5.
(1858) Pogg.Ann.,103,57,133,165.
(1858) Pogg.Ann.,104,133.
(1860) Pogg.Ann.,111,60.

Krepelka,J.H.,and Rejha,B.
(1933) Coll.Czechoslovak.Chem.Com., 5,67-75.

Krepelka,J.H.and Toul,F.,
(1929) Coll.Czechoslovak.Chem.Com., 1,155-64.

Kritschewsky,I.and Goldmann,E.
(1933) Z.anorg.Chem.,214,307-8.
(1934) Z.anorg.Chem.,218,253-4.

Kritschewski,I.and Izkowitsch,R.K.
(1933) Z.anorg.Chem.,215,103-4.

Kritchewsky,I.R.and Kasarnovsky,J.S.
(1935) J.Am.Chem.Soc.,57,2168.
(1936) Z.physik.Chem.,176,48.

Kritschewsky,I.R.,Shawaronkoff,N.M. and Aepelbaum,V.A.
(1935) Z.physik.Chem.,(A),175,232-8.

Krug,W.H.and McElroy,K.P.
(1892) J.Anal.Ch.,6,184.

Krusemann,H.D.
(1876) Ber.,9,1467.

Krüss,G.and Nilson,L.F.
(1887) Ber.,20,1696.

Kruyt,H.R.
(1908) Z.physik.Chem.,64,513.
(1908-09) Z.physik.Chem.,65,497.
(1912) Z.physik.Chem.,79,667.

Kruyt,H.R.and Heldermann,W.D.
(1916) Proc.Acad.Sci.Amsterdam,19, 439-47.
(1918) Z.physik.Chem.,93,89-107.

AUTHOR INDEX

Krym,V.
(1909) J.Russ.Phys.Chem.Soc.,41, 382-5;Chem.Zentr.,II,681.

Kubie,L.S.
(1927) J.Biol.Chem.,72,545-8.

Kugelmass,I.N.and Shohl,A.T.
(1924) J.Biol.Chem.,58,649-66.

Kulisch.
(1893) Monatsh.Chem.,14,567.

Kultascheff.
(1903) Z.anorg.Chem.,35,187.

Kumpf.
(1882) Wied.Ann.Beibl.,6,276.

Kunerth,W.
(1922) Phys.Rev.,[2],19,512-24.

Kunheim and Zimmerman.
(1884) Dingler.polyt.J.,252,478.

Kunschert,F.
(1904) Z.anorg.Chem.,41,338.

Küpper,A.
(1927) Caliche,8,467.

Kuriloff,B.
(1897) Z.physik.Chem.,24,441-67.
(1897a) Z.physik.Chem.,23,93,547. 673.
(1898) Z.physik.Chem.,25,107,419-40.

Kurnakov,N.S.
(1892) J.Russ.Phys.Chem.Soc.,24,629.
(1893) J.Chem.Soc.(Lond.),64,ii,509.
(1916) J.Russ.Phys.Chem.Soc.,48,1672.

Kurnakov,N.S.and Kanov,F.P.
(1924) Z.anorg.Chem.,135,102.

Kurnakov,J.,Krotkov,D.and Oksman,M.
(1915) Jour.Russ.Phys.Chem.Soc., 47,558-88.

Kurnakov,N.S.and Nikolajew,W.M.
(1926) J.Russ.Phys.Chem.Soc.,58,548.
(1927) Z.physik.Chem.,130,193.

Kurnakov,N.S.and Perelmutter,G.
(1924) Z.anorg.Chem.,135,114.

Kurnakov,N.S.,Perelmutter,G.and Kanov,F.P.
(1915) Ann.Polytechn.Petrograd,24,399.

Kurnakov,N.S.and Rawitsch,M.I.
(1933) Ann.Inst.Phys.Chem.Anal.(Russ), 6,169.

Kurnakov,N.S.and Wrzesnewsky,J.B.
(1912) Z.anorg.Chem.,74,89.

Kurnakov,N.S.and Zemcznzny.
(1907) Z.anorg.Chem.,52,186.

Kurtenacker,A.,Finger,W.and Hey,F.
(1933) Z.anorg.Chem.,211,83-97, 281-95.

Kurtenacker,A.and Fluss,W.
(1933) Z.anorg.Chem.,210,125-34.

Kurtenacker,A.and Laszlo,G.
(1938) Z.anorg.Chem.,237,359-68.

Küster,F.W.and Heberlein,E.
(1905) Z.anorg.Chem.,43,56.

Küster,F.W.and Kremann,R.
(1904) Z.anorg.Chem.,41,19.

Küster and Thiel.
(1899) Z.anorg.Chem.,21,116.
(1903) Z.anorg.Chem.,33,139.

Lachartre,M.
(1924) Bull.soc.chim.,[4],35,321-32.

Lachaud,M.and Lepierre,C.
(1891) Bull.soc.chim.,[3],6,230-5.

Ladenburg,A.
(1902) Ber.,35,1256.

Lafontaine,G.H.
(1925) Compt.rend.,180,2045.

Laird,J.S.
(1920) J.Phys.Chem.,24,736.

Lal De,R.
(1917) J.Chem.Soc.(Lond.),111,55

Lamb,A.B.and Phillips,A.W.
(1923) J.Am.Chem.Soc.,45,108-12.

Lamb,A.B.and Simmons,J.P.
(1921) J.Am.Chem.Soc.,43,2196.

Lambert,R.h.
(1926) J.Phys.Chem.,30,973-9.

LaMer,V.K.and Cook,R.G.
(1929) J.Am.Chem.Soc.,51,2622.

LaMer,V.K.and Goldman,F.H.
(1929) J.Am.Chem.Soc.,51,2632-45.
(1930) J.Am.Chem.Soc.,52,2791-3.
(1931) J.Am.Chem.Soc.,53,473-6.

LaMer.V.K.,King,C.V.and Mason,C.F.
(1927) J.Am.Chem.Soc.,49,363.

LaMer,V.K.and Lewinsohn,M.H.
(1934) J.Phys.Chem.,38,171-95.

LaMer,V.K.and Mason,C.F.
(1927) J.Am.Chem.Soc.,49,410.

Lami,Pio.
(1908) Chem.Zentr.,II,755.
(1908) Boll.chim.farm.,47,435-41.

Lamouroue, F.
(1899) Compt.rend.,128,998.

Lamy.
(1863) Ann.chim.phys.,[3],67,408.
(1878) Ann.chim.phys.,[5],14,145.

Landau, M.
(1893) Monatsh.Chem.,14,712.
(1910) Z.physik.Chem.,73,200-11.

Länganer, D.
(1933) Z.anorg.Chem.,213,180.

Langdon, G.M.
(1923-4) Trans.Faraday Soc.,19,285.

Lange, W.
(1927) Ber.,60,962.
(1929) Ber.,62,793.

Langheld, K. and Oppmann, F.
(1912) Ber.,45,3753.

Langley, W.D., Rosenbaum, M.G. and Rosenbaum, M.M.
(1932) J.Biol.Chem.,99,271-8.

Lannung, Axel.
(1930) J.Am.Chem.Soc.,52,68-80.
(1932) Z.physik.Chem.(A),161,255-78.
(1934) Z.physik.Chem.(A),170,144.

Lanza, J.
(1931) Anales,soc.Esp.fis.quim.,29, 221-34.

Lanzing, Miss J.C.
(1928) Ric.trav.chim.,47,901-3.

Larocque, G.L. and Maass, O.
(1935) Canadian,J.Res.,13,276-9.

Larson, A.T. and Black, C.A.
(1925) Ind.Eng.Chem.,17,715.
(1925) J.Am.Chem.Soc.,47,1015-20.

Larson, E.
( ) Svensk Kemisk Tidscrift,39,122.

Larson, E. and Adell, B.
(1931) Z.anorg.Chem.,196,354-63.

Larson, R.G. and Hunt, H.
(1939) J.Phys.Chem.,43,417-23.

Lassaigne.
(1876) J.chim.med.,12,177.

von Lasczynski, St.
(1894) Ber.,27,2285.

Lattey, R.
(1923) Dissertation,Braunschweig.

Laue, Erich.
(1927) Z.anorg.Chem.,165,325-63.

Lauffenburger, R. and Brodsky, M.
(1938) Compt.rend.,206,1383-5.

Laurie, A.P.
(1912) Proc.Roy.Soc.(Edin.),31,388.

Lautsberry, F.C.A.H. and Page, R.A.
(1920) J.Soc.Chem.Ind.,39,37.

Lawrence, R.W. and King, G.B.
(1938) J.Am.Chem.Soc.,60,1987-8.

Laybourn, K. and Madgin, W.M.
(1932) J.Chem.Soc.(Lond.),2582-9.
(1933) J.Chem.Soc.(Lond.),236-40.

Laybourn, K., Madgin, W.M. and Freeman, D.
(1934) J.Chem.Soc.(Lond.),139-46.

Lea, Chas. and Wood, J.K.
(1924) J.Chem.Soc.,125,137-48.

Leaming, Thos.H.
(1925?) Renesselaer,Polytech.Inst. (Troy,N.Y.) Eng.Sci. Series No. 7.

Leather, J.W. and Mukerji, J.M.
(1913) Mem.Dept.Agr.(India),Chem. Ser.,3,177-204.

Leather, J.W. and Sen, J.N.
(1909) Mem.Dept.Agr.(India),Chem. Ser.,1,117-31.
(1914) Mem.Dept.Agr.(India),Chem. Ser.,3,205-34.

Lebeau, P.
(1906) Ann.chim.phys.,[8],9,482-4.
(1911) Compt.rend.,152,440.

Lebedew, P.
(1911) Z.anorg.Chem.,70,302,316.

LeBlanc, M. and Harnapp, O.
(1932) Z.physik.Chem.,166,333.

LeBlanc, M. and Novotny, K.
(1906) Z.anorg.Chem.,51,181-201.

LeBlanc, M. and Noyes, A.A.
(1890) Z.physik.Chem.,6,386.

LeBlanc, M. and Schmandt, W.
(1911) Z.physik.Chem.,77,621-30.

Le Boucher, L.
(1926) Anales.Soc.Espan.fis.quim. 24,95,277.

LeChatelier.
(1894) Compt.rend.,118,350,709,800.
(1897) Compt.rend.,124,1094.

Ledrut,J.and Hauss,L.
(1932) Bull.soc.chim.(Belg.),41,104-7.
(1937) Bull.soc.chim.(France)[5],4, 1136-41.

Lee,F.H.and Lee,K.H.
(1936) J.Chinese Chem.Soc.,4,126-30.

Lee,W.B.and Egerton,A.C.
(1923) J.Chem.Soc.,123,706-16.

van Leeuwen,J.Docters.
(1897) Z.physik.Chem.,23,44.

LeFevre,R.J.W.
(1932) J.Chem.Soc.(Lond.),2503-4.

Lefort.
(1878) Ann.chim.phys.,[5],15,326.

Legerlotz,H.
(1918) Arch.Pharm.,256,162-3.

Lehrman,A.,Adler,E.Jacob,F.and Kiemand,M.
(1937) J.Am.Chem.Soc.,59,179-81.

Lehrman,A.and Breslow,D.
(1938) J.Am.Chem.Soc.,60,873-6.

Lehrman,A.and Leifer.
(1938) J.Am.Chem.Soc.,60,142-4.

Lehrman,A.,Selditch,H.and Skell,P.
(1936) J.Am.Chem.Soc.,58,1612-5.

Leick,J.
(1932) Z.anal.Chem.,87,415-22.
(1933) Z.anorg.Chem.,210,203-9.

Leidie.
(1882) Compt.rend.,95,87.
(1890) Compt.rend.,111,107.

Leikina,B.N.and Nowosselowa,A.W.
(1937) Zhur.Obs.Khimii,7,241-8.

Leinbach,G.and Pfeiffenberger,A.
(1929) Caliche,11,61.
(1930) Caliche,12,340.

Le marchands,M.
(1928) Compt.rend.,187,601.

Lenher,V.and Kao,C.H.
(1926) J.Am.Chem.Soc.,48,1550-6.

Lenher,V.and Merrill,H.B.
(1917) J.Am.Chem.Soc.,39,2630.

Leo,Rudolf.
(1923) Monatsh.,43,567-88.

Lepierre,C.and Lachaud,M.
(1891) Compt.rend.,113,196.

Lespieau.
(1894) Bull.soc.chim.,[3],11,72.

Levi,G.R.
(1923) Atti accad.Lincei[5],32,I, 623-6.

Levi,G.R.and Aguzzi,A.
(1938) Gazz.chim.ital.,68,179-84.

Levi,M.G.
(1901) Gazz.chim.ital.,31,II,523.
(1902) Z.physik.Chem.,41,110.

Levi-Malvano,M.
(1906) Z.anorg.Chem.,48,446.
(1905) Atti accad.Lincei,[5],14,II, 502-10.

Levi,Miriam and Gilbert,F.
(1927) J.Chem.Soc.(Lond.),130,2117-24.

Levi,S.M.
(1923) Z.physik.Chem.,106,93-104.
(1924) Z.physik.Chem.,108,411-30.

Lewis,G.N.and Storch,H.
(1917) J.Am.Chem.Soc.,39,2551.

Lewis,N.B.and Rivett,A.C.D.
(1924) J.Chem.Soc.,125,1156-67.

Ley,H.and Helmbuchen.
(1904) Z.Elektrochem.,10,303.

Ley,H.and Schaefer,K.
(1906) Ber.,39,1263.

Lichacjova,A.I.and Lucinsky,G.P.
(1938) Zhur.Obs.Khimii,8,916-23.

Lichty,D.M.
(1903) J.Am.Chem.Soc.,25,474.

Lidoff.
(1893) Bull.soc.chim.,[3],10,356.

Liebermann,C.
(1902) Ber.,35,1094.
(1903) Ber.,36,180.

van Liempt,J.A.M.and Van Wijk,W.
(1937) Rec.trav,chim.,56,632-4.

Limbosch,H.
(1909) Bull.soc.chim.Belg.,23,179-200.

AUTHOR INDEX

Lind,S.C.,Underwood,J.E.and Whittemore,C.F.
(1918) J.Am.Chem.Soc.,40,465-72.

van der Linden,T.
(1916) Arch.Suikerind,24,1113-28.
(1917) Chem.Abs.,11,3122.

Lindner,J.
(1912) Monatsh.Chem.,33,645.

Lindstrand,F.
(1936) Z.anorg.Chem.,230,187-208.

Linebarger,C.E.
(1892) Am.Chem.Jour.,14,380.
(1894) Am.Chem.Jour.,16,214.
(1895) Am.Jour.Sci.,49,48-53.

Lineweaver,H.
(1938) J.Biol.Chem.,122,548-67.

Linhard,M.
(1938) Z.anorg.Chem.,239,155-60.

Linhard,M.and Stephan,M.
(1933) Z.physik.Chem.,163,185-95.
(1934) Z.physik.Chem.,167,87-102.

Linhart,G.A.
(1915) J.Am.Chem.Soc.,37,258-74.
(1918) J.Am.Chem.Soc.,40,158-63.

Linz,A.
(1939) Ind.Eng.Chem.,31,302.

Liou Qui Tao and Wang Shim Mo.
(1936) Compt.rend.,202,846.

Lloyd,E.,Brown,C.B.,Glynwyn,D.,Bonnel,R.and Jones,W.J.
(1928) J.Chem.Soc.(Lond.),658-66.

Lloyd,S.J.
(1918) J.Phys.Chem.,22,300-3.

Locke.
(1901) Am.Chem.J.,26,174.
(1902) Am.Chem.J.,27,459.

Locuty,P.and Laffitte,P.
(1933) Compt.rend.,196,1311.
(1934) Compt.rend.,199,950.

Loewel.
(1851) Ann.chim.phys.,[3],33,382.
(1855) Ann.chim.phys.,[3],43,413.

Logan,M.A.and Taylor,H.L.
(1937) J.Biol.Chem.,119,293-306.

Long.
(1888) J.Anal.Chem.,2,243.

Longi.
(1883) Gazz.chim.ital.,13,87.

Longuimine.
(1862) Liebig's Ann.,121,123.

Lorah,J.R.,Tartar,H.V.,and Wood,L.
(1929) J.Am.Chem.Soc.,51,1097-1106.

Loomis,A.G.
(1922) J.Am.Chem.Soc.,44,8-19.

Lord,R.C.
(1907) J.Phys.Chem.,11,182.

Lorenz,R.and Bergheimer,E.
(1924) Z.anorg.allgem.Chem.,137,141-54.

Lorenz,R.and Winger,R.
(1929) Z.anorg.Chem.,183,121-6.

Lorenz,R.,Jabs,A.and Eitel,S.
(1913) Z.anorg.Chem.,83,39.

Lorenz and Ruckstuhl.
(1906) Z.anorg.Chem.,51,70.

Losana,L.
(1923) Gazz.chim.ital.,53,396-410.
(1926) Gazz.chim.ital.,56,301-31.

Lothian,J.
(1909) Pharm.Jour.(Lond.),82,292.

Löwel.
(1851) Ann.chim.phys.,[3],33,382.

Löwenherz,R.
(1894) Z.physik.Chem.,13,479.
(1895) Z.physik.Chem.,18,82.
(1898) Z.physik.Chem.,25,395-410.

Lowery,H.H.and Erickson,W.R.
(1927) J.Am.Chem.Soc.,49,2729-34.

Lowry,T.M.and Gilbert,F.L.
(1929) J.Chem.Soc.(Lond.),2076-87.

Lowry,T.M.,McHatton,L.P.and Jones,G.G.
(1927) J.Chem.Soc.(Lond.),130,746-56.

Lowry,T.M.and Lemon,J.T.
(1935) J.Chem.Soc.(Lond.),692-6.
(1936) J.Chem.Soc.(Lond.),1-11.

Lowry,T.M.,Lloyd,E.and Lloyd,W.V.
(1936) J.Chem.Soc.(Lond.),11-17.

Lubarsch.
(1889) Wied.Ann.Physik.,[2],37,525.

Lubavin.
(1892) J.Russ.Ph.Chem.Soc.,24,389.

AUTHOR INDEX

de Lucchi,G.
(1910) Russ.min.,32,21.
(1910) "Tables annuelles,"1,381,403.

Luckenmeyer-Hasse and Shenk.
(1932) Arch.Eisenhüttenw.,6,210.

Lugg,J.W.H.
(1931) Trans.Faraday Soc.,27,297-309.

Lukens,H.S.
(1932) J.Am.Chem.Soc.,54,2372-80.

Lumsden,J.S.
(1902) J.Chem.Soc.(Lond.),81,355.
(1905) J.Chem.Soc.(Lond.),89,90.

Lunge,
(1885) J.Soc.Chem.Ind.,4,32.
(1892) J.Soc.Chem.,Ind.,11,882.

Luther,R.and Leubner,A.
(1912) J.prakt.Chem.,[2],85,314.
(1912a) Z.anorg.Chem.,74,389.

Lutschinsky,G.P.
(1935) Z.anorg.Chem.,224,420-6.

Lutschinsky,G.P.and Lichatschewa,A: I.
(1935) Z.anorg.Chem.,225,175-6.

Maass,O.and Hatcher,W.A.
(1922) J.Am.Chem.Soc.,44,2473.

Maass,O.and Herzberg,O.W.
(1920) J.Am.Chem.Soc.,42,2569-70.

Maass,O.and McIntosh,D.
(1912) J.Am.Chem.Soc.,34,1279.
(1913) J.Am.Chem.Soc.,35,538.

Maass,O.and Russell,J,
(1921) J.Am.Chem.Soc.,43,1227.

Maben.
(1883-84) Pharm.Jour.(Lond.),[3],14,505.

MacAdam,D.J.,Jr.and Pierle,C.A.
(1912) J.Am.Chem.Soc.,34,604.

Macalpine,G.B.and Sayce,L.A.
(1932) J.Chem.Soc.(Lond.),1560-5.

McAmis,A.J.and Felsing,W.A.
(1925) J.Am.Chem.Soc.,47,2633.

MacArthur,C.G.
(1916) J.Phys.Chem.,20,495.

McBain,J.W.,Brock,G.C.,Vold,R.D.and Vold,M.J.
(1938) J.Am.Chem.Soc.,60,1870-6.

McBain,J.W.and Eaton,M.
(1928) J.Am.Chem.Soc.,131.2166-79.

McBain,J.W.and Field,M.C.
(1933) J.Chem.Soc.(Lond.),920-32.
(1933) J.Am.Chem.Soc.,55,4776-93.

McBain,J.W.,Lozarus,L.H.and Pitten,A.V.
(1930) Z.physik.Chem.(A),147,87-117.

McBain,J.W.and Stewart,A.
(1933) J.Chem.Soc.(Lond.),924-32.

McBain,J.W.,Vold,R.D.and Jameson,W.T.
(1939) J.Am.Chem.Soc.,61,30-7.

McBride,R.S.
(1910) J.Phys.Chem.,14,189-200.

McCaughey,W.J.
(1909) J.Am.Chem.Soc.,31,1261.

McCombie,H.and Reade,T.H.
(1923) J.Chem.Soc.,123,151.

McCoy,H.N.and Smith,H.J.
(1911) J.Am.Chem.Soc.,33,468-73.

McCoy,H.N.and Test,Chas.D.
(1911) J.Am.Chem.Soc.,33,473-6.

McCrae,J.and Wilson,W.E.
(1903) Z.anorg.Chem.,35,11.

McCrosky,C.R.and Buell,H.D.
(1920) J.Am.Chem.Soc.,42,1788.

McCullock,L.
(1937) J.Am.Chem.Soc.,59,2650-2.

M'David,J.W.
(1909-10) Proc.Roy.Soc.(Edinburgh),30,440-7.

McDaniel,A.S.
(1911) J.Phys.Chem.,15,587-610.

McDermott,F.Alex.
(1911) J.Am.Chem.Soc.,33,1963.

McDonnell,C.C.and Smith,C.M.
(1916) J.Am.Chem.Soc.,38,2366.

MacDougall,F.H.
(1930) J.Am.Chem.Soc.,52,1390-3.

MacDougall,F.H.and Bartsch,C.E.
(1936) J.Phys.Chem.,40,649-59.

MacDougall,F.H.and Hoffman,E.J.
(1936) J.Phys.Chem.,40,317-31.

MacDougall,F.H.and Larson,W.D.
(1937) J.Phys.Chem.,41,417-29.

MacDougall,F.H.and Rehner,John,Jr.
(1934) J.Am.Chem.Soc.,**56**,368-72.

MacDougall,G.and Davies,C.W.
(1935) J.Chem.Soc.(Lond.),1416-19.

McDowell,L.A.and Johnston,H.L.
(1936) J.Am.Chem.Soc.,**58**,2009-14.

MacFarlane,W.and Wright,R.
(1934) J.Chem.Soc.(Lond.),207-10.

McIntosh,D.
(1903) J.Phys.Chem.,**7**,350.
(1911) J.Am.Chem.Soc.,**33**,71.
(1928) Bull.Chem.Soc.(Japan),**3**,82-6.

McKelvy,E.C.and Simpson,D.H.
(1922) J.Am.Chem.Soc.,**44**,105-15.

Mackenzie.
(1877) Wied.Ann.Physik.,[2],**1**,450.

McKenzie.
(1899) J.Chem.Soc.(Lond.),**75**,969.

McKie,P.V.
(1921) J.Chem.Soc.,**119**,777-9.

McLauchlan,W.H.
(1903) Z.physik.Chem.,**44**,600-33.

Maclaurin.
(1893) J.Chem.Soc.(Lond.),**63**,729.

McMaster,LeRoy and Pratte,P.K.
(1923) J.Am.Chem.Soc.,**45**,2999.
(1924) Chem.News,**129**,4-6.

Macy,R.
(1925) J.Am.Chem.Soc.,**47**,1031-6.

Macy,R.and Thomas,E.W.
(1926) J.Am.Chem.Soc.,**48**,1547-50.

Madgin,W.M.and Briscoe,H.V.A.
(1923) J.Chem.Soc.,**123**,2914-6.

Madson,W.H.and Krauskopf,F.C.
(1931) Rec.trav.chim.,**50**,1005-10.

Maeda,T.and Yamane,S.
(1928) Bull.Inst.Phys.Chem.Res. (Tokyo),**7**,340.

Magnanini,G.
(1901) Gazz.chim.ital.,**31**,II,542.

Mahieu,J.
(1936) Bull.soc.chim.(Belg.),**45**, 667-75.

Mai,J.
(1928) Ber.,**61**,1808.

Maigret.
(1905) Bull.soc.chim.[3],**33**,631.

von Maifert.
(1894) Compt.rend.,**119**,951.

Mainzer,F.and Bruhu,M.
(1931) Biochem.Z.,**230**,395-410.

Majer,V.
(1928) Listy cukrovar,**47**,123-136.

Makarow,S.Z.
(1932) Zhur.Obs.Khimii,**2**,234-48.

Makarow,S.Z.and Jakimow,M.N.
(1933) Zhur.Obs.Khimii,**3**,990-7.

Makarow,S.Z.and Wachsberg,N.M.
(1930) Zhur.Obs.Khimii,**62**,1863.

Malhotra,K.L.
(1928) J.Indian Chem.Soc.,**5**,545-7.

Malhotra,K.L.and Suri,H.D.
(1930) J.Phys.Chem.,**34**,2103-10.

Maljaroff,K.L.and Gluschakoff,A.J.
(1933) Z.anal.Chem.,**93**,265-8.

Maljaroff,K.L.and Matskiewitsch,W.B.
(1934) Z.anal.Chem.,**98**,31-3.

Mallet.
(1897) Am.Chem.Jour.,**19**,807.

Malmy,M.
(1926) J.pharm.chim.,[8],**4**,111-4.

Malossi,L.
(1931) Atti accad.Lincei[6],**13**,775-9.

Malquori,G.
(1925) Atti accad.Lincei.,[6],**1**,392.
(1926) Gazz.chim.ital.,**56**,37-41,51-55.
(1926) Atti del II Congress di Chim. Palermo,1136
(1927) Atti accad. Lincei[6],**5**,510.
(1927a) Atti accad.Lincei[6],**5**,576-8.
(1927b) Gazz.chim.ital.,**57**,661-6.
(1927c) Atti accad.Lincei,[6],**5**,892-6.
(1927d) Atti accad.Lincei[6],**5**,451-2.
(1927e) Atti accad Lincei[6],**5**,801-2.
(1927f) Atti accad Lincei[6],**5**,1000.
(1928) Gazz.chim.ital.,**58**,209-16.
(1928) Atti accad.Lincei[6],**7**,740
(1928a) Gazz.chim.ital.,**58**,891-8.
(1928b) Gazz.chim.ital.,**58**,562-8.
(1928c) Gazz.chim.ital.,**58**,781-91.
(1928d) Gazz.chim.ital.,**58**,203.
(1929) Gazz.chim.ital.,**59**,556-63.
(1929a) Atti accad Lincei[6],**9**,569-72.
(1929b) Atti accad.Lincei[6],**9**,324,414.

Mameli,E.
(1922) Giorn.chim.ind.app.,**4**,293-96.

AUTHOR INDEX

Manchot,W. and Ortner,K.
(1922) Z.anorg.allgem.Chem.,120,300.

Manchot,W. and Reinburger.
(1926) Ber.,59B,2672-81.

Manchot and Zechentmayer.
(1906) Liebig's Ann.,350,368.

Mandelbaum,R.
(1909) Z.anorg.Chem.,62,370-82.

Mansuri,Q.A.
(1927) J.Chem.Soc.(Lond.),130,2993-5.
(1928) J. Chem.Soc.(Lond.),2107-8.

Manuelli,A.
(1916) Ann.chim.applicata,5,13-24.

Mar.
(1892) Am.J.Sci.,[3],43,521.

Marc,R.
(1906) Z.anorg.Chem.,48,425.
(1907) Z.anorg.Chem.,53,301.

Marckwald,W.
(1902) Ber.,35,1599.
(1904) Ber.,37,1041.

Marden,J.W.
(1914) J.Ind.Eng.Chem.,6,315-20.
(1916) J.Am.Chem.Soc.,38,310.

Marden,J.W. and Dover,Mary V.
(1916) J.Am.Chem.Soc.,38,1239.
(1917) J.Am.Chem.Soc.,39,4.

Margoscher,Hinner and Friedmann.
(1924) Z.anorg.Chem.,137,83.

Marie,C. and Marquis,R.
(1903) Compt.rend.,136,684.

Marignac.
(1853) Ann.chim.phys.,[3],39,184.
(1861) J.prakt.Chem.,83,202.
(1866) Ann.chim.phys.,[4],8,65.

Marino.
(1905) Gazz.chim.ital.,35,II,351.

Marsh,J.K.
(1939) J.Chem.Soc.(Lond.),554-8.

Marsh,J.E. and Struthers,R.de J.F.
(1905) J.Chem.Soc.(Lond.),87,1879.

Marshall,A.
(1906) J.Chem.Soc.(Lond.),89,1381.

Marshall.
(1891) J.Chem.Soc.(Lond.),59,771.

Marshall,H. and Bain,D.
(1910) J.Chem.Soc.(Lond.),97,1074-85.

Martin.
(   ) These,Bruxelles.

Martin.
(1929) Arch.Eisenhütten w.3,412.

Marvel,C.S. and Glavis,F.J.
(1938) J.Am.Chem.Soc.,60,2622-26

Masaki,Kosaku.
(1930) Bull.chem.soc.(Japan),5,345.
(1931) Bull.chem.soc.(Japan),6,143,163

Mascarelli,L.
(1906) Atti accad.Lincei,[5],15,I.
192;II,459.
(1906a) Atti accad.(Lincei),[5],15,192
(1906a) Gazz.chim.ital.,36,II,880-93.
(1908) Atti accad.Lincei,[5],17,I,29.
(1909) Gazz.chim.ital.,39,I,251-84.

Mascarelli,L. and Ascoli,U.
(1907) Gazz.chim.ital.,37,I,125.

Mason,C.W. and Ashcraft,E.B.
(1939) Ind.Eng.Chem.,31,768-74.

Mason,C.W. and Forgeng,W.D.
(1931) J.Phys.Chem.,35,1123-32.

Mason,R.B. and Mathews,J.H.
(1925) J.Phys.Chem.,29,1179-83.

Massink,A.
(1917) Chem.Weekblad.,14,756.
(1916-18) Z.physik.Chem.,92,351-80.

Massol and Maldes.
(1901) Compt.rend.,133,287.

Masson,I.
(1912-13) Proc.Roy.Soc.(Edin.),33,
64-8.
(1931) J.Chem.Soc.(Lond.),3200.

Masson,J.J.Orme.
(1911) J.Chem.Soc.(Lond.),99,1132.
(1912) J.Chem.Soc.(Lond.),101,103.

Matheson,G.L. and Maass,O.
(1929) J.Am.Chem.Soc.,51,674.

Mathews,J.H. and Benger,E.B.
(1914) J.Phys.Chem.,18,264.

Mathews,J.H. and Ritter,P.A.
(1917) J.Phys.Chem.,21,269-74.

Mathews,J.H. and Spero,S.
(1917) J.Phys.Chem.,21,402-6.

Matthews,H.E. and Davies,C.W.
(1933) J.Chem.Soc.(Lond.),1435.

Mathur,R.P.P. and Dhar,N.F.
(1931) Z.anorg.Chem.,198,387-91.

Matignon,C.
(1906) Ann.chim.phys.,[8],**8**,249,388,407.
(1909) 7th Internat.Cong.Appl. Chem.,**2**,53-57.
(1909a) Compt.rend.,**148**,550.

Matignon,C.and Meyer,F.
(1917) Compt.rend.,**165**,787-9.
(1918) Compt.rend.,**166**,115-8,686-8.
(1918) Ann.chim.,[9],251-292.

Matignon,C.and Valentin,J.
(1923) Bull.soc.chim.,[4],**33**,267-80.

Matsin,H.,Oguri,S.,Noda,H.and Kumagi,N.
(1929) J.Soc.Chem.Ind.(Japan),**32**,229.

Matsumato.
(1916) J.Chem.Soc.(Japan),**37**,324.

Matsuura,S.
(1927) Bull.Chem.Soc.(Japan),**2**,44-8.

Matthes,F.
(1911) Neues Jahrb.Min.Geol.(Beil. Bd.),**31**,342-85.

Maumee.
(1864) Compt.rend.,**58**,81.

May,O.E.,Weisberg,S.M.and Herrick,H.T.
(1929) J.Wash.Acad.Sci.,**19**,443.

Mayeda,T.
(1920) J.Chem.Ind.Tokyo,**23**,573,954, 1132.

Mayer.
(1856) Liebig's Ann.,**98**,193.

Mayer,O.
(1903) Ber.,**36**,1741.

Maxted,E.B.and Moon,C.H.
(1936) Trans.Faraday Soc.,**32**,769.

Mazatto.
(1891) Nuovo.cimento,[3],**29**,21.

Mazzetti,C.
(1926) Gazz.Chim.Ital.,**56**,601.
(1929) Am.chim.applicata,**19**,273-82.

Mazzucchelli,A.and Rosa,A.
(1921) Atti accad.Lincei,[5],**30**,II, 270-2.

Mebane,W.M.,Dobbin,J.T.and Cameron,F.K.
(1929) J.Phys.Chem.,**33**,961-9.

Meerburg,P.A.
(1902) Z.physik.Chem.,**40**,647.
(1903) Z.anorg.Chem.,**37**,203.
(1904) Chem.Weekblad.,**1**,474.
(1905) Z.anorg.Chem.,**45**,1,324.
(1908) Z.anorg.Chem.,**59**,136-42.
(1909) van Bemmlen Festschrift,356-60.
(1911) Chem.Zentralbl.,I,1036.

Meerum-Terwogt.
(1905) Z.anorg.Chem.,**47**,203.

Mees,C.E.K.and Piper,C.W.
(1912) Photogr.Jour.,**33**,227.
Photogr.Jour.,**36**,234.
Photogr.Jour.,**52**,221-37.

Mees,Graham.
(1938) J.Am.Chem.Soc.,**60**,870-1.

Meineke.
(1891) Liebig's Ann.,**261**,360.

Meissner,A.
(1919) Zement.,**8**,296,308.

Melbye,G.S.
(1922) Medd.Vetenskapsakad.Nobel Inst.,**4**,No.8.

Melcher,A.C.
(1910) J.Am.Chem.Soc.,**32**,50-66.

Meneghini,D.
(1912) Gazz.chim.ital.,**42**,II,474.

Menge,Otto.
(1911) Z.anorg.Chem.,**72**,169-218.

Menke,J.B.
(1912) Z.anorg.Chem.,**77**,283.

Menschutkin,B.N.
(1905) Mem.St.Petersburg Polyt. Inst.,**4**,75-101.
(1906) Mem.St.Petersburg Polyt.Inst., **5**,355-88.
(1907) Z.anorg.Chem.,**52**,9,155;**53**,26.
(1907a) Z.anorg.Chem.,**54**,89-96.
(1908) Mem.St.Petersburg Polyt.Inst., **9**,200-22.
(1909) Z.anorg.Chem.,**61**,106,113.
(1909) Mem.St.Petersburg Polyt.Inst., 11, 261, 567; 12, 1
(1909a) J.Russ.Phys.Chem.Soc.,**41**,1089.
(1910) Mem,St.Petersubrg Polyt.Inst., **13**,1,263,411,565;**14**,251.
(1911) Mem.St.Petersubrg Polyt.Inst., **15**,65,397,613,647,757.
(1912) Mem.St.Petersubrg Polyt.Inst., **16**,33,397.

AUTHOR INDEX

Menzel,Heinrich.
(1923) Z.physik.Chem.,105,425.
(1927) Z.anorg.Chem.,164,1-21,34,42.
(1927) Z.anort.Chem.,166,67-77,181.

Menzel,H.and Gabler,C.
(1929) Z.anorg.Chem.,177,187-98.

Menzel,H.and Hagen,W.
(1937) Z.anorg.Chem.,233,49-83,209-35.

Menzel,H.and Sieg,L.
(1932) Z.Elektrochem.,38,287.

Menzies,A.W.C.
(1936) J.Am.Chem.Soc.,58,934-7.

Menzies,A.W.C.and Dutt,N.N.
(1911) J.Am.Chem.Soc.,33,1266.

Menzies,A.W.C.and Humphrey,E.C.
(1912) 8th Int.Congr.Appl.Chem.,2, 175-8.

Menzies,A.W.C.and Potter,P.D.
(1912) J.Am.Chem.Soc.,34,1452.

Menzies,R.C.and Walker,A.R.P.
(1936) J.Chem.Soc.(Lond.),1678-85.

Mercier,Jean-Marie.
(1937) Compt.rend.,204,500.

Merz and Muhlhauser.
(1870) Ber.,3,710.

Mescherzerski.
(1882) Z.anal.Chem.,21,399.

Metler,V.
(1934) J.Am.Chem.Soc.,56,1509-10.

Metler,V.and Vosburgh,W.C.
(1933) J.Am.Chem.Soc.,55,2625-9.

Metschl,J.
(1924) J.Phys.Chem.,28,417-37.

Metzner.
(1894) Compt.rend.,119,683.

van Meurs,C.J.
(1916) Z.physik.Chem.,91,313-46.

Meusser,A.
(1901) Ber.,34,2435.
(1902) Ber.,35,1303,1422.
(1905) Z.anorg.Chem.,44,80.

Meyer,G.
(1924) Rec.trav.chim,43,397-8.

Meyer,Hans von,Brod,L.and Soyka,W.
(1913) Monatsh.Chem.,34,1125.

Meyer,J.
(1909) Z.Elektrochem.,15,266.
(1911) Ber.,44,2969.
(1923) Rec.trav.chim.,42,614-9.

Meyer,Julius and Aulich,N.
(1928) Z.anorg.Chem.,172,321-43.

Meyer,Julius and Friedrich,W.
(1922) Z.physik.Chem.,101,499.
(1922a) Z.physik.Chem.,102,369-87.

Meyer,J.and Hinke,W.
(1932) Z.anorg.Chem.,204,30.

Meyer,J.and Kittlemann,C.
(1931) Z.anorg.Chem.,195,121-6.

Meyer,J.and Stateczny,V.
(1922) Z.anorg.allgem.Chem.,122,1-21.

Meyer,J.and Wilk,H.
(1924) Z.anorg.allgem.Chem.,132, 239-59.

Meyer,K.H.and Dunkel,M.
(1931) Z.physik.Chem.(Bodenstein Festb.),556.

Meyer,R.J.
(1914) Z.anorg.Chem.,86,285.

Meyer,R.J.and Müller,U.
(1920) Z.anorg.allgem.Chem.,109,15.

Meyer,R.J.and Nachod,H.
(1924) Ann.,440,186-99.

Meyer,Victor.
(1875) Ber.,8,998.

Meyerhoffer,W.
(1890) Z.physik.Chem.,5,102.
(1904) Landolt and Börnstein "Tabellen," 4th Ed.,1912,p.486.
(1905) Z.physik.Chem.,53,513-603.
(1912) Landolt and Börnstein "Tabellen," 4th Ed.,p.481.

Meyerhoffer,W.and Saunders.
(1899) Z.physik.Chem.,28,466;31,382.

Michael,Arthur.
(1901) Ber.,34,3641,3656.

Michael,Arthur and Garner,W.W.
(1903) Ber.,36,904.

Michel and Kraft.
(1854) Ann.chim.phys.,[3],41,471.
(1858) Ann.chim.phys.,[3],41,478.

AUTHOR INDEX

Mickwitz,A.
- (1928) Z.anorg.Chem.,171,285,306.
- (1928) Z.anorg.Chem.,176,277.
- (1931) Z.anorg.Chem.,196,113.

Miczynski,Z.N.
- (1886) Monatsh.Chem.,7,255-72.

Middleberg,W.
- (1903) Z.physik.Chem.,43,305-53.

Milbauer,J.
- (1912-13) J.prakt.Chem.,[2],87,398.
- (1936) Bull.soc.chim.(France),[5], 3,221-4.

Miles,F.D.and Fenton,J.
- (1920) J.Chem.Soc.,117,59-61.

Miles,F.T.and Menzies,A.W.C.
- (1937) J.Am.Chem.Soc.,56,2392-5.

Millikan,J.
- (1917) Z.physik.Chem.,92,59-80.
- (1918) Z.physik.Chem.,92,496-510.

Milikau,J.
- (1916) Z.physik.Chem.,92,59-80.

Miller,C.
- (1928) J.Chem.Soc.(Lond.),1847.

Miller,L.B.and Witt,J.C.
- (1929) J.Phys.Chem.,33,285-9.

Millett,H.and Jowett,M.
- (1929) J.Am.Chem.Soc.,51,997-1004.

Millican,Ida L.,Joseph,A.F.and Lowry,T.M.
- (1922) J.Chem.Soc.,121,959-63.

Mills,R.V.and Wells,R.C.
- (1918) Bull.U.S.Geol.Survey,No.693, p.72.

Miloslawskij,S.I.
- (1931) Zhur.Obs.Khimii,1,900-4.

Misciatelli,P.
- (1929) Phil.Mag.,[7],7,670.
- (1930) Gazz.chim.ital.,60,833-8.

Missenden,J.
- (1922) Chem.News,124,326.

Mitchell,A.E.
- (1923) J.Chem.Soc.,123,1887-1904.

Mitscherlich.
- (1832) Pogg.Ann.,25,301.

Miyaka,S.
- (1924) J.Chem.Ind.Japan,27,735-41.
- (1925) Mem.Coll.Eng.Kyusha,Imp. Univ.,3,187-93.

Moesveld,A.L.Th.
- (1919) Z.physik.Chem.,93,402.

Moissan,H.
- (1882) Bull.soc.chim.,[2],37,296.
- (1885) Ann.chim.phys.,[6],4,136.

Moissan,H.and Siemens,F.
- (1904) Compt.rend.,138,657, 1300.
- (1904) Bull.soc.chim.,[3],31,1010.
- (1904) Ber.,37,2088.

Moles,E.and Carlota,R.de R.
- (1936) Anales Soc.Esp.fis.quim.,34, 331-62.

Moles,E.and Gonzalez,F.
- (1923) Anales soc.espanola fis.quim., 21,204-12.

Moles,E.and Jimeno,E.
- (1915) Archiv.sci.phys.naturelles,[4], 40,536.

Moles,E.and Marquina,M.
- (1914) Anales soc.espanola fis.quim., 12,383-93.
- (1924) Anales soc.espanola fis.quim., 22,551-4.

Moles,E.and Perez-Vitorio,A.
- (1931) Z.physik.Chem.(Bodenstein Festb.) 583-90.
- (1932) Anales.Soc.esp.fis.quim.,30, 200-7.

Moles,E.and Portillo,R.
- (1924) Anales soc.espanola fis.quim., 22,133.

Moller.
- (1908) Z.Ver.dent.Ing.,52,2,1315.

Mondain-Monval,P.
- (1922) Compt.rend.,174,1014.
- (1922) Compt.rend.,175,162.
- (1923) Compt.rend.,177,175.
- (1923) Compt.rend.,176,301-4.

Mondain-Monval,P.and Schneider,P.
- (1928) Bull.Soc.chim.(France),43,1302.

Money,R.W.and Davies,C.W.
- (1934) J.Chem.Soc.(Lond.),400-3.
- (1938) J.Chem.Soc.(Lond.),2098-2100.

AUTHOR INDEX

Mönkemeyer.
(1906) N.Jahrb.Min.Geol.(Beil.Bd.), **22**, 1.

Montemartini, G. and Losana, L.
(1928) L'Industria Chimica, **4**, 107, 199, 291.

Moody, G. T. and Leyson, L. F.
(1908) J.Chem.Soc.(Lond.), **93**, 1767.

Moore, B., Wilson, F. P. and Hutchinson, L.
(1909) Biochem.Jour., **4**, 347.

Moore, T. S. and Winmill, T. F.
(1912) J.Chem.Soc.(Lond.), **101**, 1662.

Morey, Geo. W.
(1917) J.Am.Chem.Soc., **39**, 1173-1220.

Morgan, J. C. and James, C.
(1914) J.Am.Chem.Soc., **36**, 10-16.

Morgan, J. L. R. and Pyne, H. R.
(1930) J.Phys.Chem., **34**, 1578-82, 2045-8.

Morgan, J. L. R. and Richardson, A. H.
(1930) J.Phys.Chem., **34**, 2356-66.

Mori, J.
(1923) J.Chem.Soc.Japan, **44**, 730-8.

Morrell, R. S.
(1918) J.Chem.Soc., **113**, 111-24.

Morris, T. C.
(1932) Ind.Eng.Chem., **24**, 584-7.

Morse, H.
(1902) Z.physik.Chem., **41**, 708-34.

Moser, L.
(1909) Z.anorg.Chem., **61**, 384.

Moser, L. and Behr, M.
(1924) Z.anorg.allgem.Chem., **134**, 49-53.

Moser, L. and Bruke, A.
(1926) Monatsh., Chem., **47**, 711.

Moser, L. and Hackhofer, H.
(1932) Monatshefte chem., **59**, 44-51.

Moser, L. and Ritschel, E.
(1925) Monatsh., **46**, 9-22.

Moufgang, E.
(1911) Wochschr.Brau., **28**, 434-6.
(1911) J.Soc.Chem.Ind., **30**, 1210.

Mougnard, P.
(1911) Compt.rend., **192**, 1733-5.

Mousseron, M. and Gravier, P.
(1932) Bull.soc.chim.(France), **51**, 1382-7.

Muchin, G.
(1913) "Solubility of Calcium Iodide in Organic Solvents," Pamphlet, 45pp. and 12 charts, Kharkoff, 1913. (Reprint in the Russian language received from author.) *See* also Trav.sco.sci.physic. Chem.Univ.Kharkoff 39 fasc., **24**, 1-49, 1913.

Muir.
(1876) J.Chem.Soc.(Lond.), **29**, 857.

Mulder, G. J.
(1864) Scheikundige Verhandelingen en Onderzoekingen, Vol. 3, Pt. 2, Bijdragen tot de Geschiedenis van Het Scherkungig Gebonden Water, Rotterdam, 1864.

Mueller, P. and Abegg, R.
(1906) Z.physik.Chem., **57**, 514.

Müller, C.
(1910) N.Jahrb.Min.Geol.(Beio.Bd.), **30**, 1.
(1912-13) Z.physik.Chem., **81**, 483-503.

Müller.
(1887) Compt.rend., **104**, 992.
(1889) Wied.Ann.Physik., [2], **37**, 29.
(1892) Ann.chim.phys., [6], **27**, 409.

Müller, Erich.
(1920) Z.angew.Chem., **33**, 303.
(1923) Z.physik.Chem., **105**, 73-118.
(1924) Z.physik.Chem., **110**, 363-83.
(1924a) Z.physik.Chem., **114**, 129-56.

Müller, E., Müller, J. and Fauvel, A.
(1927) Z.Elektrochem., **33**, 134-44.

Müller, Ilse.
(1916) Z.anorg.allgem.Chem., **96**, 29-63.

Müller, J. H.
(1922) J.Am.Chem.Soc., **44**, 2496.

Müller, J. H. and Gulezian, C. E.
(1929) J.Am.Chem.Soc., **51**, 2029.

Müller, J. M.
(1926-27) Proc.Am.Phil.Soc., **65**, 44, 193.

Müller. J. M. and Blank, H. R.
(1924) J.Am.Chem.Soc., **46**, 2358.

AUTHOR INDEX

Müller,H.
(1912) J.Chem.Soc.(Lond.),**101**,2400.

Muller,H.
(1933) Compt.rend.,**196**,1109-11.

Müller,R.,Pinter,E.and Prett,K.
(1925) Monatshefte Chem.,**45**,525.

Müller,R.,Raschka and Wittmann.
(1927-28) Monatshefte Chem.,**48**,660.

Müller,Robert.
(1924-25) Z.anorg.allgem.Chem.,**142**, 130-2.
(1932) Z.Elektrochem.,**38**,450.
(1932a) Z.Elektrochem.,**38**,227-32.

Mumford,S.A.and Gilbert,L.F.
(1923) J.Chem.Soc.,**123**,471-5.

Munzberg,F.
(1928) Lotos (Prague),**76**,351.

Murata,K.
(1932) J.Soc.Chem.Ind.(Japan),Suppl. **35**,523B.

Murray,A.G.
(1929) J.Assoc.Offic.Agr.Chemists. **12**,309.

Muthmann and Kuntze.
(1894) Z.Kryst.Min.,**23**,368.

Muthmann and Rolig.
(1898) Z.anorg.Chem.,**16**,455.
(1898) Ber.,**31**,1728.

Mylius,F.
(1901) Ber.,**34**,2208.
(1911) Ber.,**44**,1315.
(1911) Z.anorg.Chem.,**70**,209.

Mylius,F.and Funk,R.
(1897) Ber.,**30**,1718.
(1900) Wiss.Abh.p.t.Reichsanstalt, **3**,451.

Mylius,F.and von Wrochem,J.
(1900) Wiss.Abh.p.t.Reichsanstalt, **3**,462.
(1900) Ber.,**33**,3689.

Nacken,R.
(1907a) Nachr.kgl.Ges.Wissenschaft (Göttingen),602.
(1907b) Jahrb.Min.Geol.(Beil.Bd.), **24**,1.
(1907c) Zentralbl.Min.Geol.,262,301.
(1910) Sitzber.kgl.preuss.Akad.Wis., 1016-26.

Nagorski,N.D.and Nowosselos,A.V.
(1935) Zhur.Obs.Khimii,**5**,182-4.

Nakatsuchi,A.
(1930) J.Soc.Chem.Ind.(Japan),**33**,182.

Naken,R.and Mosebach,R.
(1936) Z.anorg.Chem.,**228**,19-27.

Nasini,R.and Ageno,I.
(1910) Z.physik.Chem.,**69**,482.
(1911) Gazz.chim.ital.,**41**,I,131.

Nasu,N.
(1933) Bull.Chem.Soc.(Japan),**8**, 195-207,392-9.
(1933) Sci.Reports.Tohoku Univ.,**22**, 972.
(1934) Bull.Chem.Soc.(Japan),**9**,201.

Naude,S.M.
(1927) Z.physik.Chem.,**125**,98-110.

Naumann,Alex.
(1904) Ber.,**37**,3600,4328.
(1909) Ber.,**42**,3789.
(1910) Ber.,**43**,311.
(1914) Ber.,**47**,1370.

Naumann,Alex.and Rucker,A.
(1905) Ber.,**38**,2293.

Naumann,Alex,and Schier,A.
(1914) Ber.,**47**,249.

Neal,J.L.Jr.,and McCrosky,C.R.
(1938) J.Am.Chem.Soc.,**60**,911-4.

Neale,S.M.and Stringfellow,S.A.
(1932) Trans.Faraday Soc.,**28**,765-6.

Neave,G.B.
(1912) Analyst.,**37**,399.

Neckers,J.W.and Kremers,H.C.
(1928) J.Am.Chem.Soc.,**50**,950-4.

Negishi,G.R.,Donnally,L.H.and Hildebrand,J.H.
(1933) J.Am.Chem.Soc.,**55**,4793-4800.

Nelson,O.A.and Haring,M.M.
(1937) J.Am.Chem.Soc.,**59**,2216-23.

Nernst,W.
(1889) Z.physik.Chem.,**4**,379.
(1891) Z.physik.Chem.,**8**,110.

Nesterow,W.J.and Petine,N.J.
(1931) Zhur.Obs.Khimii,**1**,272-8.

Neuhausen,B.S.and Patrick,W.A.
(1921) J.Phys.Chem.,**25**,693-720.

AUTHOR INDEX

Neuman,B.and Domke,R.
(1928) Z.Elektrochem.,**34**,136-53.

Neuman,E.W.
(1932) J.Am.Chem.Soc.,**54**,2195-2207.
(1933) J.Am.Chem.Soc.,**55**,879-884.
(1934) J.Am.Chem.Soc.,**56**,28.

Newbery,Edgar.
(1936) Trans.Electrochem.Soc.,**69**,611-28.

Newth.
(1900) J.Chem.Soc.(Lond.),**77**,776.

Nicol,S.W.J.
(1891) Phil.Mag.(Lond.),[5],**31**,369,386.

Nichols,E.L.,Howes,H.L.et al.
(1919) Pub.Carnegie Inst.,**298**,207-30.

Nicolardot,P.
(1919) Compt.rend.,**169**,335.

von Niementowski,S.and von Roszkowski,T.
(1897) Z.physik.Chem.,**22**,146.

Niggli,Paul.
(1916) Z.anorg.allgem.Chem.,**98**,241-326.
(1919) Z.anorg.allgem.Chem.,**106**,126-42.

Nijuik,A.T.
(1937) Zhur.Obs.Khimii,**7**,1935-47.

Nikitin,B.and Tomatscheff,P.
(1933) Z.physik.Chem.(A),**167**,260-72.

Nikitina,E.A.
(1933) Zhur.Obs.Khimii,**3**,513-8.

Nikolajew,W.M.
(1926) J.Russ.Phys.Chem.Soc.,**58**,557.

Nikolajew,V.I.
(1927) J.Russ.Phys.Chem.Soc.,**59**,289.
(1928) J.Russ.Phys.Chem.Soc.,**60**,895.
(1929) Z.anorg.Chem.,**181**,249-79.

Nikolajew,V.I.and Rawitch,M.I.
(1931) Zhur.Obs.Khimii,**1**,785-91.

Nims,L.F.and Bonner,D.
(1929) J.Phys.Chem.,**33**,586.

Nishizawa,K.
(1920) J.Chem.Ind.Tokyo,**23**,25-43,1015-26.

Nishizawa,K.and Hachihama,Y.
(1925) J.Soc.Chem.Ind.(Japan),**28**,272.
(1927) J.Soc.Chem.Ind.(Japan),**30**,435.
(1929) Z.Elektrochem.,**35**,385-92.

Nobuyaki,Nasu, *see* **Nasu,N.**

Noddak,I.and Noddak,W.
(1929) Z.anorg.chem.,**181**,25.
(1931) Z.angew.Chem.,**44**,215.
(1933) Z.anorg.Chem.,**215**,167.

Nordenskjold and Lindstrom.
(1869) Pogg.Ann.,**136**,314.

Northrop,J.H.
(1929) J.Gen.Physiol.,**12**,435.

Noss,F.
(1912) Dissertation,Graz.
(1912) Landolt and Börnstein "Tabellen," 4th Ed.,p.467.

Nowosselowa,A.V.
(1931) Zhur.Obs.Khimii,**1**,668-89.
(1934) Zhur.Obs.Khimii,**4**,1206-10.
(1939) Zhur.Obs.Khimii,**9**,1063-6.

Nowosselowa,A.V.,Bodaljova,N.V.and Guerstein,M.M.
(1938) Zhur.Obs.Khimii,**8**,732-7.

Nowosselowa,A.V.and Nogorskaya,N.D.
(1935) Bull.Soc.Chim.(France)[5],**2**,967-71.
(1935) Zhur.Obs.Khimii,**5**,1002-6.

Noyes,A.A.
(1890) Z.physik.Chem.,**6**,248.
(1892) Z.physik.Chem.,**9**,606,623.

Noyes,A.A.and Abbott,C.G.
(1895) Z.physik.Chem.,**16**,130.

Noyes,A.A.and Boggs,C.R.
(1911) J.Am.Chem.Soc.,**33**,1650.

Noyes,A.A.and Chapin,E.S.
(1898) Z.physik.Chem.,**27**,443.
(1899) J.Am.Chem.Soc.,**21**,513.

Noyes,A.A.and Clement.
(1894) Z.physik.Chem.,**13**,413.

Noyes,A.A.and Farrel,F.S.
(1911) J.Am.Chem.Soc.,**33**,1654.

Noyes,A.A. and Hall,F.W.
(1917) J.Am.Chem.Soc.,39,2529.

Noyes,A.A. and Kohr,D.A.
(1902) J.Am.Chem.Soc.,24,1144.
(1902-03) Z.physik.Chem.,42,336-42.

Noyes,A.A. and Sammet,G.V.
(1903) Z.physik.Chem.,43,526.

Noyes,A.A. and Schwartz,D.
(1898) Z.physik.Chem.,27,279-84.
(1898) J.Am.Chem.Soc.,20,744.

Noyes,A.A. and Seidenslicker.
(1898) Z.physik.Chem.,27,359.

Noyes,A.A. and Stewart,M.A.
(1911) J.Am.Chem.Soc.,33,1658.

Noyes,A.A. and Whitcomb,W.H.
(1905) J.Am.Chem.Soc.,27,756.

Nuka,P.
(1929) Z.anorg.Chem.,180,235.

O'Brien,H.R. and Parker,W.L.
(1922) J.Biol.Chem.,50,289-300.

Occleshaw,V.J.
(1925) J.Chem.Soc.,127,2598-2602.
(1931) J.Chem.Soc.(Lond.),55-60,1436-8.
(1932) J.Chem.Soc.(Lond.),2404-10.
(1934) J.Chem.Soc.(Lond.),1892-5.

O'Connor,E.A.
(1924) J.Chem.Soc.(Lond.),125,1422-7.
(1927) J.Chem.Soc.(Lond.),130,2700-10.

Ogawa,E.
(1930) J.Chem.Soc.(Japan),51,4,193.

Oglesby,N.E.
(1929) J.Am.Chem.Soc.,51,2352-62.

Okada,K.
(1914) Mem.Coll.Sci.(Kyoto),1,95-103.

Okazawa,T.
(1920) J.Tokyo Chem.Soc.,41,602-20.

Olie,Jr.,J.
(1906) Z.anorg.Chem.,51,29-70.
(1907) Z.anorg.Chem.,53,273-80.

Olivari,F.
(1908) Atti accad.Lincei,[5],17,II,512,584,717.
(1909) Atti accad.Lincei,[5],18,II,96.
(1911) Atti accad.Lincei,[5],20,I,470-4.
(1912) Atti accad.Lincei,[5],21,I,718.
(1914) Atti accad.Lincei,[5],I,23,41.

Oliveri-Mardala, E.
(1920) Gazz.chim.ital.,50,II,89-98.
(1921) Gazz.chim.ital.,51,I,130-8.
(1926) Gazz.chim.ital.,56,889-901.

Oliveri-Mandala,E. and Angenica,A.
(1920) Gazz.chim.ital.,50,I,273-81.

Olmer,L.J.
(1924) Bull.soc.chim.,[4],35,333-9.

Olsson,F.
(1930) Z.anorg.Chem.,187,313-20.

O'Neill,L. and Partington,J.R.
(1934) Trans.Faraday Soc.,30,1134.

Orcutt,F.S. and Seevers,M.H.
(1936) J.Biol.Chem.,117,501-7.
(19379 J.Pharmacol.,59,206-10.

Ordway.
(1865) Am.Jour.Sci.,[2],40,173.

Orloff.
(1902) J.Russ.Phys.Chem.Soc.,37,949.

Ormandy,W.R. and Craven,E.C.
(1921) J.Inst.Petroleum Techn.,7,325-34,422-39.

Osaka,Y.
(1903-8) Mem.Coll.Sci.Eng.(Kyoto),1,93,265,290.
(1909) 7th Int.Cong.Appl.Chem.,4A,308.
(1910) Mem.Coll.Sci.Eng.(Kyoto),2,21-35.
(1910) Nature (London),84,248.
(1910-11) Mem.Coll.Sci.Eng.(Kyoto),3,58.
(1911) J.Tok.Chem.Soc.,32,870.

Osaka,Y. and Abe,R.
(1911) Mem.Coll.Sci.Eng.(Kyoto),3,51-4.
(1911) J.Tok.Chem.Soc.,32,446.

AUTHOR INDEX

AUTHOR INDEX

Parravano,N.and de Cesaris,P.
(1912) Atti accad.Lincei,[5],**21**,I,535.
(1912a) Atti accad.Lincei,[5],**21**,I,800.
(1912b) Gazz.chim.ital.,**42**,II,1-191.

Parravano,N.and Fornaini,M.
(1907) Gazz.chim.ital.,**37**,II,521.
(1907) Atti accad.Lincei,[5],**16**,II,465.

Parravano,N.and Mieli,A.
(1908) Atti accad.Lincei,[5],**17**,II,33-4.
(1908) Gazz.chim.ital.,**38**,II,536.

Pascal,P.and Ero.
(1919) Bull.soc.chim.,[4],**25**,35-49.

Pascal,P.and Garneir.
(1919) Bull.soc.chim.[4],**25**,314.

Parsons, Chas.L.and Corliss,H.P.
(1910) J.Am.Chem.Soc.,**32**,1367.

Parsons,C.L.and Carson,H.P.
(1910) J.Am.Chem.Soc.,**32**,1383.

Parsons,C.L.and Perkins,C.L.
(1910) J.Am.Chem.Soc.,**32**,1387.

Parsons,C.L.and Whittemore,C.F.
(1911) J.Am.Chem.Soc.,**33**,1933.

Partheil and Ferle.
(1903) Archiv.Pharm.,**241**,554.

Partheil and Hübner.
(1903) Archiv.Pharm.,**241**,413.

Partington,J.R.
(1911) J.Chem.Soc.(Lond.),**99**,315.

Partington,J.R.and Soper.
(1929) Phil.Mag.[7],**7**,209.

Partington,J.R.and Stonehill,H.J.
(1936) Phil.Mag.[7],**22**,857-82.

Partington,J.R.and Winterton,R.J.
(1934) Trans. Faraday Soc.,**30**,619-26.
(1934a) Trans.Faraday Soc.,**30**,1104-5.

Partridge,E.P.and White,A.H.
(1929) J.Am.Chem.Soc.,**51**,360-70.

Pascal,P.
(1909) Ann.chim.phys.,[8],**16**,374.
(1912) Bull.soc.chim.,[4],**11**,323,596,1033.
(1913) Bull.soc.chim.,[4],**13**,746.
(1914) Bull.soc.chim.,[4],**15**,454.
(1923) Bull.soc.chim.(France)[4],**33**,539.

Pascal,P.and Garnier.
(1923) Compt.rend.,**176**,450.

Pascal,P.and Normand,L.
(1913) Bull.soc.chim.,[4],**13**,154-202,879.

de Passille,A.
(1936) Ann.chim.[11],**5**,85-8.

Patrick and Aubert.
(1874) Trans.Kansas Acad.Sci.,19.

Patscheke,G.
(1933) Z.physik.chem.(A),**163**,340-50.

Patscheke,G.and Taune,C.
(1935) Z.physik.Chem.(A),**174**,135-55.

Patten,H.E.and Mott,W.R.
(1904) J.Phys.Chem.,**8**,153.

Patterson,A.M.
(1906) J.Am.Chem.Soc.,**28**,1734.

Paul,Th.
(1894) Z.physik.Chem.,**14**,111.
(1896) Z.physik.Chem.,**25**,95.
(1901) Arch.Pharm.,**239**,64.
(1915) Z.Elektrochem.,**21**,543.
(1917) Z.Elektrochem.,**23**,65-86.
(1926) Arb.Reichsgesundh.Amt.,**57**,94-114.

Paul,Th.,Ohlmüller,W.,Heise,R.and Auerbach,Fr.
(1906) Arb.Kaiserl.Gesundheitsamt.,**23**,333-88.

Pauli,W.and Stenzinger,Th.
(1929) Biochem.Z.,**205**,71-103.

de Pauw,P.F.M.
(1922) These,Utrecht.
(1926) "Tabelles Annuelles",**5**,929.

Pawlewski,Br.
(1893) Anzeiger Akad.Wiss.Krakau,p.379.
(1898) Ber.,**30**,2806.
(1899) Ber.,**32**,1040.
(1900) Ber.,**33**,1223.

Pawlewski,Br.and Filemonowicz.
(1888) Ber.,**21**,2973.

Payen.
(1852) Compt.rend.,**34**,356.

Payne,J.H.
(1937) J.Am.Chem.Soc.,**56**,947.

AUTHOR INDEX

Pearce,G.W.and Norton,L.B.
(1936) J.Am.Chem.Soc.,**58**,1104-8.
(1937) J.Am.Chem.Soc.,**59**,1258-61.

Pearce,J.N.and Eversole,W.G.
(1924) J.Phys.Chem.,**28**,245-55.

Pearce,J.N.and Fry,E.J.
(1914) J.Phys.Chem.,**18**,667.

Pearce,J.N.and Moore,T.E.
(1913) Am.Chem.Jour.,**50**,218.

Pearce,J.N.and O'Leary,J.V.
(1923) Proc.Iowa Acad.Sci.,**30**, 379-85.

Pearson,T.G.and Robinson,P.L.
(1930) J.Chem.Soc.(Lond.),1473-95.
(1931) J.Chem.Soc.(Lond.),413,1304-13.

Peddle,C.J.and Turner,W.E.S.
(1913) J.Chem.Soc.(Lond.),**103**,1205.

Pedersen,Kai J.
(1939) J.Am.Chem.Soc.,**61**,334-6.

Peiker,A.L.and Coffin,C.C.
(1933) Canadian,J.Res.,**8**,114.

Pelabon,H.
(1897) Compt.rend.,**124**,35.
(1904) J.chim.phys.,**2**,320.
(1907) Compt.rend.,**145**,118.
(1908) Compt.rend,**146**,975.
(1909) Ann.chim.phys.[8],**17**,526-66.
(1913) Compt.rend.,**156**,705-7.

Pelabon,H.and Laude,Mme.
(1928) Bull.Soc.chim.(France)[4],**45**, 488-92.

Pelling,A.J.
(1925) J.S.African Chem.Inst.,**8**,3-6.

Pelling,A.J.and Robertson,J.B.
(1923) S.African J.Sci.,**20**,236-40.

Pellini,G.
(1906a) Atti accad.Lincei[5],**15**,I, 629.
(1909) Atti accad.Lincei [5],**18**,I, 703,II 21,280.

Pellini,G.and Pedrina,S.
(1908) Atti accad.Lincei,[5],**17**,II, 78.

Pellini,G.and Vio,G.
(1906) Atti accad.Lincei,[5],**15**,II, 46-53.

Pelouze.
(1869) Compt.rend.,**68**,1179;**69**,56.

van Pelt,A.J.Jr.and de Boer,F.
(1934) Z.physik.Chem.(A),**170**,256-61.

Peng Chung-Ming.
(1935) Bull.soc.chim.(France),[5],**2**, 985-93.

Penny.
(1855) Phil.Mag.,[4],**10**,401.

Perkin.
(1894) J.Chem.Soc.(Lond.),**65**,27.

Perman,E.P.
(1901) J.Chem.Soc.(Lond.),**79**,718.
(1902) J.Chem.Soc.(Lond.),**81**,480.
(1903) J.Chem.Soc.(Lond.),**83**,1168.
(1922) J.Chem.Soc.,**121**,2473-83.

Perman,E.P.and Harrison,W.R.
(1924) J.Chem.Soc.,**125**,364-9.
(1924a) J.Chem.Soc.,**125**,1709-13.

Perman,E.P.and Howells,W.J.
(1923) J.Chem.Soc.,**123**,2128-34.

Perman,E.P.and Saunders,H.L.
(1923) J.Chem.Soc.,**123**,841-9.

Pernot,Mlle.M.
(1926) Compt.rend.,**182**,1154.
(1927) Compt.rend.,**185**,950.
(1929) Compt.rend.,**188**,635.
(1929) Compt.rend.,**189**,325.
(1931) These,Paris.
(1931) Ann.chim.,[10],**15**,1-84.
(1932) Compt.rend.,**195**,238.
(1933) Compt.rend.,**196**,1314-16.
(1934) Compt.rend.,**199**,478-80.
(1936) Compt.rend.,**202**,576.
(1938) Compt.rend.,**206**,909.

Peterson,B.H.and Meyers,E.L.
(1930) J.Am.Chem.Soc.,**52**,4853-7.

Pettersson,O.and Sonden,K.
(1889) Ber.,**22**,1439.

Pfaundler and Schnegg.
(1875) Sitzber.k.Akad.Wis.(Wien)., **71**,II,351.

Pfeiffenberger,A.and Leimbach,G.
(1928) Caliche,**9**,485.

Pfeiffer,P.and Modelski,J.v.
(1912) Z.physiol.Chem.,**81**,331-3.

AUTHOR INDEX

Plater,J.
- (1928) Z.anorg.chem.,174,321-41.

Pickering,S.U.
- (1890) J.Chem.Soc.(Lond.),57,331.
- (1890-91) Proc.Roy.Soc.(Lond.),49,25.
- (1893) J.Chem.Soc.(Lond.),63,141, 463,909,998.
- (1893a) Ber.,26,2307.
- (1895) J.Chem.Soc.(Lond.),67,669.
- (1912) Landolt and Börnstein, "Tabellen,"4th Ed.,p.471.
- (1915) J.Chem.Soc.(Lond.),107,942-54.

Picon,M.
- (1924) Bull.soc.chim.,[4],35,1093-1112.
- (1931) Bull.soc.chim.(France)[4],49, 399-423.
- (1931) J.pharm.chim.[8],13,185-95, 233-43.
- (1934) Bull.soc.chim.(France),[5],1, 926-34.

Pictet,Raoul.
- (1894) Compt.rend.,119,642.

Pierrat,M.
- (1921) Compt.rend.,172,1041-3.

Pierre.
- (1847) J.pharm.chim.,[3],12,237.

Pina de Rubies,S.
- (1913) Anales soc.espan.fis.quin.,11, 422-35.
- (1914) Anales soc.espan.fis.quin.,12, 343-9.
- (1914) Archiv.sci.physique,naturelle (Madrid),[4],38,414-22.
- (1915) Chem.Zentralbl.,I,521.

Pink,R.C.
- (1938) J.chem.soc.(Lond.),53-5.

Pinkus,A.and Berkolaiko,N.
- (1930) J.Chim.phys.,27,364-85.

Pinkus,A.,Frederic,Mlle.S.and Schepmans,R.
- (1938) Bull.soc.chim(Belg.,47, 304-36.

Pinkus,A.and Haugen,M.
- (1936) Bull.soc.chim.(Belg.),45, 693-716.

Pinkus,A.and Maurez,P.
- (1938) Bull.soc.chim.(Belg.),47, 532-74.

Pinkus,A.and Jacobi.
- (1927) Bull.soc.chim.(Belg.),36, 464.

Pinkus,A.and Martin,F.
- (1927) Jour.chim.phys.,24,83-102, 137-68.

Pinkus,A.and Shepmans,R.
- (1938) Bull.soc.chim.Belg.,337-61.

Pinkus,A.and Timmermans,Mlle.A.M.
- (1937) Bull.soc.chim.(Belg.),46, 46-73.

Plato.
- (1907) Z.physik.Chem.,58,350.

Platt,J.H.and Hudson,D.
- (1926) J.Soc.Dyers & Colourists,42, 348.

Pleissner,M.
- (1907) Arb.Kais.Gesundheitsamt,26, 384-443.

Ploinowna,A.
- (1926) Roczniki chem.,6,690-9.

Plotnikow,W.A.
- (1911) Ann.inst.Polytech.Kiev.,11, 310.
- (1915) J.Russ.Phys.Chem.Soc.,47, 1062-4.

Plotnikow,W.A.and Iwanow,K.N.
- (1931) Zhur.Obs.Khimii,1,823-5.

Poggiale.
- (1843) Ann.chim.phys.,[3],8,467.

Pohl.
- (1852) J.prakt.Chem.,56,216.
- (1860) Sitzber.k.Akad.Wiss.(Wien), 41,627.

Pollacci.
- (1896) L'Orosi,19,217.

Polessitsky,A.
- (1932) Z.physik.Chem.(A),161,325-35.
- (1933) Z.physik.Chem.(A),167,394-8.
- (1935) Z.physik.Chem.(A),172,300-3.

Pollitzer,F.
- (1909) Z.anorg.Chem.,64,121-48.

AUTHOR INDEX

Poma,G.
(1909) Atti accad.Lincei,[5],**18**,I, 133-8.
(1910) Gazz.chim.ital.,**40**,I,197.

Poma,G.and Gabbi,G.
(1912) Gazz.chim.ital.,**42**,II,8.
(1911) Atti accad.Lincei,[5],**20**,I, 464-70.

Ponomarev,I.F.
(1917) J.Russ.Phys.Chem.Soc.,**49**, 29-40.
(1921) Soobscenija man.techn.rabotsch.Respublike,Moskow, 67-71.

Popoff,Stephen and Newman,E.W.
(1930) J.Phys.Chem.,**34**,1853-60.

Porlezza,C.
(1914) Atti accad.Lincei,[5],**23**,II, 509,597.

Portillo,R.
(1929) Anales Soc.Esp.fis.quim.,**27**, 236-50,351-7.

Portillo,R.and Alberola,L.
(1930) Anales Soc.Esp.fis.quim.,**28**, 1187.

Portnow,M.A.and Dwilewitch,N.K.
(1937) Zhur.Obs.Khimii,**7**,2149-53.

Portnow,M.A.and Rawdine,J.A.
(1937) Zhur.Obs.Khimii,**7**,2478-85.

Portnow,M.A.and Schurawlew,A.W.
(1935) Z.anorg.Chem.,**223**,45-8.

Portnow,M.A.and Wassilew,B.B.
(1935) Z.anorg.Chem.,**221**,149-53.

Posnjak,E.and Merwin,H.E.
(1922) J.Am.Chem.Soc.,**44**,1965-94.

Posnjak,E.and Tunell,G.
(1929) Am.J.Sci.,**18**,1.

Postma,S.
(1920) Rec.trav.chim.,**39**,515-36.

Power,F.B.and Tutin.
(1905) J.Chem.Soc.(Lond.),**87**,24.

Prandtl,W.and Ducrue,H.
(1926) Z.anorg.allgem.Chem.,**150**, 105-16.

Prandtl,W.and Rauchenberger,J.
(1920) Ber.,**53B**,843-53.

Pratolongo,U.
(1916) Ann.chim.applicata,**6**,59-112.
(1925) Atti accad.Lincei.,[6]I, 238-43.
(1913) Atti accad.Lincei[5],**22**,I,388.

Precht,H.and Wittgen,B.
(1881) Ber.,**14**,1667.
(1882) Ber.,**15**,1666.

Presse,C.H.
(1874) Ber.,**7**,599.

Prideaux,E.B.R.and Millott,J.O.
(1929) J.Chem.Soc.(Lond.),2703-9.

Prociv.D.
(1929) Coll.Czechoslov.Chem.Com.,**1**, 95.

Prutton,C.F.,Brosheer,J.C.and Maron,S.H.
(1935) J.Am.Chem.Soc.,**57**,1656-7.

Prutton,C.F.and Tower,O.F.
(1932) J.Am.Chem.Soc.,**54**,3040-7.

Puckner,W.A.and Hilpert,W.S.
(1909) J.Am.Med.Assoc.,**52**,311.

Pugh,W.
(1926) J.Chem.Soc.(Lond.),2828.
(1929) J.Chem.Soc.(Lond.),1537-41.
(1932) Trans.Roy.Soc.S.Africa,**21**,67.

Purcell,R.H.and Cheesman,G.H.
(1932) J.Chem.Soc.(Lond.),826-34.

Purdum,R.B.and Rutherford,H.A.Jr.
(1933) J.Am.Chem.Soe.,**55**,322-3.

Puschin,N.A.and Baskow,A.
(1913) Z.anorg.Chem.,**81**,347-63.

Puschin,N.A.and Dezelic,M.
(1932) Monatshefte Chem.,**60**,431-7.

Puschin,N.A.and Hrustanovic,K.S.
(1938) Ber.,**71**,798-801.

Puschin,N.A.and Kovac,D.
(1931) Z.anorg.Chem.,**199**,369-73.

Puschin,N.A.and Kriger,J.
(1914) J.Russ.Phys.Chem.Soc.,**46**,559.

Puschin,N.A.and Lowy,S.
(1926) Z.anorg.Chem.,**150**,167.

Puschin,N.A.and Makuc,J.
(1938) Z.anorg.Chem.,**237**,177-82.

Puschin,N.A.and Radoicic,M.
(1937) Z.anorg.Chem.,**233**,41-46.

Quam,G.N.
(1929) Ind.Eng.Chem.,**21**,703.

AUTHOR INDEX

Quartarolli, A.
(1920) Gazz.chim.ital.,50,II,67.

Queisner.
(1921) Mitt.Kaliforschungs Inst.,75.

Quercigh, E.
(1912) Atti accad.(Lincei),[5],21,1, 417,786.
(1914) Atti accad.(Lincei),[5],23,1, 449,825.

Quill, L. L. and Robey, R. F.
(1937) J.Am.Chem.Soc.,59,1071,2591-5.

Quinet, L.
(1935) Bull.soc.chim.(France)[5],2, 1201-5.

Quinn, E. L.
(1928) J.Am.Chem.Soc.,50,672-81.

Rabe, W. O.
(1901) Z.physik.Chem.,38,175-84.
(1902) Z.anorg.Chem.,31,156.

Rabinowitsch, M. and Jakubsohn, S.
(1923) Z.anorg.allgem.Chem.,129,55-9.

Rack, G.
(1914) Centr.Min.Geol.,326-8.

Radan.
(1889) Liebig's Ann.,251,129.

Radiscev, V. P.
(1928) J.soc chim.Russe,60,322.

Raditschew.
(1930) Zhur.fisiko-chemic Obsc.,62, 1063.

Raeder, M. G.
(1927) Z.anorg.Chem.,162,222-30.
(1933) Z.anorg.Chem.,210,156.

Raffo, M. and Rossi, G.
(1915) Gazz.chim.ital.,45,I,45.

Rakowski, A. W. and Babajewa, A. W.
(1931) U.S.S.R. Sci.Res.Dept.Sup. Council.Nat.Econ.,No.420. Trans.Inst.Pure Chem.Rec.No. 11,15.

Rakowski, A. W. and Nikitina, E. A.
(1931) U.S.S.R.Sci.Research Dept.Sup. Council Nat.Economy, No.420,5. Trans.Inst.Pure Chem.Reagents No.11,51.

Rakowski, A. W. and Polanski, V. V.
(1927) U.S.S.R.Trans.Inst.Pure Chem. Reagents. No.6,7.

Rakowski, A. W. and Slavina, D. S.
(1931) Trans.Inst.Pure Chem.Reagents, No.11,20.

Rakowski, A. W. and Tarassenkow, D. N.
(1928) Z.anorg.Chem.,174,91.

Ramann, E. and Sallinger, H.
(1921) Z.physik.Chem.,98,103-50.

Rammelsberg.
(1838) Pogg.Ann.,43,665;44,575.
(1841) Pogg.Ann.,52,81,96.
(1892) J.prakt.Chem.,[2],45,153.

Ramstedt, Eva.
(1911) Radium,8,253-6.

Randall, Merle and Halford, J. O.
(1930) J.Am.Chem.Soc.,52,178-91.

Randall, M. and Spencer, H. M.
(1928) J.Am.Chem.Soc.,50,1572-83.

Randall, M. and Vietti, W. V. A.
(1928) J.Am.Chem.Soc.,50,1526-34.

Rankin, G. A. and Merwin, H. E.
(1916) Z.anorg.allgem.Chem.,96, 291-316.
(1916) J.Am.Chem.Soc.,38,568.

Rankin, G. A. and Wright.
(1915) Am.Jour.Sci.,[4],39,1-79.

Raoult.
(1874) Ann.chim.,[5],1,262.

Raupenstrauch, G. A.
(1885) Monatsh.Chem.,6,585.

Ravitz, S. F.
(1936) J.Phys.Chem.,40,61-70.

Ray, R. C. and Chatterji, K. K.
(1932) J.Chem.Soc.,384-6.

Ray, R. C. and Mitra, H. C.
(1934) Trans.Faraday Soc.,30,1161-3.
(1935) Trans.Faraday Soc.,31,1312-4.

Ray, P. C. and Sarkar, P. V.
(1922) J.Chem.Soc.,121,1449-55.

Rebiere, G.
(1915) Bull.soc.chim.,[4],17,268,309.

Reburn, W. T. and Shearer, W. N.
(1933) J.Am.Chem.Soc.,55,1774-9.

Redfield, H. L. and King, G. B.
(1936) J.Phys.Chem.,40,919-25.

Reed, R. M. and Tartar, H. V.
(1936) J.Am.Chem.Soc.,58,322-32.

AUTHOR INDEX

Reedy,J.H.
(1921) J.Am.Chem.Soc.,**43**,1443.

Rees,A.G. and Huddleston,L.J.
(1931) J.Chem.Soc.(Lond.),1648-52.

Reich.
(1891) Monatsh.Chem.,**12**,464.

Reicher,L.T. and van Deventer,C.M.
(1890) Z.physik.Chem.,5,560.

Reichstein,S.,Ewentow,L. and Kasarnowsky,I.
(1933) Z.anorg.Chem.,**216**,1-9.

Reid.
(1887-88) Proc.Roy.Soc.(Edin.),**15**,151.

Reid,H.S. and McIntosh,D.
(1916) J.Am.Chem.Soc.,**38**,615-25.

Reiff,F. and Toussaint,S.M.
(1939) Z.anorg.Chem.,**241**,372-80.

Reinders,W.
(1900) Z.physik.Chem.,**32**,494,514.
(1906) Z.physik.Chem.,**54**,609.
(1914) Proc.k.Akad.Wet.(Amst.),**16**, 1065.
(1915) Z.anorg.Chem.,**93**,202.

Reinders,W. and Van Gelder,D.W.
(1932) Rec.trav.chim.,**51**,253-9.

Reinders,M. and Khinkenberg,A.
(1929) Rec.trav.chim.,**48**,1227-64.

Reinders,W. and de Lange,S.
(1912-13) Z.anorg.Chem.,**79**,230.
(1912) Proc.k.Akad.Wet.(Amst.),**15**, 474.

Reinitzer,D.
(1913) Z.angew.Chem.,**26**,456.

Reissig.
(1863) Liebig's Ann.,**127**,33.

Remy,H.
(1925) Z.Elektrochem.,**31**,92.

Remy,H. and Kuhlmann,A.
(1924) Z.anal.Chem.,**65**,1-24,161-81.

Rengade,E.
(1917) Rev.gen.sci.,**28**,489.
(1922) Chim.et indust.,**7**,1090-8.

Restanio,dIS.
(1934) Atti accad.Lincei [6],**20**, 192-200.

Retgers,J.W.
(1893) Z.anorg.Chem.,**3**,253,344.
(1893) Rec.trav.chim.,**12**,229.

Retortillo,N.M. and Moles,E.
(1933) Anales Soc.Esp.fis.quim.,**31**, 830-9.

Rex.
(1906) Z.physik.Chem.,**55**,355.

Reychler,A.
(1910) J.chim.phys.,**8**,618.

Reynolds,J.E. and Werner,E.A.
(1903) J.Chem.Soc.(Lond.),**83**,5.

Rheimboldt,H. and Schneider,K.
(1929) J.prakt.Chem.,**120**,240.

Rhodes,F.H. and Bascom,C.H.
(1927) Ind.Eng.Chem.,**19**,480-1.

Rhodes,F.H. and Lewis,A.W.
(1928) Ind.Eng.Chem.,**20**,1366-7.

Ricci,J.E.
(1934) J.Am.Chem.Soc.,**56**,290-303.
(1935) J.Am.Chem.Soc.,**57**,805-10.
(1936) J.Am.Chem.Soc.,**58**,1077-9.
(1937) J.Am.Chem.Soc.,**59**,866-9,1763.
(1938) J.Am.Chem.Soc.,**60**,2040-3.

Ricci,J.E.,Budish,J. and Borodulia,N.
(1937) J.Am.Chem.Soc.,**59**,868-9.

Ricci,J.E. and Yanick,N.S.
(1936) J.Am.Chem.Soc.,**58**,313-5.
(1937) J.Am.Chem.Soc.,**59**,491-6.

Richard,F.
(1926) J.pharm.chim.,[8],**4**,306.

Richards,T.W.
(1897) Z.anorg.Chem.,**3**,455.

Richards,T.W. and Archibald,E.H.
(1901-02) Proc.Am.Acad.,**37**,345.
(1902) Z.physik.Chem.,**40**,385-98.

Richards,T.W. and Churchill.
(1899) Z.physik.Chem.,**28**,314.

Richards,T.W. and Faber,H.B.
(1899) Am.Chem.Jour.,**21**,167-72.

Richards,T.W. and Kelley.
(1911) J.Am.Chem.Soc.,**33**,847.

Richards,T.W.,McCaffrey and Bisbee.
(1901) Z.anorg.Chem.,**28**,85.

Richards,T.W. and Meldrum,W.B.
(1917) J.Am.Chem.Soc.,**39**,1821-2.

Richards,T.W.and Schumb,W.C.
(1918) J.Am.Chem.Soc.,40,1403-9.

Richards,T.W.and Yngve,V.
(1918) J1Am.Chem.Soc.,40,164-74.

Richert,P.H.
(1930) J.Am.Chem.Soc.,52,2241-4.

Riesenfeld,E.H.
(1902) Z.physik.Chem.,41,346.
(1903) Z.physik.Chem.,45,461.

Riesenfeld,E.H.and Feld,H.
(1921) Z.anorg.allgem.Chem.,116, 213-27.

Riley,W.A.
(1911) Jour.Inst.Brewing,17,124.
(1911) "Tables annuelles,"2,428.

Rimbach,E.
(1897) Ber.,30,3079.
(1902) Ber.,35,1300.
(1904) Ber.,37,463.
(1905) Ber.,38,1553-7,1570.

Rimbach,E.and Fleck,K.
(1916) Z.anorg.Chem.,94,139-56.

Rimbach,E.and Korten,F.
(1907) Z.anorg.Chem.,52,407.

Rimbach,E.and Schubert,A.
(1909) Z.physik.Chem.,67,183-200.

Rindell,A.
(1902) Compt.rend.,134,112.
(1910) Z.physik.Chem.,70,452-8.

Ringer,W.E.
(1902) Z.anorg.Chem.,32,212.
(1902) Rec.trav.chim.,21,374.

Ritzel,A.
(1911) Z.Kryst.Min.,49,152.

Rivett,A.C.D.
(1922) J.Chem.Soc.,121,379-93.
(1926) J.Chem.Soc.,129,1063-70.

Rivett,A.C.D.and Clendinnen,F.W.J.
(1923) J.Chem.Soc.,123,1634-40.

Rivett,A.C.D.and Lewis,N.B.
(1923) Rec.trav.chim.,42,954-63.

Rivett,A.C.D.and O'Conner,E.A.
(1919) J.Chem.Soc.,115,1346-54.

Rivett,A.C.D.and Packer,J.
(1927) J.Chem.Soc.(Lond.),130,1342-9.

Robertson,J.B.
(1924) J.Soc.Chem.Ind.,43,334-8.
(1933) S.African,J.Sci.,30,187.

Robertson,P.W.
(1907) Chem.News,95,253.

Robinet.
(1864) Compt.rend.,58,608.

Robinson,A.F.
(1928) J.Phys.Chem.,32,1089-93.

Robinson,F.W.
(1909) J.Chem.Soc.(Lond.),95,1353-9.

Robinson,P.L.and Scott,W.E.
(1931) J.Chem.Soc.Lond.,693-709.
(1933) Z.anorg.Chem.,210,57.

Robinson,R.F.
(1918) Bull.Oregon Agr.Col.Exp.Sta., 131,1-15.

Robinson,R.H.
(1929) Ind.Eng.Chem.,21,1132-5.

Robinson,W.O.and Waggaman,W.H.
(1909) J.Phys.Chem.,13,673-8.

Robl,R.
(1924) Z.angew.Chem.,37,938.

Robson,H.L.
(1927) J.Am.Chem.Soc.,49,2772-82.

Rodebush,W.H.
(1918) J.Am.Chem.Soc.,40,1204-13.

Redwell.
(1862) J.Chem.Soc.(Lond.),15,59.

Roederer,E.
(1936) Z.anorg.Chem.,226,145-167.

Roelofsen.
(1894) Am.Chem.Jour.,16,466.

Rogier and Fiore.
(1913) Bull.sci.Pharmacologique,20, 7,72.

Rohland,P.
(1897) Z.anorg.Chem.,15,412.
(1898) Z.anorg.Chem.,18,328.

Rohmer,R.
(1934) Compt.rend.,199,641.
(1939) Ann.chim.[11],11,611-721.

Rollet A.P.
(1930) Compt.rend.,191,488-90.
(1935) Compt.rend.,200,1763.

AUTHOR INDEX

Rollet, A. P. and Andres, L.
(1930) Compt.rend.,191,375,567.
(1931) Bull.Soc.Chim.,(France)[4],
49,1065-92.

Rollet, A. P. and Graf, W.
(1933) Compt.rend.,197,555.

Rollet, A. P. and Lauffenburger, R.
(1934) Bull.soc.chim.(France)[5],1,
146-52.

Rollet, A. P. and Peng Chung-Ming.
(1935) Bull.soc.chim.(France)[5],2,
982-5.

Rollet, A. P. and Wohlgemuth, J.
(1934) Compt.rend.,198,1772-4.

Roloff, M.
(1894) Z.physik.Chem.,13,341.
(1895) Z.physik.Chem.,17,325-56.
(1895) Z.physik.Chem.,18,572-84.

Roozeboom, H. W. B.
(1884) Rec.trav.chim.,3,29-87.
(1889) Rec.trav.chim.,8,1-146.

Roscoe and Dittmar.
(1859) Liebig's Annalen,112-234.

Rose, H. J.
(1925) Trans.Roy.Soc.(Canada),[3],
19(Sec.III),33,.

Rosenbaum, C. K. and Walton, J. H.
(1930) J.Am.Chem.Soc.,52,3568-73.

Rosenbladt.
(1886) Ber.,19,2531.

Rosenheim, A.
(1916) Z.anorg.allgem.Chem.,96,143.

Rosenheim, A. and Bertheim, A.
(1903) Z.anorg.Chem.,34,430.

Rosenheim, A. and Davidsohn, I.
(1903) Z.anorg.Chem.,37,315.

Rosenheim, A. and Grunbaum.
(1909) Z.anorg.Chem.,61,187.

Rosenheim, A. and Krause, L.
(1921) Z.anorg.allgem.Chem.,118,182.

Rosenheim, A. and Leyser, F.
(1921) Z.anorg.allgem.Chem.,119,12-19.

Rosenheim, A. and Pritze, M.
(1908) Ber.,41,2708.
(1909) Z.anorg.Chem.,63,275-81.

Rosenheim, A. and Reglin, W.
(1921) Z.anorg.allgem.Chem.,120,103-19.

Rosenheim, A., Stadler and Jakobsohn.
(1906) Ber.,39,2841.

Rosenheim, A. and Thor, S.
(1927) Z.anorg.Chem.,167,1-20.

Rosenheim, A. and Weinheber, M.
(1910-11) Z.anorg.Chem.,69,263.

Rosenheim, A. and Wolff, A.
(1930) Z.anorg.Chem.,192,56.

Rosenheim, A. and Zickermann, J.
(1932) Z.anorg.Chem.,208,95-9.

Rosenmund, K. W. and Zetzsche, F.
(1918) Ber.,51,598.

Roshdestwensky, A. and Lewis, W. C. McC.
(1911) J.Chem.Soc.(Lond.),99,2144.
(1912) J.Chem.Soc.(Lond.),101,2098.

Ross, Merz and Jacob.
(1929) Ind.Eng.Chem.,21,286.

Ross, J. D. M. and Morrison, T. J.
(1933) J.Chem.Soc.(Lond.),1016-22.
(1936) J.Chem.Soc.(Lond.),867-72.

Ross, J. D. M., Morrison, T. J., and Johnstone, C.
(1937) J.Chem.Soc.(Lond.),608-14.

Ross, W. H. and Jones, R. M.
(1925) J.Am.Chem.Soc.,47,2165.

Rössler.
(1873) J.prakt.Chem.,[2],7,14.

van Rossum, C.
(1912) Chem.Weekblad,9,396.

Rostkowski, A. P.
(1927) Zhur.fisiko.chimic(Russe),
59,349.
(1929a) Zhur.fisiko-chimic(Russe),
61,89.
(1929b) Zhur.fisiko-chimic(Russe),
61,98,595.
(1930a) Zhur.fisiko-chimic(Russe),
62,2055.
(1930b) Zhur.fisiko-chimic(Russe),
62,2067.

Roth.
(1897) Z.physik.Chem.,24,123.

Sandonnini,C.
(1911) Atti accad.Lincei,[5],20,I,173,253.
(1911) Gazz.chim.ital.,41,II,146.
(1911) Atti accad.Lincei,[5],20,II,62,497,572,588,646.
(1911a) Atti accad.Lincei,[5],20,I,457,760.
(1912) Atti accad.Lincei,[5],21,I,208-13,479.
(1912a) Atti accad.Lincei,[5],21,II,197,524,635.
(1912b) Atti Ist.Ven.,71,553.
(1913) Atti accad.Lincei,[5],22,I,630;II,21.
(1914) Atti accad.Lincei,[5],23,I,962.
(1914) Gazz.chim.ital.,44,I,296,382.

Sandonnini,C.and Aureggi,P.C.
(1912) Atti accad.Lincei,[5],21,I,493.

Sandonnini,C.and Scarpa,G.
(1911a) Atti accad.Lincei,[5],20,II,62.
(1911b) Atti accad.Lincei,[5],20,II,497.
(1912) Atti accad.Lincei,[5],21,II,77-84.
(1913) Atti accad.Lincei,[5],22,II,21,163,518.

Sandquist,H.
(1911) Liebig's Ann.,379,85.
(1912) Liebig's Ann.,392,76.
Ark.Kem.Min.Geol.,4,8-81.
(1917) Ark.Kem.Min.Geol.,7,No.2.

Sandved,K.
(1927) J.Chem.Soc.(Lond.),130,2967-74.
(1929) J.Chem.Soc.(Lond.),337-44.

Sanfourche,A.and Focet,B.
(1933) Bull.soc.chim.(France)[4],53,974-80.

Sanfourche,A.and Gardent,L.
(1924) Bull.soc.chim.,[4],35,1088-93.

Sanfourche,A.and Krapivine,A.
(1933) Bull.soc.chim.(France)[4],53,970-3

Sanfourche,A.and Liebaut,Mlle.A.M.
(1922) Bull.soc.chim.,[4],31,966-72.

Sarker,P.and Barat,T.
(1930) J.Indian Chem.Soc.,7,199.

Sarver,L.A.and Brinton,H.M.P.
(1927) J.Am.Chem.Soc.,49,943-58.

Saslawsky,A.J.and Ettinger,J.L.
(1935) Z.anorg.Chem.,223,277-87.
(1937) Zhur.Obs.Khimii,7,1948-58.

Saslawsky,A.J.,Ettinger,J.L.and Eserowa,E.A.
(1935) Z.anorg.Chem.,225,305-11.
(1937) Zhur.Obs.Khimii,7,2410-6.

Saunders,K.H.
(1922) J.Chem.Soc.,121,2667-75.

Sborgi,U.
(1913) Atti accad.Lincei,[5],22,I,91,636,716,798.
(1915) Atti accad.Lincei,[5],24,I,1225.
(1912) Atti accad.Lincei,[5],21,II,855.
(1913) Atti accad.Lincei,[5],22,I,90-5.
(1924) Gazz.chim.ital.,54,946-64.
(1932) Gazz.chim.ital.,62,3-15.

Sborgi,U.and Amelotti,L.
(1930) Gazz.chim.ital.,60,468-74.

Sborgi,U.and Bovalini,E.
(1924) Gazz.chim.ital.,54,919-33.

Sborgi,U.,Bovalini,E.and Cappellini,L.
(1924) Gazz.chim.ital.,54,298-321.

Sborgi,U.,Bovalini,E.and Medici,M.
(1924) Gazz.chim.ital.,54,934-45.

Sborgi,U.and Cappellini,L.
(1924) Gazz.chim.ital.,54,298-321.

Sborgi,U.and Ferri,L.
(1921) Mem.accad.Lincei,[5],13,569-91.
(1922) Atti accad.Lincei,[5],31,I,324-9.

Sborgi,U.and Franco,C.
(1921) Gazz.chim.ital.,51,II,1-57.
(1922) Giorn.chim.ind.applicata.,4,(June).

Sborgi,U.and Gallichi,E.
(1924) Gazz.chim.ital.,54,255-97.

Sborgi, U. and Mecacci, F.
(1915) Atti accad.Lincei,[5],24,1. 443-8,1225-31.
(1916) Atti accad.Lincei,[5],25,II, 327-32,386-9,455-8.

Sborgi, U. and Mezzetti.
(1921) Atti accad.Lincei,[5],30,II, 189-94.

Sborgi, U. and Stefanini, L.
(1924) Gazz.chim.ital.,54,322-38.

Scarpa, G.
(1912) Atti accad.Lincei,[5],21,II. 720.
(1915) Atti accad.Lincei,[5],24,I, 741.955;II,476.

Schäfer, H.
(1905) Z.anorg.Chem.,45,310.

Schaefer, W.
(1914) Neues Jahrb.Min.Geol.,I,15-24.
(1919) Neues Jahr.Min.Geol.(Beil Bd.), 43,132-89.

Schattenstein, A.J. and Monossohn, A.
(1932) Z.anorg.Chem.,207,204-8.

von Scheele, C.
(1899) Ber.,32,415.

Scheffer, F.E.C.
(1911) Proc.k.Akad.Wet.(Amst.),13, 829;14,195.
(1912) Z.physik.Chem.,76,161.
(1912a) Proc.K.Akad.Wet.(Amst.), 15,380.

Scheffer, F.E.C. and Smittenberg, J.
(1932) Rec.trav.chim.,51,1008-11.
(1933) Rec.trav.chim.,52,1-8.

Scheffer, F.E.C. and de Wijs, H.J.
(1925) Rec.trav.chim.,44,654.

Scheflan, L. and McCrosky, C.R.
(1932) J.Am.Chem.Soc.,54,193-202.

Scheibler, C.
(1883) J.pharm.chim.[5],8,540.

Schenck, R. and Albero, Agnes.
(1919) Z.anorg.allgem.Chem.,105,146.

Schenck, R. and Rassbach, W.
(1908) Ber.,41,2917.

Scherer, P.C.
(1931) J.Am.Chem.Soc.,53,3694-7.

Scheringa, K.
(1932) Chem.Weekblad,29,605.

Schiavor, G.
(1902) Gazz.chim.ital.,32,II,532.

Schick, K.
(1903) Z.physik.Chem.,42,163.

Schierholz.
(1890) Sitzber.k.Akad.Wiss.(Wien.), 101, 2b,4.

Schiff.
(1859) Liebig's Ann.,109,326.
(1860) Liebig's Ann.,113,350.
(1861) Liebig's Ann.,118,365.

Schiff and Monsacchi.
(1896) Z.physik.Chem.,21,277.

Schimmel, F.
(1928) Z.anorg.Chem.,176,285-8.
(1929) Ber.,62,963.

Schlamp, A.
(1894) Z.physik.Chem.,14,272.

Schloesing.
(1871) Compt.rend.,73,1273.
(1872) Compt.rend.,74,1552;75,70.

Schlossberg, J.
(1900) Ber.,33,1082.

Schmidt, J.M.
(1926) Bull.soc.chim.,[4],39, 1686-1703.
(1929) Ann.chim.[10],11,351-445.

Schnellbach, W.
(1929) Am.J.Pharm.,101,586.

Schnellbach, W. and Rosin, J.
(1929) J.Am.Pharm.Assoc.,18,762-71, 1230.
(1931) J.Am.Pharm.Assoc.,20,227.

Scholder, R.
(1927) Ber.,60,1523.
(1930) Ber.,63,2831.

Scholder, R., Gadenne, E. and Niemann, H.
(1927) Ber.,60,1510-25.

Scholder, R. and Hendrick, G.
(1939) Z.anorg.Chem.,241,76-92.

Scholder, R. and Linström, C.F.
(1930) Ber.,63,2831.

Scholder, R. and Pätsch, R.
(1935) Z.anorg.Chem.,222,135-44.

Scholich,K.
(1920) Neues Jahr.Min.Geol.(Beil Bd.),43,251-94.

Scholl,A.W.,Hutchinson,A.W. and Chandlee,G.C.
(1933) J.Am.Chem.Soc.,55,3081-3.

Scholl,R.and Steinkopf.
(1906) Ber.,39,4393.

Schöne.
(1873) Ber.,6,1224.

Schönfeld.
(1885) Liebig's Ann.,95,5.

Schoorl,N.
(1903) Rec.trav.chim.,22,40.
(1923) Rec.trav.chim.,42,790-9.

Schoorl,N.and Regenbogen,A.
(1919) Pharm.Weekblad.,56,538-45.
(1922a) Rec.trav.chim.,41,125-34.

Schrager,B.
(1927) Coll.Czechoslovak Chem.Com. I,276.

Schrefeld.
(1894) Z.Ver.Zuckerind,44,971.

Schreiber,J.
(1933) These,Strasbourg.

Schreinemakers,F.A.H.
(1892) Z.physik.Chem.,9,65-71.
(1897) Z.physik.Chem.,23,417-41.
(1898) Z.physik.Chem.,25,543-67.
(1898) Z.physik.Chem.,26,237-54.
(1898c) Z.physik.Chem.,27,95-122.
(1899) Z.physik.Chem.,29,577.
(1900) Proc.k.Akad.Wet.(Amst.),2,I.
(1900) Z.physik.Chem.,33,79.
(1903) Z.anorg.Chem.,37,207.
(1906) Z.physik.Chem.,55,89.
(1907) Z.physik.Chem.,59,641.
(1908-09) Z.physik.Chem.,65,555, 575.
(1908) Chem.Weekblad.,5,847.
(1909) Z.physik.Chem.,66,687-98.
(1909) Chem.Weekblad.,6,131,140.
(1909-10) Z.physik.Chem.,68,83-103.
(1910) Arch.neer.sc.ex.nat.,[2],15, 81,117.
(1910) Z.physik.Chem.,69,557-68.
(1910a) Z.physik.Chem.,71,109-16.
(1910b) Chem.Weekblad.,7,333.
(1911) Proc.k.Akad.Wet.(Amst.),13, 1163.

Schreinemakers,F.A.H.and de Baat,W.C.
(1908) Chem.Weekbl.,5,465-72.
(1908-9) Z.physik.Chem.,65,586.
(1909) Z.physik.67,551-60.
(1910) Chem.Weekblad.,7,259.
(1910a) Arch.neer.sc.ex.nat.,[2],15, 415.
(1914) Proc.k.Akad.Wet.(Amst.),17, 533,781.
(1915) Proc.k.Akad.Wet.(Amst.),17, 1111.
(1915) Verslag.k.Akad.Wet.(Amst.), 23,1097;May.
(1917) Chem.Weekblad.,14,141,203,244.
(1917) Chem.Weekblad.,14,262-7,288.

Schreinemakers,F.A.H.and de Baat, Miss W.C.
(1920) Rec.trav.chim.,39,423-8.

Schreinemakers,F.A.H.,Berkhoff,G.and Posthumus,K.
(1924) Rec.trav.chim.,43,508-11.

Schreinemakers,F.A.H.and Cocheret,D.H.
(1905) Chem.Weekblad.,2,771-778.

Schreinemakers,F.A.H.and Cocheret, D.H.,Filippo,H.and de Waal,A.J.C.
(1901) Z.physik.Chem.,59,645.

Schreinemakers,F.A.H.and Deuss,J.J.B.
(1912) Z.physik.Chem.,79,554.

Schreinemakers,F.A.H.and Van Dorp, W.A.Jr.
(1906) Chem.Weekblad.,3,557-561.
(1907) Z.physik.Chem.59,641-69.

Schreinemakers,F.A.H.and Figee,T.
(1911) Chem.Weekblad.,8,683-8.

Schreinemakers,F.A.H.and Figee,Th.
(1912-17) Archiv.neerlandaises sci., ex.et nat.,[3A],2,39-44.

Schreinemakers,F.A.H.and Filippo,A.Jr.
(1906) Chem.Weekblad.,3,157-65.
(1906) Chem.Zentralbl.,77,I,1321.

Schreinemakers,F.A.H.and Hoenen,P.H.J.
(1909) Chem.Weekblad.,6,51.

Schreinemakers,F.A.H.and Van der Horn van den Bos, J.L.M.
(1912) Z.physik.Chem.,79,551.

Schreinemakers,F.A.H.and Jacobs,W.
(1910) Chem.Weekblad.,7,215.

AUTHOR INDEX

Schreinemakers,F.A.H. and Kayser,G.M.A.
(1918) Chem.Weekblad.,15,120-1.

Schreinemakers,F.A.H. and Massink,A.
(1910) Chem.Weekblad.,7,214.

Schreinemakers,F.A.H. and Meijeringh,D.J.
(1908) Chem.Weekblad.,5,811.

Schreinemakers,F.A.H. and Noorduyn,A.C.
(1918) Chem.Weekblad,15,118-20.

Schreinemakers,F.A.H. and Van Provije,D.J.
(1913) Proc.k.Akad.Wet.,15,1326.

Schreinemakers,F.A.H. and Thonus,J.C.
(1912) Proc.k.Akad.Wet.(Amst.),15,472.

Schreinemakers,F.A.H. and de Waal,A.J.C.
(1906) Chem.Weekblad.,3,539-43.

Schreiner,L.and Sieverts,A.
(1935) Z.anorg.Chem.,224,167-72.

Schroeder,J.
(1905) Z.anorg.Chem.,44,6.
(1908) J.prakt.Chem.,[2],77,267-8.

Schroeder,W.C.,Berk,A.A.,and Gabriel,A.
(1936) J.Am.Chem.Soc.,58,843-9.
(1937) J.Am.Chem.Soc.,59,1783-95.

Schroeder,W.C.,Gabriel,A.and Partridge,E.P.
(1935) J.Am.Chem.Soc.,57,1539-46.

Schröder,Wilhelm.
(1929) Z.anorg.Chem.,184,63-89.
(1929a) Z.anorg.Chem.,177,71-85.
(1929b) Caliche,11,154.
(1930) Z.anorg.Chem.,185,153-66.
(1930a) Z.anorg.Chem.,185,267-79.
(1936) Z.anorg.Chem.,228,129-59.
(1938) Z.anorg.Chem.,239,39-56.

Schröder,W.,Beckmann,U,and Ansel,W.
(1939) Z.anorg.Chem.,241,179-95.

Schröder,W.,Homspesch,H.and Mirbach,P.
(1938) Z.anorg.Chem.,239,225-39.

Schröder,W.,Kehren,E.,Frings,K.and Poelvoorde,H.
(1938) Z.anorg.Chem.,238,209-34,305-20.

Schröder,W.and Kleese,W.
(1938) Z.anorg.Chem.,239,399-417.

Schröder,W.and Schackmann,H.
(1934) Z.anorg.Chem.,220,389-410.

Schröder,W.and Schwedt,H.
(1938) Z.anorg.Chem.,240,50-66.

Schukarew,A.
(1901) Z.physik.Chem.,38,543.

Schuler.
(1879) Sitzb.k.Akad.Wis.(Berlin),79, 302.

Schultz.
(1860) Zeit.Chem.,[2],5,531.
(1861) Pogg.Ann.,113,137.

Schulze.
(1881) J.prakt.Chem.,[2],24,168.

Schulze,A.
(1920) Z.physik.Chem.,95,257-79.

Schwab and Hantke.
(1924) Z.physik.Chem.,114,251.

Schwarze,Robert.
(1916) Ber.,49,2359.

Schwarze,R.and Haacke,A.
(1921) Z.anorg.allgem.Chem.,115, 87-99.

Schwarz,R.and Heinrich,F.
(1932) Z.anorg.Chem.,205,43.

Schwarz,R.and Huf,E.
(1931) Z.anorg.Chem.,203,188-217.

Schwarz,R.and Romero,A.
(1927) Z.anorg.Chem.,162,149-60.

Schweitzer,
(1890) Z.anal.Chem.,29,414.

Schwicker.
(1889) Ber.,22,1731.

Scott,A.F.and Durham,E.J.
(1930) J.Phys.Chem.,34,531-7, 1424-38.

Scott,A.F. and Frazier,W.R.
(1927) J.Phys.Chem.,31,459-63.

Scott,A.F.and Johnson,C.R.
(1930) J.Am.Chem.Soc.,52,3586.

Sedlitzky.
(1887) Monatsh.Chem.,8,563.

Sehnal,J.
(1909) Compt.rend.,148,1394.

AUTHOR INDEX

Seidell,A.
(1902) Am.Chem.Jour.,27,52.
(1907) J.Am.Chem.Soc.,29,1088-95.
(1908) Trans.Am.Electrochem.Soc., 13,319-29.
(1909) J.Am.Chem.Soc.,31,1164.
(1910) Bull.No.67 Hygienic Laboratory,U.S.Public Health Service.

Seliwanow,Th.
(1914) Z.anorg.Chem.,85,337.

Semisine,V.I.
(1939) Zhur.Obs.Khimii,9,83-5.

Semzusni,S.F.
(1927) Ann.Inst.Platin.(Russ),5,364.

Sendroy,Jr.,J.and Hastings,A.B.
(1927) J.Biol.Chem.,71,783-846.

Serowy,Dr.
(1923) Kali,17,289,305,320,333,345.

Serullas.
( ) Ann.chim.phys.,22,118.

Sestini.
(1890) Gazz.chim.ital.,20,313.

Setschenow.
(1892) Ann.chim.phys.,[6 ,25,226.

Setterburg.
(1882) Liebig's Annalen,211,104.

Seubert and Elten.
(1892) Z.anorg.Chem.,2,434.

Seward,R.P.
(1932) J.Am.Chem.Soc.,54,4598-4605.
(1934) J.Am.Chem.Soc.,56,2610-2.

Seward,R.P.and Hamblet,C.H.
(1932) J.Am.Chem.Soc.,54,554-63.

Seward,R.P.and Schumb,W.C.
(1930) J.Am.Chem.Soc.,52,3962-7.

Seyer,W.F.and Ball.
(1926) Trans.Roy.Soc.(Canada)III,[3], 20,343.

Seyer,W.F.and Cornett,W.F.
(1937) Ind.Eng.Chem.,29,91-2.

Seyer,W.F.and Dunbar.
(1922) Trans.Roy.Soc.(Canada),III[3], 16,307.

Seyer,W.F.and Gallaugher.
(1926) Trans.Roy.Soc.(Canada),III,[3], 20,343.

Seyer,W.F.and Hodnett,L.
(1936) J.Am.Chem.Soc.,58,996-8.

Seyer,W.F.and King,E.G.
(1933) J.Am.Chem.Soc.,55,3140-9.

Seyer,W.F.and Peck,W.S.
(1930) J.Am.Chem.Soc.,52,19.

Seyer,W.F.and Todd,Eric.
(1929) Trans.Roy.Soc.(Canada),III,[3], 23,67-70.
(1931) Ind.Eng.Chem.,23,325-7.

Seyler,C.A.
(1908) Analyst,33,454-7.

Seyler,C.A.and Lloyd,P.V.
(1909) J.Chem.Soc.(Lond.),95,1347-52.

Shad,H.and Bornemann,K.
(1916) Metall u.Erz.,13,251-62.

Sharwood,W.J.
(1903) J.Am.Chem.Soc.,25,576.

Shear,M.J.and Kramer,B.
(1928) J.Biol.Chem.,79,125-45.

Shear,M.J.,Washburn,M.and Kramer,B.
(1929) J.Biol.Chem.,83,697-720.

Shearman,R.W.and Menzies,W.C.
(1937) J.Am.Chem.Soc.,56,185-6.

Shenstone and Cundall.
(1883) J.chem.Soc.,(Lond.),43,550.

Sheppard,S.E.and Hudson,H.
(1927) J.Am.Chem.Soc.,49,1814-19.

Sherrill,M.S.
(1903) Z.physik.Chem.,43,705-40.

Sherrill,M.S.and Eaton,F.M.
(1907) J.Am.Chem.Soc.,29,1643.

Sherrill,M.S.and Russ,D.E.
(1907) J.Am.Chem.Soc.,29,1657-61.

Sherrill,M.S.and Haas,A.J.Jr.
(1936) J.Am.Chem.Soc.,58,952-9.

Sherrill,M.S.and Izard,E.F.
(1928) J.Am.Chem.Soc.,50,1665-75.
(1931) J.Am.Chem.Soc.,53,1667-74.

Sherwood,T.K.
(1925) Ind.Eng.Chem.,17,745-7.

Shibata,F.L.E.
(1932) J.Sci.Hiroshima Univ.(A)1,215.

Shibata,F.L.E.,Oda,S.and Furukawa,Sh.
(1932) J.Sci.Hiroshima Univ.(A),2,85.

Shiomi,T.
(1908) Mem.Coll.Sci.Eng.(Kyoto),I, 406-13.

Shnidman,L.
(1934) J.Phys.Chem.,38,901-6.

Showalter,H.A.
(1933) Trans.Roy Soc.(Canada),III, (3),27,183-5.

Showalter,H.A.and Ferguson,J.B.
(1936) Canadian J.Res.(B),14,120-6.

Sidersky,D.
(1921) Bull.assoc.chim.sucr.dist., 39,167-77.

Sidgwick,N.V.and Eubank,E.K.
(1922) J.Chem.Soc.,121,1844-53.

Sidgwick,N.V.and Gentle,J.A.H.R.,
(1922) J.Chem.Soc.,121,1837-43.

Sidgwick,N.V.and Lewis,N.B.
(1926) J.Chem.Soc.,129,1287-1302.

Sidgwick,N.V.and Sutton,L.E.
(1930) J.Chem.Soc.(Lond.),1461-72.

Siebeck.
(1909) Scand.Arch.f.Physiol.,21,368.

Siegler,Robert.
(1909) Dissertation (Technischen Hochschule),Darmstadt.

Sieverts,A.
(1907) Z.physik.Chem.,60,129.
(1911) Z.physik.Chem.,77,591,611.
(1914) Z.physik.Chem.,88,103.
(1931) Z.physik.Chem.(A),155,313.

Sieverts,A.and Bergner,E.
(1912) Ber.,45,2576.

Sieverts,A.and Hagen.
(1931) Z.physik.Chem.(A),155,317.
(1934) Z.physik.Chem.(A),169,238.

Sieverts,A.and Jurisch.
(1912) Ber.,45,221.

Sieverts,A.and Müller,E.L.
(1931) Z.anorg.Chem.,200,305-20.

Sieverts,A.and Müller,H.
(1930) Z.anorg.Chem.,189,241-57.
(1930) Caliche,12,91.

Sieverts,A.and Petzold,W.
(1932) Z.anorg.Chem.,205,113-26.
(1933) Z.anorg.Chem.,212,49-60,233-41.
(1933a) Z.anorg.Chem.,214,27-32, 396-402.

Sieverts,A.and Schreiner,L.
(1934) Z.anorg.Chem.,219,105-12.

Sieverts,A.and Zapf,G.
(1935) Z.physik.Chem.(A),174,359.

Sieverts,A.,Zapf,G.and Moritz,H.
(1938) Z.physik.Chem.(A),183,19-37.

Sill,H.F.
(1905) Z.physik.Chem.,51,577-602.
(1916) J.Am.Chem.Soc.,38,2632.

Sims.
(1861) Liebig's Ann.,118,340.

Simmons,J.P.,Freimuth,H.and Russell,H.
(1936) J.Am.Chem.Soc.,58,1692-5.

Simmons,J.P.and Ropp,C.D.L.
(1928) J.Am.Chem.Soc.,50,1650-3.

Simmons,J.P.and Waldeck,W.F.
(1931) J.Am.Chem.Soc.,53,1725-7.

Simons,J.H.
(1931) J.Am.Chem.Soc.,53,83-7.

Sirucek,J.
(1938) J.chim.phys.,35,136-42.

Siskin,N.V.and Pochvaleusky,E.D.
(1938) Zhur.Obs.Khimii,8,1125-31.

Sisokin,V.P.
(1927) Ann.Inst.Polytechn.(Leningrad), 30,385.

Siskind,Bertha and Kasarnowski,I.
(1931) Z.anorg.Chem.,200,279-86.
(1933) Z.anorg.Chem.,214,385-95.

Skaliks.
(1928) Schr.d.Königsberger Gel. Ges.Naturw.Klasse,5,102.

Skirrow,F.W.
(1902) Z.physik.Chem.,41,144.

Skinner,S.
(1892) J.Chem.Soc.(Lond.),61,342.

Skossareswky,M.and Tchitchinadze,N.
(1916) J.Chim.phys.,14,153-75.

Slade,R.E.
(1912) Z.Elektrochem.,18,1.

Sloan and Mallet.
(1882) Chem.News.,48,194.

Smirnoff,Wladimer.
(1907) Z.physik.Chem.,58,373,667.

Smith.
(1912) Landolt and Börnstein "Tabellen,"4th Ed.,p.481.

AUTHOR INDEX

Smith and Bradbury.
(1891) Ber.,**24**,2930.

Smith,A.and Carson,C.M.
(1908) Z.physik.Chem.,**61**,200.

Smith,A.and Eastlack,H.E.
(1916) J.Am.Chem.Soc.,**38**,1500,1265.

Smith,A.,Holmes,W.B.and Hall,E.S.
(1905) J.Am.Chem.Soc.,**27**,805.

Smith,A.and Menzies,A.W.C.
(1909) J.Am.Chem.Soc.,**31**,1183-91.

Smith,C.M.
(1920) J.Am.Chem.Soc.,**42**,259-65.

Smith,D.F.
(1923) J.Am.Chem.Soc.,**45**,365.

Smith,F. Hastings.
(1917) J.Am.Chem.Soc.,**39**,1309.

Smith,G.F.
(1923a) J.Am.Chem.Soc.,**45**,2074.
(1924) J.Am.Chem.Soc.,**46**,1581.
(1925) J.Am.Chem.Soc.,**47**,762-9.

Smith,G.F.and Ring,F.
(1937) J.Am.Chem.Soc.,**56**,1889-90.

Smith,G.McP.and Ball,T.R.
(1917) J.Am.Chem.Soc.,**39**,217.

Smith,H.A.and Taylor,H.
(1938) J.Am.Chem.Soc.,**60**,1696-7.

Smith,Herbert,J.
(1918) J.Am.Chem.Soc.,**40**,879-85.

Smith,L.
(1928) Z.anorg.Chem.,**176**,155.

Smith,S.B.
(1931) J.Am.Chem.Soc.,**53**,3711-18.

Smith,S.B.and Ely,E.C.
(1938) J.Am.Chem.Soc.,**60**,2909-11.

Smith,S.B.and Sturm,W.A.
(1933) J.Am.Chem.Soc.,**55**,2414-9.

Smith,S.B.,Sturm,W.A.and Ely,E.C.
(1935) J.Am.Chem.Soc.,**57**,2406-8.

Smith,W.R.
(1909) J.Am.Chem.Soc.,**31**,245.

Smith,W.T.and Parkhurst,R.B.
(1922) J.Am.Chem.Soc.,**44**,1918-27.

Smits,A.and Bokhorst,S.C.
(1915) Z.physik.Chem.,**89**,374.

Smits,A.,Elgersma,J.and Hardenberg,M.E.
(1924) Rec.trav.chim.,**43**,671.

Smits,A.and Kettner,A.
(1912) Proc.k.Akad.Wet.(Amst.),**15**,685.

Smits,A.and de Leeuw,H.L.
(1910) Proc.k.Akad.Wet.(Amst.),**13**,329.

Smits,A.and Maarse,J.
(1911) Proc.k.Akad.Wet.(Amst.),**14**,192.

Smits,A.and Mazee,W.M.
(1928) Z.physik.Chem.,**135**,73.

Smits,A.and de Mooy.
(1910) Verslag.Akad.Wet.(Amst.),**19**,
293.

Smits,A.and Postma,S.
(1914) Proc.k.Akad.Wet.(Amst.),**17**,183.

Smits,A.,Rinse,J.and Louwe-Kooymans,L.H.
(1928) Z.physik.Chem.,**135**,73-84.

Smolensky,S.
(1911-12) Z.anorg.Chem.,**73**,293.

Smyth,L.
(1928) Z.anorg.Chem.,**176**,171.

Smyth and Adams.
(1923) J.Am.Chem.Soc.,**45**,1167.

Sneider.
(1866) Pogg.Ann.,**127**,624.

Snell,J.F.
(1898) J.Phys.Chem.,**2**,474-484.

Snyder.
(1878) Ber.,**11**,936.

Soch,C.A.
(1898) J.Phys.Chem.,**2**,43.

Sokalov,V.A.
(1939) Zhur.Obs.Khimii,**9**,753-8.

Sörensen,S.P.L.
(1925) J.Am.Chem.Soc.,**47**,457.

Sosman,R.B.and Merwin,H.E.
(1916) J.Wash.Acad.Sci.,**6**,532-37.

Souchay and Leussen.
(1856) Liebig's Ann.,**99**.33.

Sowerby,A.L.McRae.
(1927) J.Chem.Soc.(Lond.),**130**,1337-42.

Spack,A.
(1930) These,Strasbourg.

AUTHOR INDEX

Spencer,J.F.
(1912) Z.physik.Chem.,80,701.
(1913) Z.physik.Chem.,83,293.

Spencer and LePla.
(1909) Z.anorg.Chem.,65,14.

Speyers,C.L.
(1902) Am.J.Sci.,[4],14,294.

Spicin,W.J.
(1917) J.Chem.Soc.Russ.,49,357-70.

Spielrein,C.
(1913) Compt.rend.,157,46.

Spinoglis,P.and Ravenna.
(1935) Gazz.chim.Ital.,65,668-78.

Spitzen,V.I.
(1917) J.Russ.Phys.Chem.Soc.,49, 357-70.

Spring and Romanoff.
(1896) Z.anorg.Chem.,13,34.

Squire,P.W.And Caines,C.M.
(1905) Pharm.Jour.(Lond.),74,720, 784.

v. Stackelberg,E.F.
(1896) Z.physik.Chem.,20,337-58.

v. Stackelberg,M.
(1934) Z.physik.Chem.,(A),170,262-72.

v. Stackelberg,M.,Quantram,F.and Dresoll,J.
(1937) Z.Elektrochem.,43,21.

Stalhave,B.
(1930) Z.Elektrochem.,36,404-8.

Stanbridge,F.
(1918) J.Chem.Soc.,113,808-16.

Stanley,H.
(1904) Chem.News,89,193.

Stark,G.
(1911) Z.anorg.Chem.,70,174.

Starkowa,S.P.
(1931) Zhur.Obs.Khimii,1,747-9.

Starokadomskaja,E.L.
(1939) Zhur.Obs.Khimii,9,840-4.

Staronka,W.
(1910) Anzeiger akad.Wis.Krakau. Ser.A.,372-98.
(1910) Chem.Zentralbl.,81,1741.

Starrs,B.A.and Clark.L.
(1930) J.Phys.Chem.,34,1058-63.

Stasevich,N.
(1913) J.Russ.Phys.Chem.Soc.,45, 912-30.

Staub,F.G.
(1932) Ind.Eng.Chem.,24,914-7.

Steacie,E.W.R.and Johnson,F.M.G.
(1928) Proc.Roy Soc.(Lond.),117, 662-79.

Steele and Johnson.
(1904) J.Chem.Soc.(Lond.),85,116.

Steger.
(1903) Z.physik.Chem.,43,595.

Steiner,P.
(1894) Ann.der.Physik.(Wiederman), 52,275.

Steinwehr.
(1902) Ann.der Physik.(Drude),[4], 9,1050.

v.Steinwehr.H.
(1920) Z.physik.Chem.,94, 17.

Stern,Otto.
(1912-13) Z.physik.Chem.,81,468.

Stewart,J.
(1922) Soil Science,14,111-8.

Stiasseny.
(1891) Monatsh.Chem.,12,601.

Stich,C.
(1903) Pharm.Ztg.,48,343.
(1903) Pharm.Jour.(Lond.),70,700.

Stock,A.
(1904) Ber.,37,1432.
(1910) Ber.,43,156,1227.

Stock,A.and Kuss,E.
(1917) Ber.,50,159-64.

Stock,A.and Others.
(1934) Z.anorg.Chem.,217,241-53.

Stoddard,J.L.
(1927) J.Biol.Chem.,71,629-92.

Stolba.
(1865) J.prakt.Chem.,94,406.
(1867) J.prakt.Chem.,101,1.
(1872) Z.anal.Chem.,11,199.
(1877) Chem.Centralbl.,418,578.
(1883) Chem.Centralbl.,293.
(1889) Chem.Techn.Cent.,Anz.,7,459.

AUTHOR INDEX

Stolle.
(1900) Z.Ver.Zuckerind.,**50**,331.

Stollenwerk,W.
(1926) Z.anorg.allgem.Chem.,**156**, 37-55.

Stollenwerk,W.
(1926) Z.anorg.Chem.,**156**,37-55.

Stoltzenberg,H.
(1912) Ber.,**45**,2248.
(1914) Z.physik.Chem.,**92**,461-94.

Stortenbecker,W.
(1888) Rec.trav.chim.,**7**,152.
(1889) Z.physik.Chem.,**3**,11.
(1897) Z.physik.Chem.,**22**,62.
(1900) Z.physik.Chem.,**34**,109.
(1902) Rec.trav.chim.,**21**,407.
(1907) Rec.trav.chim.,**26**,245.

Story,L.G.and Anderson,E.
(1924) J.Am.Chem.Soc.,**46**,533.

Straub,Jan.
(1911) Z.physik.Chem.,**77**,332.

Straull,L.
(1918) These,Zurich.
(1926) "Tabelles Annuelles",**5**,932.

Strock,L.W.and McCutcheon,T.P.
(1931) J.Am.Chem.Soc.,**53**,2852.

Strömholm,D.
(1900) Ber.,**33**,835.
(1903) Z.physik.Chem.,**44**,721-32.
(1908) Z.anorg.Chem.,**57**,72-103.

Struve.
(1854) J.prakt.Chem.,**61**,460.
(1870) Z.anal.Chem.,**9**,34.
(1899) J.prakt.Chem.,[2],**61**,457.

Stuckgold,M.
(1917) J.chim.phys.,**15**,502-16.

Stumper.
(1925) Bull.soc.chim.(Belg.),**34**, 422-7.

Sudhaus,Käthe.
(1914) Neues Jahrb.Min.Geol.(Beil. Be.),**37**,1-50.

Sugden,Ruth.
(1926) J.Chem.Soc.,**129**,960-1.
(1929) J.Chem.Soc.(Lond.),488-91.

Sulc.
(1900) Z.anorg.Chem.,**25**,401.

Sullivan.
(1905) J.Chem.Soc.,**27**,529.

Sunier,A.A.and Gramke,B.E.
(1929) J.Am.Chem.Soc.,**51**,1703-8.

Sunier,A.A.and Hess,C.B.
(1928) J.Am.Chem.Soc.,**50**,662-8.

Sunier,A.A.and Weiner,L.G.
(1931) J.Am.Chem.Soc.,**53**,1714-21.

Sunier,A.A.and White,C.M.
(1930) J.Am.Chem.Soc.,**52**,1842-50.

Süss,J.
(1913) Z.Kryst.Min.,**51**,262.

Svecova,K.B.
(1938) Zhur.Obs.Khimii,**8**,690-4.

Swan,Clifford,M.
(1899) "Chemistry Thesis," Mass. Inst.Technology, (unpublished).
(1911) J.Am.Chem.Soc.,**33**,1814.

Swearingen,L.E.and Florence,R.T.
(1935) J.Phys.Chem.,**39**,701-7.

de Sweener, A.
(1932) Naturwetensch,Tijdscher, **14**,231.

Swenson,T.and Ricci,J.E.
(1939) J.Am.Chem.Soc.,**61**,1974-7.

Swinne,R.
(1913) Z.physik.Chem.,**84**,348.

Sworykin,A.J.
(1927) Z.anorg.Chem.,**163**,178-84.

Taber,W.C.
(1906) J.Phys.Chem.,**10**,593.
(1906) Bull.,**33**,Bureau of Soils, U.S.Dept.Agr.

Tacchini,G.
(1924) Gazz.chim.ital.,**54**,777.

Takahashi,G.
(1927) Bull.Imp.Hyg.Lab.(Tokyo),**29**, 165.

Takahashi,Y.
(1919) Mem.Coll.Sci.Kyoto,Imp. Univ.,**4**,47-50.

Takayama,Y.
(1930) J.Soc.Chem.Ind.(Japan),**33**,302.

AUTHOR INDEX

Takegami,S.
(1920) J.Tokyo Chem.Soc.,41,831-68.
(1921) Mem.Coll.Sci.Kyoto,Imp.Univ., 4,317-42.
(1921a) J.Chem.Soc.Tokyo,42,441-53.
(1922) Mem.Coll.Sci.Kyoto,Imp.Univ., 5,191-9.

Takenchi,J.
(1915) Mem.Coll.Sci.(Kyoto),1,249-55.

Tamm,O.
(1910) Z.physik.Chem.,74,499.

Tammann,G.
(1930) Z.anorg.Chem.,188,396.

Tammann,G.,Kollman,K.and Hinnüber.
(1927) Z.anorg.Chem.,160,242-9.

Tammann,G.and Krings,W.
(1923) Z.anorg.allgem.Chem.,130,242.

Tammann,G.and Olsen.
(1930) Z.anorg.Chem.,193,245.

Tammann,G.and Schaftmeister,P.
(1924) Z.anorg.allgem.Chem.,138,219-32.

Tanaka,H.
(1930) J.Soc.Chem.Ind.(Japan) Suppl.33, 488B.

Tananaev,Iv.
(1938) Zhur.Obs.Khimii.,8,1120-4.

Tananaev,Iv.and Tchrelachwili,S.
(1936) Zhur.Obs.Khimii.,6,606-11.

Tantzov,N.V.
(1924) J.Russ.Phys.Chem.Soc.,55, 335-41.
(1925) Chem.Abs.,19,2437.

Tarassenkow,D.N.and Katz,K.
(1937) Zhur.Obs.Khimii.,7,2243-5.

Tarassenkow,D.N.and Poloshinzewa,E.N.
(1931) Zhur.Obs.Khimii.,1,71-9.
(1932) Ber.,65,184-6.

Tarbutton,G.,Egan,E.P.Jr.and Frary,S.G.
(1939) J.Am.Chem.Soc.,61,2555-6.

Tarbutton,G.and Vosburgh,W.C.
(1932) J.Am.Chem.Soc.,54,4537-44.

Tartar.H.V.and Lorah,J.R.
(1929) J.Am.Chem.Soc.,51,1091.

Tartar.H.V.,Rice,M.R.and Sweo,B.J.
(1931) J.Am.Chem.Soc.,53,3949-56.

Tartar,H.V.,Wood,L.and Hines,E.
(1924) J.Am.Chem.Soc.,46,812.

Tartar,H.V.and Wright,K.A.
(1939) J.Am.Chem.Soc.,61,539-44.

Tarugi,N.
(1904) Gazz.chim.ital.,34,I,329.
(1914) Gazz.chim.ital.,44,I,131.

Tarugi,N.and Checchi,Q.
(1901) Gazz.chim.ital.,31,II,439,445.

Taverne,H.J.
(1900) Rec.trav.chim.,19,109.

Taylor,H.S.,Caley,E.R.and Eyring,H.
(1933) J.Am.Chem.Soc.,55,4334.

Taylor,H.S.and Henderson,W.N.
(1915) J.Am.Chem.Soc.,37,1692.

Taylor,N.W.and Hildebrand,J.H.
(1923) J.Am.Chem.Soc.,45,682-94.

Taylor,S.F.
(1897) J.Phys.Chem.,1,301,468,720.

Teeple,John.E.
(1929) "The Industrial Development of Searles Lake Brines" The Chem.Catalogue Co.,New York,N.Y.

Tereda,K.
(1928) Bull.Inst.Phys.Chem.Res. (Tokyo),7,455.

Terres.F.and Behrens,H.
(1928) Z.physik.Chem.,130,695-716.

Terres,E.and Brückner,K.
(1920) Z.Elektrochem.,26,1-32.

Terres,E.and Constantinescu,M.
(1934) Z.angew.Chem.,47,470.

Terres,E.and Rühl,G.
(1934) Z.angew.Chem.,47,331-4.

Terres,E.and Weiser,H.
(1921) Z.Elektrochem.,27,177-93.

Terrey,H.and Jolly,V.G.
(1923) J.Chem.Soc.,123,2217-22.

Terrey,H.and Spong,H.
(1932) J.Chem.Soc.(Lond.),219-26.

Tettamanzi,A.
(1933) Gazz.chim.ital.,63,575-9.

Thiel,A.
(1900) Z.anorg.Chem.,27,57.

AUTHOR INDEX

Thiel,A.and Koelsch.
(1910) Z.anorg.Chem.,**66**,309.

Thiel,A.and Schulte,E.
(1920) Z.physik.Chem.,**96**,312-42.

Thilo.
(1892) Chem.Ztg.,**16**,II,1688.

Thin,R.G.and Cumming,Alex.C.
(1915) J.Chem.Soc.(Lond.),**107**,361-6.

Thomas.
(1896) Compt.rend.,**123**,943.

Thomas,J.S.and Rule,A.
(1917) J.Chem.Soc.(Lond.),**111**, 1063-85.

Thompson,H.E.Jr.
(1935) J.Phys.Chem.,**39**,655-64.

Thompson,M.de K.
(1910) Met.Chem.Eng.,**8**,279,324.
(1910) Proc.Am.Acad.,**45**,431-52.

Thorvaldson,Th.,Grace,N.G.and Vigfusson,V.A.
(1929) Canadian,J.Res.,**1**,201.

Tichomirow,W.
(1907) J.Russ.Phys.Chem.Soc.,**39**, 731-43.
(1908) Chem.Zentralbl.,**I**,11.

Tilden,W.A.
(1884) J.Chem.Soc.(Lond.),**45**,269, 409.

Tilden and Shenstone.
(1883) Proc.Roy.Soc.(Lond.),**35**,345.
(1884) Phil.Trans.,23-31.
(1885) Proc.Roy.Soc.(Lond.),**38**,331.

Timofeiew,Wladimir.
(1890) Z.physik.Chem.,**6**,147.
(1891) Compt.rend.,**112**,1137,1224.
(1894) Dissertation (Kharkhov.)

Timmermans,J.
(1907) Z.physik.Chem.,**58**,129-213.
(1910) Proc.k.Akad.Wet.(Amst.),**13**, 523.
(1911) "Recherches expérimentales sur les phénomenes de demixtion des mélanges liquides" (Thése) Bruxelles. April,1911.
(1912) Bull.soc.chim.(Belg.),**26**,382.

Timmermans,J.and Dumont,M.
(1931) Bull.soc.chim.(Belg.),**40**,689-709.

Ting,H.H.and McCabe,W.L.
(1934) Ind.Eng.Chem.,**26**,1207-8.

Tiollais,Rene.
(1936) Bull.soc.chim.(France),[5],**3**, 70-87.

Tiollais,R.and Perdreau,H.
(1939) Bull.soc.chim.(France)[5],**6**, 631-46.

Tobler.
(1855) Liebig's Ann.,**95**,193.

Toda,S.
(1921) Mem.Coll.Sci.Kyoto,Imp.Univ., 4,305-10.
(1921a) Mem.Coll.Sci.Kyoto,Imp.Univ., 4,377-82.
(1922) J.Chem.Soc.Japan,**43**,320-40.

Tolmatschew,P.J.
(1930) Compt.rend.Akad.Sci.,U.S.S,R. Russ.Doklady Akad.Nank.Ser.A, 689.

Tollert,H.
(1932) Z.anorg.Chem.,**204**,142.

Tomicek,O.and Kubik,J.
(1937) Coll.Czechoslovak.Chem.Com.,**9**, 525-41.

Tomula,E.S.
(1921) Z.anorg.Chem.,**118**,88.

Toole,F.J.and Johnson,F.M.G.
(1933) J.Phys.Chem.,**37**,331-46.

Toporescu,E.
(1922) Compt.rend.,**174**,870.

Touren.
(1900) Compt.rend.,**130**,259,908,1252.

Tourneux,C.
(1919) Ann.chim.,[9],**11**,225-61.
(1934) Bull.soc.chim.(France)[5],**1**, 1043-9.

Tourneux,C.and Pernot,M.
(1925) Compt.rend.,**180**,740.

Tower.
(1906) Z.anorg.Chem.,**50**,382.

Townley,R.W.,Whitney,W.B.and Felsing,W.A.
(1937) J.Am.Chem.Soc.,**56**,631-3.

AUTHOR INDEX

Trapp,Hans.
(1935) J.prakt.Chem.,143,193-210.

Traube,I.
(1909) Ber.,42,2185,4185-8.

Trautz and Anschütz.
(1906) Z.physik.Chem.,56,238.

Traütz,Max and Dalai,V.P.
(1920) Z.anorg.allgem.Chem.,110,1-47.

Trautz,M.and Gerwig,W.
(1925) Z.anorg.allgem.Chem.,145,4-15.

Travers,A.and Malaprade.
(1926) Bull.soc.chim.,[4],39,1543-73.

Travers,A.and Nouvel.
(1929) Compt.rend.,188,499.

Travers,A.and Sehnoutka,J.
(1930) Ann.chim.[10],13,253-331.

Treadwell and Reuter.
(1898) Z.anorg.Chem.,17,185.

Treis,K.
(1914) Neues.Jahr.Min.(Beil.Bd.),37,
766-818.

Trenner,N.R.and Taylor,H.A.
(1931) J.Phys.Chem.,35,1336-44.

Trevor.
(1891) Z.physik.Chem.,7,470.

rifonov,N.
(1924) Mitt.wiss. 6th Arbeuten
Republik (Russia),13,72.
(1925) Chem.Zentr.,II,382.

Trimble,H.M.
(1922) J.Am.Chem.,44,451-60.
(1931) Ind.Eng.Chem.,23,165.
(1936) J.Am.Chem.Soc.,58,1868.

Trömel.
(1932) Mitt.Kais.Wilh.Inst.f.Eisenf.
14,25.

Trömel and Korber.
(1932) Z.Elektrochem.,38,578.

Truthe,W.
(1912) Z.anorg.Chem.,76,129-73.

Ts'ai Liu-Sheng and Yen Wen-Hsing.
(1936) J.Chinese Chem.Soc.,4,178-82.

Tsakalotos,D.E.
(1913) Bull.soc.chim.(France)[4],13,
282.

Tschugajew,L.A.
(1926) Ann.Inst.Platinum(Russ.),4,1.

Tschugajew,L.A.and Fritmann,E.I.
(1928) Z.anorg.Chem.,172,225.

Tschugaeff,L.A.and Chlopin,W.
(Chugaev,L.and Khlopin,W.)
(1914) Z.anorg.Chem.,86,159.

Tschugaeff,L.A.and Kiltinovic,S.S.
(1916) J.Chem.Soc.(Lond.),109,1286.

Tuchschmidt,C.and Follenius,O.
(1871) Ber.,4,583.

Tubaudt,C.and Eggert,S.
(1920) Z.anorg.allgem.Chem.,110,220-3.

Tubaudt,C.and Münzing,E.
(1927) Z.anorg.Chem.,160,323.

Tunell,G.and Posnjak,E.
(1931) J.Phys.Chem.,35,929-46.

Turner,W.E.S.and Bissett,C.C.
(1913) J.Chem.Soc.(Lond.),103,1904.

Turner,W.E.S.and English.
(1914) J.Chem.Soc.(Lond.),105,1786.

Tutton,A.E.H.
(1897) J.Chem.Soc.(Lond.),71,850.
(1907) Proc.Roy.Soc.(Lond.),79,
(A) 351-82.

Tyrer,Dan.
(1910) Jour.Chem.Soc.(Lond.),97,
1778-88.
(1910a) Jour.Chem.Soc.(Lond.),97,
621-32.
(1911) Proc.Chem.Soc.(Lond.),27,142.

Tyson,F.T.
(1939) J.Am.Chem.Soc.,61,183-5.

Ueda,V.
(1933) Sci.Reports Tohoku Univ.,(1)
22,472.

Uspenskii.
(1929) Neftyanoe Khozyaistvo,17,713.

U.S.P.,VIII.
(1907) U.S.Pharmacopoeia,8th
decennial revision.

Usher,F.L.
(1908) Z.physik.Chem.,62,622-5.
(1910) J.Chem.Soc.(Lond.),97,66-78.

AUTHOR INDEX

Usso.
(1904) Z.anorg.Chem.,38,419.

Ullmann,F.and Kertesz,P.
(1919) Ber.,52B,545-58.

Uyeda,K.
(1909-10) Mem.Coll.Sci.Eng.(Kyoto), 2,245-61.
(1912-13) Mem.Coll.Sci.Eng.(Kyoto), 5,147-50.
(1912) 8th Int.Cong.Appl.Chem.,22, 237.

Valenta.
(1894) Monatsh.Chem.,15,250.

Valentin,J.
(1922) Compt.rend.,175,1061.

Valentiner,S.
(1922) Ber.physik.Ges.,3,62-3.
(1927) Z.Physik.,25(?),269.

Valeton,J.J.P.
(1910) Verslag k.Akad.Wet.(Amst.), 18,755.

Valeton,J.J.and Fromel,W
((1924) Z.anorg.allgem.Chem.,137, 91-100.

Valeur,A.
(1917) Compt.rend.,164,818-20.

Vallance,R.H.
(1922) Chem.News,125,7.
(1927) J.Chem.Soc.(Lond.),130,1328-34.
(1931) J.Chem.Soc.(Lond.),1421-7.

Van Arkel,A.E.and Lebbink,F.J.
(1937) Rec.trav.chim.,56,208-10.

Van Eyk,C.
(1899) Z.physik.Chem.,30,430.
(1900) Proc.k.Akad.Wet.(Amst.),2,480.
(1901) Proc.k.Akad.Wet.(Amst.),3,98.
(1905) Z.physik.Chem.,51,721.
(1905) Chem.News.,91,295.

Van Dorp,G.C.A.
(1923) Rec.trav.chim.,42,765-74.

Van't Hoff see van't Hoff.

Van Klooster,H.S.and Owens,R.M.
(1935) J.Am.Chem.Soc.,57,670-1.

Van Liempt,J.A.M.
(1922) Z.anorg.allgem.Chem.,122,175-80.
(1925) Z.anorg.allgem.Chem.,143,285-92.

Van Meurs,G.J.
(1916) Z.physik.Chem.,91,313-46.

Van Name,R.S.and Brown,W.G.
(1917) Am.Jour.Sci.,[4],44,105-23.

Van Rysselberge.
(   ) These,Bruxelles.

Van Slyke,D.D.,Dillon,R.T.and Margaria,R.
(1934) J.Biol.Chem.,105,571.

Van Slyke,D.D.and Neill,J.M.
(1924) J.Biol.chem.,61,523.

Van Slyke,D.D.and Sendroy,J.Jr.
(1928) J.Biol.Chem.,78,801.

Van Slyke,D.D.,Sendroy,J.Jr., Hastings,A.B.and Neill,J.M.
(1928) J.Biol.Chem.,78,765-99.

Vanstone,E.
(1914) J.Chem.Soc.(Lond.),105, 1491-1503.
(1925) J.Chem.Soc.(Lond.),127,550-2.

Van Veldhuizen,H.
(1929) Thése,Utrecht.

Van Wyk,H.J.
(1902) Z.anorg.Chem.,32,115.
(1905) Z.anorg.Chem.,47,1-52.

Varenne and Pauleau.
(1881) Compt.rend.,93,1016.

Vasiliev,A.M.(Wasilieff).
(1909) J.Russ.Phys.Chem.Soc.,41, 748-53;953-7.
(1910) J.Russ.Phys.Chem.Soc.,42, 423,562-81.
(1910) Chem.Zentralbl.,II,1527.
(1910) "Tables annuelles,"1,381.
(1911) J.Russ.Phys.Chem.Soc.
(1912) Chem.Abs.,6,577.
(1912) J.Russ.Phys.Chem.Soc.,44,1076.

Venable,C.S.and Greene,C.D.
(1922) Ind.Eng.Chem.,14,319.

Vesterberg,A.
(1912) 8th Inter.Congr.Appl.Chem.,2, 238,255.

Vesterberg,K.A.
(1916) Z.anorg.allgem.Chem.,94,371.
(1917) Ark.Kemi Min.Geol.,6,No.11.

Vilbrandt,F.C.and Bender,J.A.
(1923) Ind.Eng.Chem.,15.967-9.

AUTHOR INDEX

Virck.
(1862) Chem.Centralbl.,402.

Voerman,G.L.
(1905) Chem.Weekblad,2,766.
(1906) Chem.Weekblad,3,784,806.
(1906) Chem.Zentralbl.,77,I,125.
(1907) Rec.trav.chim.,26,293.

Von Euler,see von Euler.

Vogel,Fritz.
(1903) Z.anorg.Chem.,35,389.

Vogel.
(1867) Neues Repert.Pharm.,16,557.
(1874) Neues Repert.Pharm.,23,335.

Vold,R.D.and Ferguson,R.H.
(1938) J.Am.Chem.Soc.,60,2066-76.

Voogd,N.H.J.M.
(1933) Rec.trav.chim.,52,768.

Vortisch,E.
(1914) Neues Jahrb.Min.Geol.(Beil, Bd.),38,185-272.
(1914a) Neues Jahrb.Min.Geol.(Beil, Bd.),38,513-24.

Vosburg,W.C.,Israel,K.and Birch,O.G.
(1936) J.Am.Chem.Soc.,58,2282-3.

Vosburg,W.C.and Lackey,O.N.
(1930) J.Am.Chem.Soc.,52,1407-10.

Vosburg,W.C.,Newlin,I.G.,Puette,L.A., Peck,R.L.and Dick,R.
(1936) J.Am.Chem.Soc.,58,2079.

Vosnesenskij,J.A.
(1927) Zhur.Obs.Khimii,59,225.

de Waal,A.J.C.
(1910) Dissertation,Leyden.
(1910) "Tables annuelles."

Waddell,John.
(1898) J.Phys.Chem.,2,236.
(1899) J.Phys.Chem.,3,160.
(1900) J.Phys.Chem.,4,161.

Waddell,J.
(1918) Analyst,43,287-9.

Wadsworth,A.E.and Dawson,H.M.
(1926) J.Chem.Soc.,129,2784-6.

Waentig,P.and McIntosh,D.
(1915) Trans.Roy.Soc.(Canada),[3],9, (Sec.III),203-9.

Wagner,C.L.
(1910) Z.physik.Chem.,71,430.

Wagner,K.L.and Zerner,E.
(1911) Monatsh.Chem.,31,833.

Wagemmann,K.
(1912) Metallurgie,9,518,537.

Waldeck,W.F.,Lynn,G.and Hill,A.E.
(1932) J.Am.Chem.Soc.,54,928-36.
(1934) J.Am.Chem.Soc.,56,43-7.

Walden,P.T.
(1905) Am.Chem.Jour.,34,149.
(1906) Z.physik.Chem.,55,712.

Walden,P.T.and Centnerszwer,M.
(1902-03) Z.physik.Chem.,42,432-68.

Waldman,A.and Klatchko-Gourvitch,L.
(1935) Zhur.Obs.Khimii,5,791-4.

Walker,A.C.,Bray,U.B.and Johnston,J.
(1927) J.Am.Chem.Soc.,49,1235-56.

Walker,J.and Fyffe,W.A.
(1903) J.Chem.Soc.(Lond.),83,179.

Walker,O.J.
(1925) J.Chem.Soc.,127,61-6.

Wallace.
(1855) J.Chem.Soc.(Lond.),7,80.

Wallace.
(1909) Z.anorg.Chem.,63,1.

Walter,G.,Adler,M.and Reimer,G.
(1934) Monatshefte Chem.,65,59-81.

Walter.Z.T.and Schlundt,H.
(1928) J.Am.Chem.Soc.,50,3266.

Walton,J.H.Jr.,and Judd,R.C.
(1911) J.Am.Chem.Soc.,33,1036.

Walton,J.H.,and Lewis,H.A.
(1916) J.Am.Chem.Soc.,38,633.

Walton,J.H.and Whitford,E.L.
(1923) J.Am.Chem.Soc.,45,601-6.
(1930) J.Am.Chem.Soc.,52,2189.

Walton,J.H.and Wise,C.R.
(1922) J.Am.Chem.Soc.,44,103-4.

Warington.
(1875) J.Chem.Soc.,28,946.

Waris,Ghulam.
(1925) Quart.J.Indian Chem.Soc., 1,307-10.

v. Wartenberg.
(1924) Ann.(Liebig's),440,97-110.

v. Wartenberg and Gurr.
(1931) Z.anorg.Chem.,196,374.

v.Wartenberg,and Padjaski.
(1925) Z.anorg.Chem.,148,391.

v. Wartenberg and Prophet.
(1932) Z.anorg.Chem.,208,369.

v. Wartenberg,and Werth.
(1930) Z.anorg.Chem.,190,178.

Warynski,T.and Kourapatwinska,S.
(1916) J.chim.phys.,14,328-35.

Wasilieff see Vasiliev .

Wassilieff,A.A.and Martinoff,N.N.
(1935) Z.anal.Chem.,103,103-6.

Wassilieff,B.B.,Ettinger,J.L.and Golowkov,M.M.
(1934) Z.anorg.Chem.,219,341-7.

Watt,G.W.and Fernelius,W.C.
(1935) Z.anorg.Chem.,221,187.

Waxberg.
(1930) Zhur.Obs.Khimii,62,1265.

Webb,K.R.and Prideaux,E.B.P.
(1938) J.Chem.Soc.(Lond.),111-6.

Weber,L.J.
(1929) Z.anorg.Chem.,181,385-93.

Wedekind,E.and Paschke,F.
(1910) Z.physik.Chem.,73,127.

Wegschneider,R.and Mehl,J.
(1928) Monatshefte Chem.,49,283-315.

Wegscheider,R.and Walter,H.
(1905) Monatsh.Chem.,26,685.
(1907) Monatsh.Chem.,28,633-72.

Weigel,O.
(1906) Nachr.kgl.Ges.Göttingen,p. 525-48.
(1907) Z.physik.Chem.,58,293-300.

Weiller,P.
(1911) Z.physik.Chem.,35,1063-5.

von Weimarn,P.P.
(1911) Z.physik.Chem.,76,218.

Weinhardt,A.
(1926) Dissertation,T.H.Stüttgart.

Weinland,R.F.and Heinzler,J.
(1920) Ber.,53B,1362.

Weisberg..
(1896) Bull.soc.chim.,[3],15,1097.
(1899) Bull.soc.chim.(France)[3],21, 775.
(1900) Bull.soc.chim.(France)[3],23, 740.

Weisz and Opalski see Zerner

Weitz,Ernst.
(1914) Ann.,410,119.

Weitz,Ernst and Stamm,H.
(1925) Z.Elektrochem.,31,546.

Wellman,H.B.
(1930) J.Am.Chem.Soc.,52,985-999.

Wells,H.L.
(1892) Am.Jour.Sci.,[3],44,221.

Wells,H.L.and Wheeler,H.L.
(1892) Am.Jour.Sci.,[3],43,475.

Wells,R.C.
(1915) J.Wash.Acad.Sci.,5,617-22.
(1915) J.Am.Chem.Soc.,37,1704.
(1918) Pub.Carnegie Inst.,213,316.

Wells,R.C.and McAdam,D.J.,Jr.
(1907) J.Am.Chem.Soc.,29,721-7.

Welsh,T.W.B.and Broderson,H.J.
(1915) J.Am.Chem.Soc.,37,816.

Welton,R.C.and King,G.B.
(1939) J.Am.Chem.Soc.,61,1251-2.

Wempe,G.
(1912) Z.anorg.Chem.,78,298-327.

Wenger.
(1892) Am.Chem.Jour.,16,466.

Wenger,Paul.
(1911) Dissertation,Genéve.
(1911) "Tables annuelles,"2,411.

Wentzel.
( ) Dammer's"Handbuch,"II,2,858.

Wenze.
(1891) Z.angew.Chem.,5,691.

Wester,D.H.and Bruins,A.
(1914) Pharm.Weekblad,51,1443-6.

Weston,Arnold.
(1922) J.Chem.Soc.,121,1223-37.

Wheat,J.A.II and Browne,A.W.
(1936) J.Am.Chem.Soc.,58,2410-13.
(1938) J.Am.Chem.Soc.,60,371.

Wheeler,H.L.
(1892) Am.J.Sci.,[3],**44**,123.
(1893) Am.J.Sci.,[3],**45**,267.
(1893a) Z.anorg.Chem.,**3**,432.

Whipple,G.C.and Whupple.M.C.
(1911) J.Am.Chem.Soc.,**33**,362.

Whitby,G.S.
(1910) Z.anorg.Chem.,**67**,107-9.

Whitby,L.
(1932) Trans.Faraday Soc.,**28**,474-8.
(1933) Trans.Faraday Soc.,**29**,415-25 523-31,853-61,1327.

White,A.McLaren.
(1933) J.Am.Chem.Soc.,**55**,3182.

White,H.A.
(1919) J.Chem.Met.Min.Soc.,S.Africa, **20**,1-8,15,97-101.
(1923) J.Chem.Met.Min.Soc.,S. Africa,**23**,170,218.

Whitman,W.G.,Russell,R.B.and Davis, G.H.B.
(1925) J.Am.Chem.Soc.,**47**,70-9.

Whitney,W.R.and Melcher,A.C.
(1903) J.Am.Chem.Soc.,**25**,78.

Whittaker,C.W.,Lindstrom,F.O.and Shimp,J.H.
(1936) J.Am.Chem.Soc.,**58**,1975-7.

Wibaut,J.P.
(1909) Chemisch Weekblad,**6**,401.
(1913) Rec.trav.chim.,**32**,269.

Widmark,E.M.P.
(1923) Biochem.,Z.**17**,668.

Wiebe,R.and Gaddy,V.L.
(1934) J.Am.Chem.Soc.,**56**,76-9.
(1935) J.Am.Chem.Soc.,**57**,847-51,1487.
(1937) J.Am.Chem.Soc.,**59**,1984.
(1939) J.Am.Chem.Soc.,**61**,315-8.

Wiebe,R.,Gaddy,V.L.and Heins,C.Jr.
(1932) Ind.Eng.Chem.,**24**,823-5,927.
(1933) J.Am.Chem.Soc.,**55**,947-53.

Wiebe,R.and Tremearne,T.H.
(1933) J.Am.Chem.Soc.,**55**,975-8.
(1934) J.Am.Chem.Soc.,**56**,2357.

Wieth.
(1929) Physik.Z.,**30**,126.

Wigand,A.
(1910) Z.physik.Chem.,**75**,235.

Wilcox,K.W.and Bailey,C.R.
(1927) J.Chem.Soc.(Lond.),**130**,150-3.

Wilke,E.and Martin,W.
(1927) Z.physik.Chem.,**125**,420-30.

Wilke-Dörfurt,E.and Gunzert,Th.
(1933) Z.anorg.Chem.,**215**,369-87.

Wilke-Dörfurt,E.and Mureck,H.G.
(1929) Z.anorg.Chem.,**184**,121-34.

Wilke-Dörfurt,E.and Niederer,K.
(1929) Z.anorg.Chem.,**184**,145-66.

Wilke-Dörfurt,E.and Schliephake,O.
(1928) Z.anorg.Chem.,**170**,129-44.
(1929) Z.anorg.Chem.,**183**,301-10.

Wilkie,H.F.
(1921) Chem.Met.Eng.,**25**,1186.

Wilkerson,L.,Bathhurst,N.O.,and Parton,H.N.
(1937) Trans.Faraday Soc.,**33**,623-8.

Wilkinson,I.A.,Neilson,C.and Wylde, H.M.
(1920) J.Am.Chem.Soc.,**42**,1377.

Willard,H.H.and Kassner,J.L.
(1930) J.Am.Chem.Soc.,**52**,2391-96.
(1930a) J.Am.Chem.Soc.,**52**,2402-8.

Willard,H.H.and Smith,G.F.
(1922) J.Am.Chem.Soc.,**44**,2816.
(1923a) Chem.News,**127**,42,57.
(1923) J.Am.Chem.Soc.,**45**,286-97.

Williams,M.D.,Fogg,H.G.and James,C.
(1925) J.Am.Chem.Soc.,**47**,297-301.

Williams.
(1921) Chem.News,**122**,62.

Willstaetter.
(1904) Ber.,**37**,3753.

Wilsmore.
(1900) Z.physik.Chem.,**35**,305.

Wing,H.J.
(1927) J.Am.Chem.Soc.,**49**,2859-61.

Wing,H.J.and Thompson,T.J.
(1926) J.Am.Chem.Soc.,**48**,104-6.

AUTHOR INDEX

Winkler,L.W.
(1887) J.prakt.Chem.,[2],**34**,177;
36,177.
(1891) Ber.,**24**,3609.
(1899) Chem.Ztg.,**23**,687.
(1901) Ber.,**34**,1409,1421.
(1905) Landolt and Börnstein "Tabellen,"3rd Ed.,p.604.
(1906) Z.physik.Chem.,**55**,350.
(1912) Landolt and Börnstein "Tabellen,"4th Ed.,p.597,601.

Winteler,F.
(1900) Z.Elektrochem.,**7**,360.

Winther,C.
(1923-24) Trans.Faraday Soc.,**19**,280.

Wirth,F.
(1908) Z.anorg.Chem.,**58**,219.
(1912) Z.anorg.Chem.,**76**,174-200.
(1912-13) Z.anorg.Chem.,**79**,357.
(1914) Z.anorg.Chem.,**87**,1-12.

Wirth,F.and Bakke,B.
(1914) Z.anorg.Chem.,**87**,29,47.

Wise,C.R.
(1923) J.Am.Chem.Soc.,**45**,1233.

Wise,W.C.A.and Davies,C.W.
(1938) J.Chem.Soc.(Lond.),273-7.

Witt,O.N.
(1915) Ber.,**48**,767.

v.Wittorff,N.
(1904) Z.anorg.Chem.,**41**,83.

Wöhler,L.and Schäffer,W.
(1925) Z.anorg.allgem.Chem.,**149**,391.

Wohlgemuth,J.
(1934) Compt.rend.,**199**,601.

Wohlk,A.
(1934) Dansk.Tidskr.Farm.,**8**,107.

Wolf,G.
(1935) Compt.rend.,**200**,1203-5.

Wolff.
(1905) Z.anorg.Chem.,**45**,102.

Wolkov,P.A.
(1926) Ann.Inst.phys.chem.Anal.
(Leningrad),**3**,704.
(1927) Ann.Inst.phys.chem.anal.
(Leningrad),**3**,(2)714-5.

Wolkowitsch,S.I.,Berlin,L.E.and Manzev,B.M.
(1932) Russ.Chiml.Shurm(Ser.B)
Shurm pribladnoi Chim.,**5**,1.

Wolkowitsch,S.I.Belopolski,A.P.and Lebeden,B.A.
(1931) Russ.chim.shurm.(Ser.B)
Shurm prikladnor.Chimi,**4**,177.

Wolters.
(1910) N.Jahrb.Min.Geol.(Beil.Bd.),
30,57.

Wood,J.Kerfoot.
(1908) J.Chem.Soc.(Lond.),**93**,412.

Wood,J.K.and Scott,J.D.
(1910) J.Chem.Soc.(Lond.),**97**,1573.

Wood,T.B.and Jones,H.O.
(1907-08) Proc.Cambridge Phil.Soc.,
14,171-6.

Woodman,R.M.
(1933) J.Soc.Chem.Ind.,**52**,185-8.

Worden,E.C.
(1907) J.Soc.Chem.Ind.,**26**,452.

Worley,F.P.
(1905) J.Chem.Soc.(Lond.),**87**,1107.

Worthington,K.K.and Haring,M.M.
(1931) Ind.Eng.Chem.(Anal.Ed.),**3**,7.

Woskrassens,N.K.
(1934) Zhur.Obs.Khimii,**4**,153-67.

Woskresenskaja.
(1929) Zhur.Obs.Khimii,**61**,79.

Wosnessensky,S.and Astachow,K.
(1925) Z.physik.Chem.,**118**,295.
(1927) Z.physik.Chem.,**128**,363.

Woudstra,H.W.
(1912) 8th Int.Cong.Appl.Chem.,**12**,251.

Wurmser,Mlle.
(1922) Compt.rend.,**174**,1466.

Wright and Thomson.
(1884-85) Phil.Mag.[5],**17**,288;**19**,1.

Wright,Rob't.
(1927) J.Chem.Soc.(Lond.),**130**,1334-7.

Wright,R.H.and Maass,O.
(1932) Canadian J.Res.,**6**,94-101.

Wroblewski,
(1882) Compt.rend.,**94**,1335.

AUTHOR INDEX

Wroczynski,A.and Guye,P.A.
(1910) J.chim.phys.,8,197.

Wrzesnewsky,J.B.
(1912) Z.anorg.Chem.,74,95.

Wuite,J.P.
(1913-14) Z.physik.Chem.,86,349-82.

Wuth,B.
(1902) Ber.,35,2415.

van Wyk, see Van Wyk.

Wynne-Jones,W.
(1930) J.Chem.Soc.(Lond.),1064.

Wyrouboff,G.
(1869) Ann.chim.phys.,[4],16,292.
(1901) Bull.soc.chim.,[3],25,105,121.

Yagoda,H.
(1930) J.Am.Chem.Soc.,52,3068-76.

Yamamoto,T.
(1908) J.Coll.Sci.(Tokyo),25,XI.
(1930) Sci.Papers Inst.Phys.Chem. Res.(Tokyo),13,190-206.
(1930) Bull.Inst.Phys.Chem.Res. (Tokyo),9,352.

Yost,D.M.and Stone,W.E.
(1933) J.Am.Chem.Soc.,55,1890.

Young,S.W.
(1897) J.Am.Chem.Soc.,19,851.

Young,S.W.and Burke,W.E.
(1904) J.Am.Chem.Soc.,26,1417.
(1906) J.Am.Chem.Soc.,28,321.

Yutzy,H.C.and Kolthoff,I.M.
(1937) J.Am.Chem.Soc.,59,916.

Zahorsky.
(1893) Z.anorg.Chem.,3,41.

Zambonini,F.
(1913) Atti accad.Lincei,[5],22,I,523.
(1920) Gazz.chim.Ital.,50,II.128-46.

Zambonini,F.and Cagliotti,V.
(1924) Atti accad.Lincei,[5],33, 308,385.
(1925) Atti accad.Lincei,[6],2,153-8.
(1927) Atti accad.Lincei[6],5,630-6.

Zambonini,F.and Carobbi,G.
(1924) Atti accad.Lincei,[5],33, II,301-8.
(1925a) Atti accad.Lincei,[6],2, 300-05,374-7.
(1925) Atti accad.Lincei,[6],1,278-83.

Zambonini,F.and Restaino,S.
(1926) Atti accad.Lincei,[6],3, 178-83.
(1926a) Atti accad.Lincei,[6],4, 5-10,175-81.
(1927) Atti accad.Lincei[6],5,828-32.
(1929) Atti accad.Lincei,[6],9,131-3.
(1929) Atti accad.Lincei[6],10,774-9.
(1931) Atti accad.Lincei[6],13,650-4.
(1931) Atti accad.Lincei[6],14,69-71.

Zambonini,F.and Stolfi,A.
(1926) Atti accad.Lincei,[6],4,424-9.
(1927) Atti accad.Lincei[6],5,832-7.

Zapata,C.and Zapata.
(1930) Anales.Soc.Esp.fisc.quim.,28, 603-10.

Zappi,E.V.and Manini,A.
(1929) Anales Assoc.quim.Argintina, 17,90.

Zawidski,V.
(1904) Z.physik.Chem.,47,721.

Zeisberg,F.C.
(1925) Chem.Met.Eng.,32,326.

Zeitlin,S.M.
(1926) Z.physik.Chem.,121,39-44.

Zemcznzny,S.F.
(1908) Z.anorg.Chem.,57,267.
(1926) Z.anorg.Chem.,153,47-61.

Zemcznzy and Rambach.
(1910) Z.anorg.Chem.,65,403.

Zerner,E.,Weisz,H.and Opalski,H.
(1922) Z.angew.Chem.,35,253-6.

Zieler,H.
(1927) Z.anorg.Chem.,162,190.

Zink,Julius.
(1933) Z.anal.Chem.,91,246-58.

Zink,J.and Llera,R.
(1915) Z.angew.Chem.,28,226-32.

Zocher,H.
(1920 Z.anorg.allgem.Chem.,112,1-66.

Zouravlev,D.I.
(1939) Zhur.Obs.Khimii,9,769-70.

Zuccari,G.
(1914) Boll.Chim.Farm.,53,321.
(1915) Annali.Chim.Applicata.,3,277.

CROSS REFERENCE INDEX

(For locating results not found by searching the alphabetically arranged tables.)

CROSS REFERENCE INDEX

(For locating results not found by searching the alphabetically arranged tables.)

CROSS REFERENCE INDEX

(For locating results not found by searching the alphabetically arranged tables.)

CROSS REFERENCE INDEX

(For locating results not found by searching the alphabetically arranged tables.)

CROSS REFERENCE INDEX

(For locating results not found by searching the alphabetically arranged tables.)

CROSS REFERENCE INDEX

(For locating results not found by searching the alphabetically arranged tables.)

CROSS REFERENCE INDEX

(For locating results not found by searching the alphabetically arranged tables.)

CROSS REFERENCE INDEX

(For locating results not found by searching the alphabetically arranged tables.)

CROSS REFERENCE INDEX

(For locating results not found by searching the alphabetically arranged tables.)

CROSS REFERENCE INDEX

(For locating results not found by searching the alphabetically arranged tables.)

CROSS REFERENCE INDEX

(For locating results not found by searching the alphabetically arranged tables.)

CROSS REFERENCE INDEX

(For locating results not found by searching the alphabetically arranged tables.)

CROSS REFERENCE INDEX

(For locating results not found by searching the alphabetically arranged tables.)

CROSS REFERENCE INDEX

(For locating results not found by searching the alphabetically arranged tables.)